



GUIDE FOR

HABITABILITY OF INDUSTRIAL PERSONNEL ON ACCOMMODATION VESSELS

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**American Bureau of Shipping
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Foreword

ABS has produced this *Guide for Habitability of Industrial Personnel on Offshore Accommodation Vessels* in order to provide a single source for habitability criteria suitable for accommodation vessels.

This Guide may be applied to accommodation vessels providing accommodation to industrial personnel, excluding members of the crew, who are engaged in some aspect of coastal, offshore, or related employment. More specifically, this Guide may be applied to mobile offshore units (i.e., a self-elevating or column-stabilized mobile offshore units), non-self-propelled barges and offshore support vessels primarily intended for the accommodation of more than 36 persons who are industrial personnel, engaged in some aspect of coastal, offshore, or related employment, excluding members of the crew. In the case of an accommodation barge, it is intended to accommodate these persons only when the barge is moored or otherwise fixed on location. During transit, the accommodation barge will have on board only those crew members necessary for the transit operation. In the case of a self-elevating unit, during jacking or towing operations, it is intended that the unit have on board only those crew members necessary for these operations.

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

For the **HAB(ACCOM)** level, this Guide focuses on five (5) categories of habitability criteria that can affect task performance, safety and the quality of life. These categories can be controlled, measured, and assessed in personnel rest, and recreation areas of offshore accommodation vessel. These categories are: personnel accommodation area design, whole-body vibration, noise, indoor climate, and lighting.

For the **HAB+(ACCOM)** level, this Guide invokes more stringent accommodation area, whole-body vibration, and noise criteria aimed at increasing personnel comfort and safety. For the **HAB++(ACCOM)** level, there are more stringent accommodation area, whole-body vibration and noise criteria.

To be awarded any of these notations, an offshore accommodation vessel must meet the appropriate prescriptive criteria across the various habitability categories.

In addition to the **HAB(ACCOM)** notation assignment, at the Owner's request, ABS may review the crew accommodation area design for compliance with the requirements of the applicable *ABS Guide for Crew Habitability* as related to the **HAB**, **HAB(WB)**, and **HAB(MODU)** notations as well as with the ILO MLC, 2006 Title 3 requirements, as related to the **MLC-ACCOM** notation.

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.



GUIDE FOR

HABITABILITY OF INDUSTRIAL PERSONNEL ON ACCOMMODATION VESSELS

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SECTION 1 General

1 Introduction

ABS recognizes the importance that suitable habitability criteria and design practices may have on the safety, productivity, morale, and overall well-being of industrial personnel. The *ABS Guide for Habitability of Industrial Personnel on Accommodation Vessels* has been developed with the objective of improving the quality of personnel performance and comfort by improving their living environment in terms of accommodation area design and ambient environmental qualities. These habitability criteria have been chosen to provide a means to reduce personnel fatigue, improve performance and safety, and to enhance personnel recruiting and retention.

2 Application

This Guide is applicable to new and existing accommodation vessels for which an optional Habitability (**HAB(ACCOM)**), Habitability Plus (**HAB+(ACCOM)**), or Habitability Plus Plus (**HAB++(ACCOM)**) notation has been requested. The habitability criteria are a measure of the acceptability of industrial personnel accommodation areas for living.

In addition to the **HAB(ACCOM)** notation assignment, at the Owner's request, ABS may review the crew accommodation area design for compliance with the requirements of the applicable *ABS Guide for Crew Habitability* as related to the **HAB**, **HAB(WB)**, and **HAB(MODU)** notations as well as with the ILO MLC, 2006 Title 3 requirements, as related to the **MLC-ACCOM** notation.

ABS has produced this *Guide for Industrial Personnel Habitability on Accommodation Vessels* in order to provide a single source for habitability criteria suitable for the industrial personnel areas of accommodation vessels. This Guide may be applied to vessels providing accommodation to industrial personnel who are engaged in some aspect of coastal, offshore, or related employment, excluding members of the vessel's crew.

3 Scope

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

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

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

- i) Whole-body Vibration
- ii) Noise
- iii) Indoor Climate
- iv) Lighting

The criteria provided in this Guide are based on currently available research data and standards for the purpose of improving personnel performance and providing a base level of habitability and elements of safety related to habitability.

While producing this Guide, ABS took a pragmatic 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/unit or shipyard for the purposes of meeting any of the ABS Habitability (**HAB(ACCOM)**, **HAB+(ACCOM)**, **HAB++(ACCOM)**) notation requirements. Approval of the Testing Specialist for accommodation vessels may also allow for testing and measurement services for other ABS Habitability, Comfort, and MLC notations.

