



GUIDE FOR

CREW HABITABILITY ON SHIPS

DECEMBER 2001

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

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Foreword

One unique aspect of the maritime industry is that workers are often required to live at their workplaces (i.e., on board ship). While this aspect is shared with some other industries like offshore oil and gas, the conditions that the mariner may be subjected to are unique and under some circumstances, the conditions may even be considered harsh. In addition to crew members being required to live away from home for extended periods, the crew may also be subjected to ship motions such as pitching, rolling and slamming as well as less than favorable ambient environmental conditions involving vibrations, noise, lighting and temperatures. Each of these aspects can take a toll on the daily performance of crew members. Indeed such conditions may affect human performance by increasing physical and mental fatigue and this may lead to an increase in human errors.

Two of the most influential factors for enhancing human performance and reducing human errors are facility design and ambient environmental conditions. The quality of the accommodations where ships' crews sleep, eat and relax can influence mariner job performance and overall sense of comfort and well-being. The type, quality and quantity of the various ambient environmental conditions that mariners are subjected to can have a positive or negative effect on the crew. As a result, ABS has produced this *Guide for Crew Habitability on Ships* for the maritime industry in order to provide a comprehensive set of habitability criteria. The subjects of this Guide and their associated criteria have been chosen to provide a means to improve crew performance and on board conditions that will enhance crew retention.

In the present context, "habitability" is defined as the acceptability of conditions on-board a ship in terms of vibration, noise, indoor climate and lighting as well as physical and spatial characteristics, according to prevailing research and standards for human efficiency and comfort.

This Guide provides the assessment criteria and describes the measurement methodology for obtaining a Habitability notation. It is intended for use by vessel owners or companies requesting the optional notations of Habitability (**HAB**) or Habitability Plus (**HAB+**). For the Habitability (**HAB**) level, this Guide focuses on five (5) categories of habitability criteria that can affect task performance and may be controlled, measured and assessed in crew spaces and open deck recreation areas of ships. These categories are as follows: accommodations design, whole-body vibration, noise, indoor climate and lighting. For the Habitability Plus (**HAB+**) level, this Guide provides more stringent accommodations, vibration and indoor climate criteria aimed at increasing crew comfort. To be awarded the Habitability (**HAB**) or Habitability Plus (**HAB+**) notation, a vessel must meet all the appropriate criteria across the various habitability categories. Meeting the criteria of this Guide will also fulfill the physical design (but not the procedural or managerial) requirements as contained in International Labor Organization (ILO) Conventions 92 and 133 except where additional Flag Administration requirements exist.

The ABS *Guide for Crew Habitability on Ships* focuses on evaluation criteria and measurement methodologies specific to awarding the optional ABS Habitability notation. In addition, a separate guide, the ABS *Guide for Passenger Comfort on Ships*, has been issued for the assessment of passenger comfort on ships.

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SECTION 1 General

1 Introduction

The American Bureau of Shipping recognizes the positive impact that appropriate habitability criteria and design practices have on the safety, productivity, morale and overall well-being of vessel crews. The *ABS Guide for Crew Habitability on Ships* has been developed with the objective of improving the quality of seafarer performance by improving their working and living environments in terms of ambient environmental qualities and in some instances the physical characteristics on board cargo vessels and passenger vessels. These habitability criteria have been chosen to provide a means to reduce crew fatigue and to increase crew retention.

2 Application

This Guide is applicable to new and existing vessels for which an optional Habitability (**HAB**) or a Habitability Plus (**HAB+**) notation has been requested. The habitability criteria are a measure of the acceptability of crew accommodations and workspaces for living and working. Meeting the criteria of this Guide will fulfill the physical aspects of design but not the procedural or managerial aspects of International Labor Organization (ILO) Conventions 92 and 133. However, additional criteria imposed by individual Flag Administrations may also be applicable.

A separate document, the *ABS Guide for Passenger Comfort on Ships*, has been developed providing criteria aimed at improving the comfort of passengers in passenger leisure and living environments.