Accommodation Vessel: Within the application of this Guide, an *Accommodation Vessel* is a mobile offshore unit (i.e., a self-elevating or column-stabilized mobile offshore unit), a non-self-propelled barge, or an offshore support vessel, primarily intended for the accommodation of more than 36 persons who are industrial personnel, engaged in some aspect of coastal, offshore, or related employment, excluding members of the crew. In the case of an accommodation barge, it is intended to accommodate these persons only when the barge is moored or otherwise fixed on location. During transit, the accommodation barge will have on board only those crew members necessary for the transit operation. In the case of a self-elevating unit, during jacking or towing operations, it is intended that the unit have on board only those crew members necessary for these operations.

Ambient Environment: Ambient environment refers to the environmental conditions that personnel are exposed to during periods of 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.

Crew: All persons carried on board the accommodation vessel to provide maintenance and operation of the vessel, its machinery, systems and arrangements or to provide services (e.g., catering, laundry, medical, etc.) for other persons onboard the vessel.

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

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

Industrial Personnel: Individuals from the offshore or similar industry who are temporarily housed on the accommodation vessel. These persons do not include members of the crew of the accommodation vessel itself, but may include crew members or industrial personnel from other vessels, drilling units, offshore installations, etc.

Industrial Personnel Accommodation Areas/Block: For the purpose of this Guide, are those areas used for cabins and sanitary spaces (private and public), food service areas, recreation spaces, medical areas, access/egress areas, office and administration spaces, and service spaces.

Recreation Spaces: Those portions of the industrial personnel accommodation areas that are used for recreation such as a lounge, library, quiet room, internet room, TV room, movie theater, exercise room, gymnasium, shop/kiosk, or similar permanently enclosed spaces.

Service Spaces: Those portions of the industrial personnel accommodation areas that are used for changing rooms, self-service laundry spaces, and similar permanently enclosed spaces.

Office and Administration Spaces: Those portions of the industrial personnel accommodation areas that are used for offices areas, reception spaces (e.g., helicopter arrival and departure areas), conference rooms and training rooms, and similar permanently enclosed spaces.

Food Service Areas: Those portions of the industrial personnel accommodation areas that are used for dining areas, snack areas and pantries containing no cooking appliances.

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

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

Transit Conditions: Those conditions where the vessel is transitioning (moving) from one location to another by its own means of propulsion.

5 Associated Documentation

See Appendix 2, “Procedural Requirements for ABS Recognized Ambient Environmental Testing Specialists” for more information.

6 Notation

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

An accommodation vessel complying with the **HAB(ACCOM)** criteria and the more stringent criteria with respect to personnel accommodation areas, whole-body vibration, noise and indoor climate may be distinguished in the *Record* by the notation **HAB+(ACCOM)**.

An accommodation vessel satisfying all the criteria in the Guide may be distinguished in the *Record* by the notation **HAB++(ACCOM)**. A summary of the differences among each of these notations is presented below.

	HAB(ACCOM)	HAB+(ACCOM)	HAB++(ACCOM)
Industrial Personnel Accommodation Areas	HAB(ACCOM) requirements for Accommodation Areas	HAB(ACCOM) and HAB+(ACCOM) requirements for Accommodation Areas (no difference between HAB+(ACCOM) and HAB++(ACCOM))	
Whole-body Vibration	Level of vibration – reducing discomfort	Lower level of vibration – increased comfort	Lowest level of vibration – increased comfort
Noise	IMO Code on Noise with modifications	HAB(ACCOM) with additional requirements	HAB+(ACCOM) with additional requirements
Indoor Climate	No provision for individual temperature adjustment		Aimed at enhancing industrial personnel comfort by making provisions for individual adjustments for indoor climate temperature
Lighting	No differences among the notations		

7 Data and Plans to be Submitted

7.1 General

The following General Arrangement-type drawings of the accommodation vessel are to be submitted:

- i) Outboard and inboard profiles that show the elevations of all major decks.
- ii) Plans of each deck showing the watertight and non-tight bulkhead locations, structural and non-structural bulkhead locations, layout of major machinery, etc.

7.2 Industrial Personnel Accommodation Areas

At a minimum, scaled arrangement drawings of the various accommodation spaces (elevation and plan views) are to be submitted to ABS Engineering. Details of the accommodation area data requirements are provided in Section 2/5, “Industrial Personnel Accommodation Area Documentation”.

7.3 Ambient Environment

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

7.3.1 Test Plans

Test Plans serve as the principal means for verifying the measurements for the ambient environmental aspects of habitability. 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:

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

Test Plans require approval by ABS Engineering before any measurements are made. ABS Engineering is to notify the Owner, operator, or builder whether the Test Plans have been approved or require alteration. An ABS approved copy of the Test Plan is to become part of the accommodation vessel’s official documentation.

7.3.2 Test Reports

Upon completion of the ambient environmental testing, Test Reports are to be submitted to the ABS Surveyor. In addition, a copy of the Test Reports is to become part of the accommodation 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:

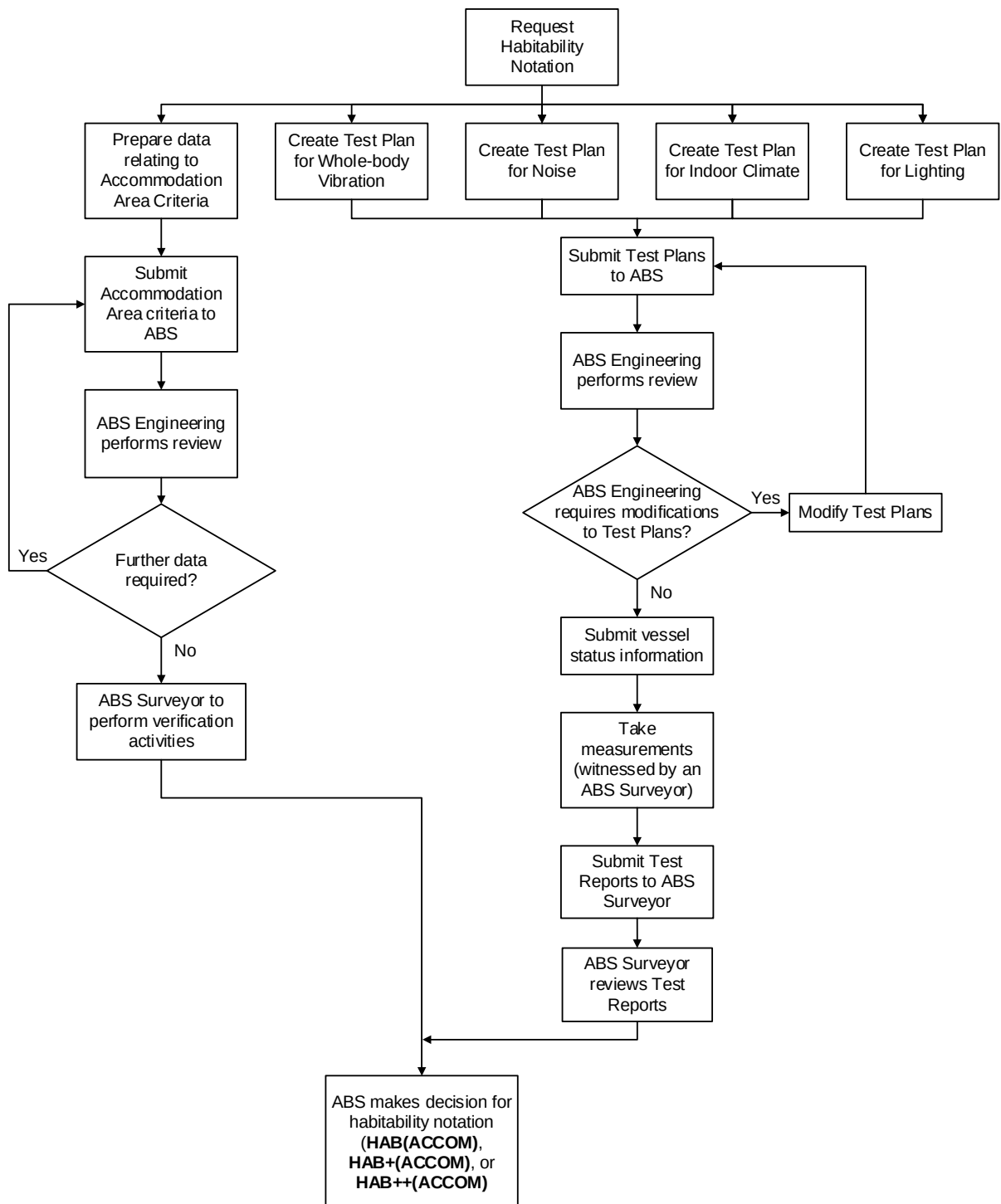
<i>Environmental Aspect</i>	<i>Test Report Details</i>
Whole-body Vibration	Subsection 3/8
Noise	Subsection 4/8
Indoor Climate	Subsection 5/8
Lighting	Subsection 6/8