3 Scope

This Guide focuses on five (5) habitability aspects of cargo and passenger vessel design and layout that can be controlled, measured and assessed. These five (5) aspects are broken into two (2) major types in this Guide: accommodations and the ambient environment.

Accommodations criteria pertain to dimensional or physical aspects of spaces and open deck areas where crew members eat, sleep, recreate and conduct their daily activities.

The ambient environmental aspects of habitability pertain to the environment that the crew is exposed to during periods of work, 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 maximizing crew performance and providing a basic level of comfort. This Guide is not specifically aimed at protecting the health and safety of crew members, for these issues are covered by regulations from the International Maritime Organization (IMO), Flag Administrations, Class Society

Rules and Port States. However, where appropriate, compliance with this Guide may warrant an enhancement in some safety systems on board the vessel. The Guide is largely aimed at improving the quality of seafarer performance and well-being.

The various criteria, test conditions, measurement locations, test methods and instruments required by this Guide may differ from the more rigorous and scientific methods reported and practiced elsewhere by the scientific community. They were, however, selected with the aim of providing a Guide that could be applied internationally by ABS and vessel owners/builders with reliability and acceptable validity.

While producing this Guide, ABS has taken steps to minimize the associated costs of acquiring this notation by economizing on measurements, test personnel (External Specialists) and test equipment.

4 Terminology

Accommodations: Vessel areas where the primary purpose is to rest or recreate. Accommodations spaces include cabins and staterooms, medical facilities (sick bays), offices, public and recreation rooms. For the purposes of this Guide, accommodations also include service spaces such as the mess rooms, laundry, storerooms and workshops.

Ambient Environment: Ambient environment refers to the environmental conditions that the crew 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.

Cargo Vessel: A cargo vessel is any vessel not specifically a passenger vessel and that is involved in commercial trade.

Crew Member: Any person on board a vessel, including the Master, who is not a passenger.

Crew Spaces: All areas on a vessel intended for crew only, such as crew accommodations spaces and crew work spaces.

External Specialists: Specialized test personnel who must meet the requirements of Appendix 2, "Procedural Requirements for External Specialists Performing Ambient Environmental Testing".

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

High Speed Craft: Vessels that meet the requirements of the *ABS Guide for Building and Classing High Speed Craft*.

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

Passenger: A passenger is every person other than the Master and the members of the crew or other persons employed or engaged in any capacity on board a vessel for the business of that vessel.

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

Recreational and Public Spaces: Those portions of the crew accommodations which are used for halls, dining rooms, lounges and similar permanently enclosed spaces.

Shall: Expresses a provision that is mandatory.

Should: Expresses a provision that is a recommended or preferred guideline.

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.

Workspaces: Areas allocated for work. Categories of workspaces include: navigation spaces, service spaces (galley, laundry) and machinery spaces.

5 Associated Documentation

Appendix 2, "Procedural Requirements for External Specialists Performing Ambient Environmental Testing", defines the process for External Specialist approval and certification with regard to testing and evaluating ambient environmental conditions on board vessels.

6 Notation

At the owner's or shipyard's request, a vessel complying with the minimum criteria for crew accommodations and the ambient environment (i.e., vibration, noise, indoor climate and lighting) provided in this Guide shall be assigned a notation of **HAB**. A vessel complying with all of the more stringent habitability criteria with respect to crew accommodations, whole-body vibration and indoor climate shall be distinguished in the *Record* by the notation **HAB+**. A summary of the differences between each of the notations is given below.