8 Process for Obtaining a Notation

Prior to scheduling accommodation area verification or ambient environmental testing activities, the Owner, operator, or builder is required to certify the operational status of the accommodation vessel as being fully operational and/or inclusive of all equipment and furnishings. If the accommodation vessel is not fully operational, a complete listing of deficiencies of areas, components, equipment, etc., is to be submitted to ABS for review. ABS will then make a determination and notify the Owner, operator, or builder as to whether accommodation area verification activities or ambient environmental testing can commence. The intent is to conclude all ambient environment testing by the end of the sea trials.

Section 1, Figure 1, “Process for Obtaining a Habitability Notation”, charts the process for obtaining a **HAB(ACCOM)**, **HAB+(ACCOM)**, or a **HAB++(ACCOM)** notation. The following paragraphs briefly describe the notation process.

FIGURE 1
Process for Obtaining a Habitability Notation



8.1 Industrial Personnel Accommodation Areas

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

Follow-up physical verification measurements of accommodation area criteria are to be performed by an ABS Surveyor. The ABS Surveyor is to select verification measurement sites. The physical verification measurements of accommodation area criteria is to be performed for all accommodation vessels in a series of vessels.

The results of the ABS Engineering review and actual ABS Surveyor verification are to 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 are to be individually prepared and submitted to ABS Engineering. These Test Plans are to 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 are to be performed by Testing Specialists and witnessed by an ABS Surveyor. Test Reports for ambient environmental testing are to be prepared by Testing Specialists and submitted to the ABS Surveyor for review.

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

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

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

- Spaces that were identified as “worst case” locations in the test plans for the first vessel are to be tested.
- By review of the first vessel’s Test Reports (all ambient environment aspects), the ABS Surveyor is to identify the locations which were out of compliance or close to non-compliance (See Section 1, Table 1) that need to be tested.
- Spaces that required some type of mitigation for the first vessel are to be tested.
- All vessels are subject to ABS Surveyor walkthroughs. Additional testing may be required at the ABS Surveyor’s discretion.

TABLE 1
Threshold for Measurements to be Considered
Close to Non-Compliance

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

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

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

8.3 Results

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

9 Initial Requirements

The initial process for obtaining a Habitability notation is to comprise ABS Engineering reviews, ambient environmental testing, and ABS Surveyor verifications. Testing is to be in accordance with the submitted Test Plans reviewed and approved by ABS Engineering in advance of the testing. Testing is to be witnessed by an ABS Surveyor. If the criteria specified in this Guide have been satisfied, then the appropriate 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 **HAB(ACCOM)**, **HAB+(ACCOM)**, or **HAB++(ACCOM)** notation, an Annual Survey is to be made within three months before or after each annual anniversary date of the crediting of the Initial Survey or the previous Special Periodical Survey. The following information is to be reviewed by the attending ABS Surveyor for issues that could affect the Habitability notation.

- i) Maintenance and Operations logs since the previous Initial, Annual, or Special Periodical Survey, if any
- ii) Fire, repair, and damage reports since the previous Initial, Annual, or Special Periodical Survey, if any
- iii) A list of all structural or mechanical modifications to the accommodation vessel since the previous Initial, Annual, or Special Periodical Survey, if any
- iv) Verification that equipment and facilities continue to be fit for purpose and are operating in accordance with the 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 Habitability notation. As a result, the accommodation 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 **HAB(ACCOM)**, **HAB+(ACCOM)**, or **HAB++(ACCOM)** notation, a Special Periodical Survey is to be completed within five years after the date of build or after the crediting date of the previous Special Periodical Survey. The interval between Special Periodical Surveys may be reduced by ABS. If a Special Periodical Survey is not completed at one time, it will be credited as of the completion date of the survey, but not later than five years from date of build or from the date recorded for the previous Special Periodical Survey. If the Special Periodical Survey is completed prematurely but within three months prior to the due date, the Special Periodical Survey will be credited to agree with the effective due date.

10.2.1 Survey Requirements

The Survey is to comprise ABS Engineering reviews, ABS Surveyor accommodation verifications, and witnessing of ambient environmental testing. The Survey will cover all applicable habitability aspects.

The following is to be submitted to ABS three months prior to carrying out the ambient environmental testing:

- i) Fire, repair, or damage reports since previous Annual Survey, if any
- ii) A list of all structural or mechanical modifications to the accommodation vessel since previous Annual Survey, if any
- iii) Drawings/arrangements of industrial personnel spaces, HVAC, electrical, etc., affected by alterations, if any
- iv) Copies of the approved Initial Test Plans and Test Reports
- v) Copies of Test Plans and Test Reports resulting from Annual Surveys, if any
- vi) Previous Special Periodical Survey Test Plans and Reports
- 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 personnel spaces against any alterations to the accommodation vessel related to the criteria in Appendix 3 of this Guide 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 by ABS Engineering. The third is to allow scheduling of measurement verifications and ambient environmental testing by ABS Surveyor.

A Special Periodical Survey Test Plan for each ambient environmental aspect of Habitability is to be submitted in accordance with the criteria stated below. The approved Initial Test Plans are to 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 Section 3 through 6 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 of Habitability are to be followed:

- i) Measurements are to be taken in all areas affected by alterations, if any. 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 are to 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 are to be taken in twenty-five (25) percent of industrial personnel cabins identified in the initial Test Plans. Any worst case locations can be considered part of the representative sample for personnel cabins, if applicable.
- iv) For all ambient environmental aspects, measurements are to be taken where a single instance of one (1) type of an industrial personnel accommodation space exists within the accommodation vessel (e.g., mess room, 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 is to 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/walk-through inspections are to be conducted in accordance with 7.4.2 of the appropriate Section of this Guide.

10.3 Requirements for Accommodation Vessel Alterations

No alterations, including the installation of portable accommodation modules, which affect or may affect the Habitability notation awarded, including alterations to the structure, machinery, electrical systems, piping, furnishings or lighting systems, are to be made to the accommodation vessel unless plans of the proposed alterations are submitted to and approved by ABS before the work of alteration/installation is commenced. If ABS determines that the alteration will affect the Habitability notation, the altered accommodation 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 satisfy 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 in which the accommodation vessel is registered (flag State) or operated (coastal State), provided they are deemed not less effective.

11.3 Departures from Criteria

The criteria contained in this Guide are envisioned to apply to accommodation 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 Mobile Offshore Drilling Units*
- *ABS Rules for Building and Classing Steel Barges*
- *ABS Rules for Building and Classing Offshore Support Vessels*
- *ABS Guide for Building and Classing Mobile Offshore Units*
- *ABS Guide for Building and Classing Accommodation Barges*
- *ABS Guide for Portable Accommodation Modules*

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



SECTION 2 Industrial Personnel Accommodation Areas

1 Background

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

Conversely, inappropriate accommodation areas can adversely impact the industrial personnel'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 industrial personnel alertness and well-being is to be of concern to accommodation vessel Owners and operators.

2 Scope

This Section and Appendix 3, "Accommodation Area Criteria", provide the evaluation criteria for accommodation spaces. In particular, Appendix 3 encompasses criteria for access and egress, as well as industrial personnel cabins, sanitary spaces, offices, food services, recreation areas, service, and medical spaces. The criteria were selected to help increase personnel safety, productivity, quality of work, retention, and morale.

The criteria are applicable only to the areas of the accommodation block allocated to the industrial personnel and do not include crew accommodation and vessel operational spaces in the accommodation block.

Compliance with this Section and Appendix 3 "Accommodation Area Criteria" is a prerequisite for the Habitability (**HAB(ACCOM)**), Habitability Plus (**HAB+(ACCOM)**), or Habitability Plus Plus (**HAB++(ACCOM)**) notation confirmation.

3 Associated Documentation

- Appendix 3, "Accommodation Area Criteria"
- International Labor Organization (ILO) Conventions 92 and 133 and the ILO MLC, Title 3, 2006
- *ABS Guide for Compliance with The ILO Maritime Convention, 2006 Title 3 Requirements*

4 Criteria

The accommodation area criteria are contained in Appendix 3, "Accommodation Area Criteria". Meeting the baseline **HAB(ACCOM)** criteria in Appendix 3 fulfills the physical quantitative accommodation area arrangement requirements contained in ILO MLC 2006, Title 3, denoted by a "#" symbol in the tables.

The **HAB+(ACCOM)** and the **HAB++(ACCOM)** notations have more stringent criteria than the **HAB(ACCOM)** notation with the objective of providing enhanced living conditions to improve industrial personnel safety and comfort. This includes enhanced criteria for access/egress, industrial personnel cabins, food service areas, and recreation/leisure.