Notation	Accommodations	Ambient Environment			
		Vibration	Noise	Indoor Climate	Lighting
HAB	Must meet HAB criteria for accommodations	Must meet performance-based vibration level criteria	No difference between HAB and HAB+	The criteria provide for a set temperature within limits	No difference between HAB and HAB+
HAB+	Must meet additional HAB+ criteria for accommodations	Must meet comfort-based vibration level criteria		The criteria provide for adjustability to suit comfort	

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 Accommodations

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

7.3 Ambient Environment

The following items are to be submitted 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 habitability. Separate test plans are required for 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	3/6
Noise	4/6
Indoor Climate	5/6
Lighting	6/6

The test plans require approval by ABS Engineering before any measurements are made. The ABS Technical Office 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:

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

8 Process for Obtaining a Notation

8.1 Cargo Vessels

Prior to scheduling accommodations 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 the ABS Technical Office for review.

The ABS Technical Office shall then make a determination and notify the vessel owner or shipyard as to whether accommodations verification activities or ambient environmental testing can commence.

Section 1, Figure 1, "Habitability Notation Process for Initial Requirements", charts the process for obtaining a **HAB** or a **HAB+** notation. The following subparagraphs briefly describe the notation process.

8.1.1 Accommodations

Arrangement drawings, plans and vessel design specifications for crew accommodations 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 crew accommodations configurations shall be provided to and approved by ABS Engineering, in advance of ABS Surveyor verifications.

Follow-up physical verification measurements of crew accommodations 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.

8.1.2 Ambient Environment

Ambient environmental test plans for vibration, noise, indoor climate and lighting shall be prepared and submitted to ABS Engineering. These test plans shall serve as a primary vehicle for verifying the measurement locations and measurement process, as well as specifying the external specialist who will perform the ambient environmental testing.

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

8.1.3 Results

The ABS Engineering crew accommodations assessment, ABS Surveyor verification measurements, ambient environmental test reports and test results, shall be reviewed by the ABS Surveyor for determination of notation confirmation.

8.2 Passenger Vessels

Prior to scheduling accommodations 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 then a complete listing of deficiencies of areas, components, equipment, etc. shall be submitted to an ABS Technical Office for review.

The ABS Technical Office shall then make a determination and notify the vessel owner or shipyard as to whether accommodations verification activities or ambient environmental testing can commence.

The process for obtaining a Habitability notation (either **HAB** or **HAB+**) is shown in Section 1, Figure 1, "Habitability Notation Process for Initial Requirements".