5 Industrial Personnel Accommodation Area Documentation

As stated in 1/7.2, “Industrial Personnel Accommodation Areas”, accommodation area documentation is to be prepared and submitted to ABS Engineering for review. Confirmatory verification measurements are to be performed by an ABS Surveyor. The following data is to be submitted to ABS Engineering:

5.1 Data Requirements

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

5.1.1 New Construction

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

5.1.2 Existing Accommodation Vessels

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

6 Submittal Review and Verification

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

ABS Engineering will review the submitted accommodation area documentation. ABS Engineering will report any deviation from criteria to the Owner, operator or builder for resolution and will also identify any criteria that the ABS Surveyors must field verify.

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

7 Results

The results of the ABS Engineering review and the ABS Surveyor verification are to be reviewed by the ABS Surveyor against the appropriate **HAB(ACCOM)**, **HAB+(ACCOM)**, or **HAB++(ACCOM)** criteria for notation confirmation.



SECTION 3 Whole-body Vibration

1 Background

Living onboard accommodation 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 when in transit. 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

This Section provides the criteria and methods for assessing whole-body vibration relating to habitability onboard accommodation vessels. The criteria were selected to limit potential vibration-related discomfort of industrial personnel.

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 personnel will be exposed.

The criteria in this Section are applicable only to industrial personnel accommodation areas, as defined in Section 1, and do not include vessel crew accommodation spaces.

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

3 Terminology

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

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

Dynamic Positioning: A system that automatically maintains an accommodation 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 20283-5:2016.

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

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

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

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

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

Transit Conditions: Those conditions where the vessel is transitioning (moving) from one location to another by its own means of propulsion.

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.

Water Depth: The expected distance from the water's surface to the seabed on location.

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. It 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 20283-5:2016, Mechanical Vibration – Measurement of Vibration on Ships – Part 5: Guidelines for Measurement, Evaluation and Reporting of Vibration with Regard to Habitability on Passenger and Merchant Ships
- ISO 2631-2:2003, Mechanical Vibration and Shock – Evaluation of Human Exposure to Whole Body Vibration – Part 2, Vibration in Buildings
- ISO 8041:2005, Human Response to Vibration – Measuring Instrumentation.
- ISO 5348:1998, Mechanical Vibration and Shock – Mechanical Mounting of Accelerometers
- ISO 20283-2:2008, Mechanical Vibration – Measurement of Vibration on Ships – Part 2: Measurement of Structural Vibration

- ISO 17025:2005, General requirements for the competence of testing and calibration laboratories.
- World Meteorological Organization (WMO) Manual on Codes, No. 306, Part A, Alphanumeric Codes (2011 Edition, Updated in 2014)

5 Criteria

The whole-body vibration criteria for the Habitability notations (**HAB(ACCOM)**, **HAB+(ACCOM)**, or **HAB++(ACCOM)**) are provided in Section 3, Table 1, “Maximum Weighted Root-Mean-Square Acceleration Level”. The severity of the vibration is to be indicated by the weighted root-mean-square acceleration value (a_w) as defined in ISO 8041:2005.

The maximum vibration levels are to be determined for the test conditions specified in 3/7.3, “Test Conditions” and are not to be exceeded. In addition, these criteria are only applicable under normal operating conditions (i.e., mooring, dynamic positioning, and/or transit) during which industrial personnel are accommodated onboard the vessel.

Whole-body vibration measurements are only to be taken in industrial personnel accommodation spaces. Specific locations are referred to in 3/7.4, “Measurement Locations”.

The **HAB(ACCOM)** notation’s maximum vibration level is primarily aimed at reducing discomfort. The more stringent maximum level for the **HAB+(ACCOM)** and **HAB++(ACCOM)** notations are aimed at improving comfort. In this instance, “comfort” means the ability of personnel to use a space for its intended purpose with minimal annoyance from whole-body vibration.

TABLE 1
Maximum Weighted Root-Mean-Square Acceleration Level

Notation	Frequency Range	Acceleration Measurement	Maximum Weighted RMS Level		
			Type A Spaces	Type B Spaces	Type C Spaces
HAB(ACCOM)	1.0 – 80 Hz	a_w	125 mm/s ² (3.5 mm/s)	125 mm/s ² (3.5 mm/s)	143 mm/s ² (4.0 mm/s)
HAB+(ACCOM)	1.0 – 80 Hz	a_w	107 mm/s ² (3.0 mm/s)	107 mm/s ² (3.0 mm/s)	125 mm/s ² (3.5 mm/s)
HAB++(ACCOM)	1.0 – 80 Hz	a_w	71.5 mm/s ² (2.0 mm/s)	89.5 mm/s ² (2.5 mm/s)	107 mm/s ² (3.0 mm/s)

Notes:

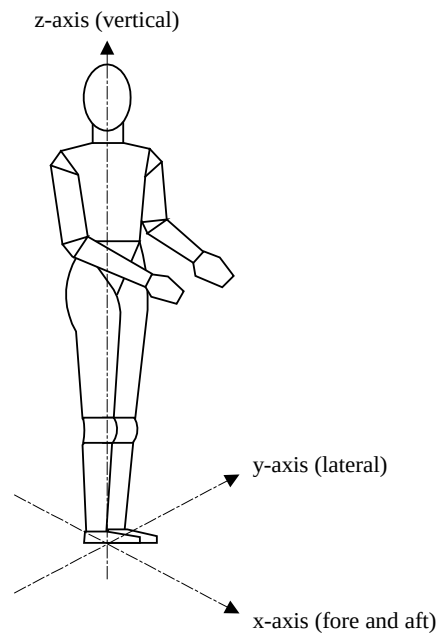
Type A Spaces: Cabins, Medical Spaces

Type B Spaces: Food Service Areas, Recreation Spaces, Public Sanitary Spaces, Service Spaces, Access/Egress Areas

Type C Spaces: Office, Administration Areas, Reception areas

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.

FIGURE 1
Measurement Axes



6 Test Plan

As stated in 1/7.3.1, “Test Plans”, a Test Plan is to 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 is to include the following:

6.1 Documentation

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

6.2 Test Personnel

The Test Plan is to 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 is to detail the conditions (i.e. mooring, dynamic positioning, and/or transit) under which the tests will be performed. The applicable normal operating conditions are those during which industrial personnel are accommodated onboard the vessel.

6.4 Measurement Locations

The Test Plan is to document, in detail, on appropriate drawings, all spaces where measurements will be taken. In addition, transducer placement positions are to be indicated. Details on selecting measurement locations and determining transducer placement positions are provided in 3/7.4, “Measurement Locations”.

6.5 Data Acquisition and Instruments

The Test Plan is to provide information regarding the methods and instrumentation to be used for measurement and data collection. Instrumentation specification details are to include type of instruments to be used, accuracy, calibration, sensitivity, conformance with ISO 8041:2005, 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 is to provide information regarding the methods, software, and instrumentation to be used for data analysis.

6.7 Test Schedule

The Test Plan is to provide information regarding the proposed test schedule. The test schedule is to include information on the approximate date and duration of testing (including a summary of the scheduled measurements per day).

6.8 Data Collection Sheets

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

6.9 Conflict of Interest Declaration

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

7 Test Requirements

7.1 General

In general, whole-body vibration measurements are to be in accordance with the procedures described in ISO 20283-5:2016.

7.2 Data Acquisition and Instruments

For the **HAB(ACCOM)**, **HAB+(ACCOM)**, or **HAB++(ACCOM)** notation, a sample of data is to be recorded for each whole-body vibration measurement position. Each whole-body vibration measurement sample is to be at least sixty (60) seconds in duration. For each location measured, a data sample is to be taken for each applicable operational condition (i.e., mooring, dynamic positioning, and/or transit), in accordance with the requirements of 3/7.3, "Test Conditions".

The above measurement samples are to all be taken using the appropriate Type 1 instrumentation (ISO 8041:2005), then frequency weighted and analyzed in accordance with ISO 20283-5:2016. It is desirable to employ equipment that records and stores acceleration time histories.

7.3 Test Conditions

The test conditions required for the whole-body vibration measurements are to be in accordance with the following Subparagraphs.

7.3.1 Power Output

- i) *Transit (if applicable)*: The propulsion machinery is to run at 80% of the maximum continuous rating (MCR). Controllable pitch and Voith-Schneider propellers, if any, are to be in the normal seagoing position. For vessels with special propulsion and power configurations, such as diesel-electric systems, the actual vessel's design or operating parameters as defined in the vessel's specifications (i.e., contractual service conditions) will be used.
- ii) *Dynamic Positioning (if applicable)*: Devices such as azimuth or tunnel thrusters, automatic or manual, are to run at contractual service conditions or with at least 40% power on the thruster.

7.3.2 Machinery and Equipment Operation

As appropriate for the mode of operation (i.e., mooring, dynamic positioning, and/or transit), all machinery essential for vessel operation is to 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 measurement period.

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 are to be taken under normal operating. The vessel, if transit condition is applicable, is to maintain a single heading and a constant speed during the test. Measurements during dynamic positioning and mooring are to be taken while the vessel is maintaining a position relative to another vessel/unit or fixed point (e.g., offshore installation).

For self-elevating units (jack-ups), the water depth and the air gap are to be within the top one-third ($\frac{1}{3}$) of the unit's operating range.

For self-elevating units (jack-ups), when reporting water depth, the expected air gap is to also be defined.

7.3.4 Rudder Conditions

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

7.3.5 Sea Condition

Measurements are to be taken under conditions of Sea State 3 or less, as defined by the World Meteorological Organization (WMO) Manual on Codes, No. 306, Part A, Alphanumeric Codes.

7.3.6 Loading Conditions

The loading condition of an accommodation vessel is to be as close as possible to normal operating conditions. If this is not practicable, the loading condition is to be highlighted in the Whole-body Vibration Test Report.

7.3.7 Test Interference

During the whole-body vibration measurements, vibration arising from every kind of unnecessary human activity is to 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 are to 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 is to obtain a representative sample of data that reflects the actual conditions in industrial personnel accommodation areas. For practical reasons, it is important to select the locations such that an appropriate amount of data can be collected during the testing phase. The measurement locations are to 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 industrial personnel accommodation areas via the accommodation vessel's structure. Measurements are to be taken in all identified worst case locations.
- ii) Where a single instance of one (1) type of industrial personnel accommodation space exists within the accommodation vessel (e.g., mess room, gymnasium, library, etc.), that location is to be selected for measurement.

- iii) Where multiple instances of the same type accommodation space exist that are not industrial personnel cabins, a representative sample of at least twenty (20) percent of each type is to be selected for measurement. The worst case locations are to be considered part of the representative sample, if applicable.
- iv) Select a representative sample of industrial personnel cabins throughout the accommodation vessel. For vessels with less than 50 cabins, fifty (50) percent of cabins are to be selected on each deck. For vessels with 50 to 100 cabins, thirty (30) percent of cabins (but not less than 25 cabins total on all decks) are to be selected on each deck. For vessels with greater than 100 cabins, twenty (20) percent of cabins (but not less than 33 cabins total on all decks) are to be selected on each deck. The worst case locations are to be considered part of the representative sample for personnel cabins, if applicable.

7.4.2 Walkthrough Verification Inspection Locations

All industrial personnel accommodation spaces are to 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 vibration qualities. At the discretion of the ABS Surveyor, additional measurements may be required.

7.4.3 Transducer Placement Positions

Vibration transducers (accelerometers) are to be located and attached properly to the floor surface to measure the vibration at the interface between the industrial personnel and the source of vibration. The mounting of accelerometers is to comply with ISO 5348:1998. 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, the vibration transducers are to 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).

For larger spaces (mess rooms, recreation areas, etc.) it will 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 are to be evenly distributed throughout the space. For a specific room size, the minimum number of measurement locations is to be as indicated in Section 3, Table 2, "Distribution of Transducer Positions Within Spaces".

TABLE 2
Distribution of Transducer Positions Within Spaces

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

Transducers located at one (1) measurement position are to be orthogonally positioned to measure whole-body vibrations in the vertical, longitudinal, and transverse axes. Translational accelerometers oriented in different axes at a single measurement position are to be as close together as possible.

8 Test Report

As stated in 1/7.3.2, “Test Reports”, a Test Report is to 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 are to be provided in the Whole-body Vibration Test Report.

8.1 Test Details

The following details (when applicable) are to be recorded for each period of testing:

- i) Loading conditions (mean draft, trim)
- ii) Power output
- iii) Vessel’s course and speed
- iv) Average water depth under keel
- v) Machinery and equipment operated during the test
- vi) Class of Dynamic Positioning (e.g., **DP-0**, **DP-1**, etc.)
- vii) Total number of persons onboard during tests
- viii) Any indication of abnormal activities during the test that might skew results
- ix) Sea state
- x) Direction of swell relative to vessel heading

8.2 Transducer Placement Positions

Actual transducer placement positions (for each applicable operational condition) are to 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), are to 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, are to be provided.

8.4 Results

The following results per measuring location, are to be provided in table format (for each applicable operational condition):

- i) Measurement position
- ii) Measurement period if different from requirements
- iii) Sample number
- iv) Multi-Axis weighted RMS values
- v) Equipment operating in proximity to the measurement position
- vi) Indication of Pass/Fail

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

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