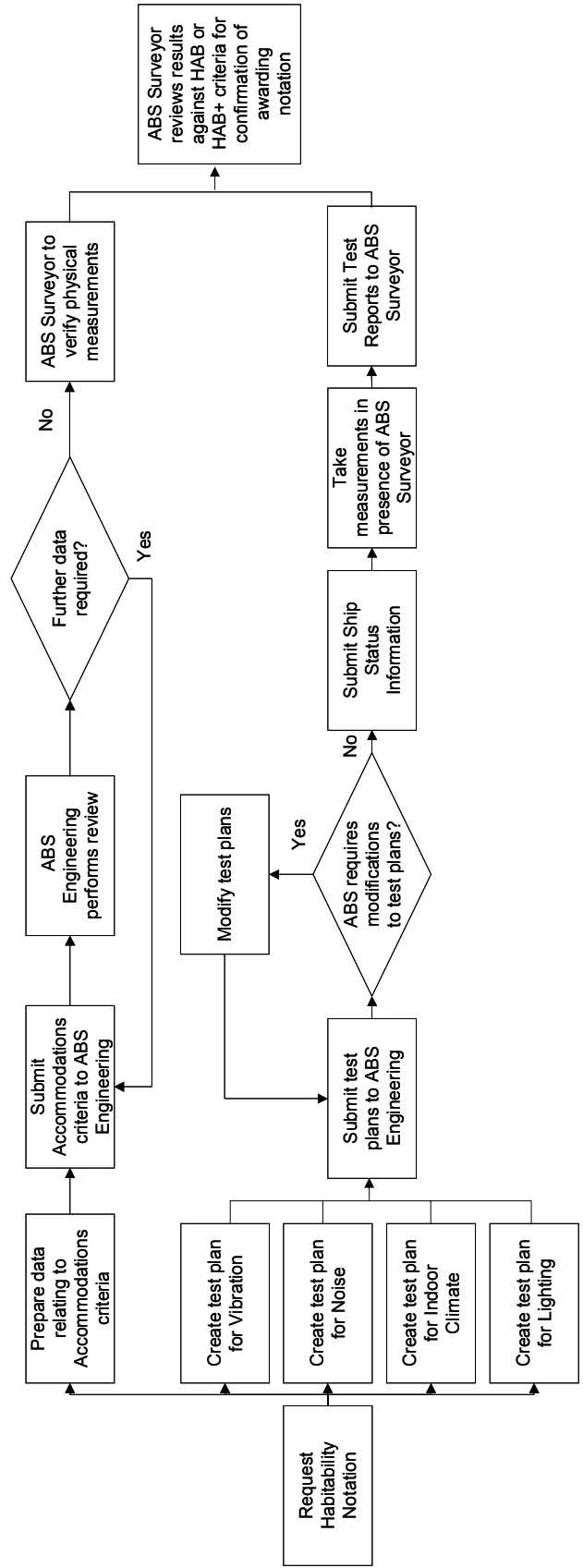
8.2.1 Accommodations

Arrangement drawings, plans and vessel specifications for crew accommodations spaces 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 crew accommodations configurations shall be provided to ABS Engineering in advance of crew accommodations criteria verifications.

Follow-up physical verification measurements shall be performed by an ABS Surveyor. Measurement sites shall be selected by the ABS Surveyor.

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

FIGURE 1
Habitability Notation Process for Initial Requirements



8.2.2 Ambient Environment

Ambient environmental test plans for vibration, noise, indoor climate and lighting shall be prepared and submitted to ABS Engineering.

Information submitted to ABS Engineering shall serve as a primary vehicle for verifying the measurement locations and measurement process, as well as specifying the external specialist who will perform the ambient environmental testing.

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

8.2.3 Results

The ABS Engineering crew accommodations assessment, ABS Surveyor verification measurements, ambient environmental test reports and test results shall be reviewed by the ABS Surveyor for determination of notation confirmation.

9 Initial Requirements

The initial process for obtaining a Habitability notation (either **HAB** or **HAB+**) shall be comprised of ABS Engineering reviews, ABS Surveyor verifications and ambient environmental testing. 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 appropriate notation shall 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** or **HAB+** 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 effect the Habitability notation.

- i)* Vessel's log since previous Initial, Annual or Special Periodical Survey
- ii)* Chief Engineer's log since previous Initial, Annual or Special Periodical Survey
- iii)* Collision and grounding reports since previous Initial, Annual or Special Periodical Survey
- iv)* Fire, repair and damage reports since previous Initial, Annual or Special Periodical Survey
- v)* A list of all alterations to the vessel since previous Initial, Annual or Special Periodical Survey
- vi)* Verification that equipment and facilities continue to be fit for purpose and are operating in accordance with Accommodations Criteria stated within this Guide
- vii)* Verification that geographical area of vessel operations has not changed since previous Initial, Annual or Special Periodical Survey.

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 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** or **HAB+** 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 Special Periodical Survey Number 1 (Age \leq 5 Years)

The Survey shall be comprised of ABS Engineering reviews, ABS Surveyor verifications and ambient environmental testing. The Survey will cover all five (5) habitability aspects.

The following shall be submitted to an ABS Technical Office three (3) months prior to carrying out the ambient environmental testing:

- i) Collision and grounding reports since previous Annual Survey
- ii) Fire, repair or damage reports since previous Annual Survey
- iii) A list of all alterations to the vessel since previous Annual Survey
- iv) Notice in any change in geographical area of vessel operations since Initial Survey
- v) Any drawings/arrangements of crew spaces, HVAC, electrical, etc. affected by alterations
- vi) Copy of approved Initial Test Plans and Test Reports
- vii) Test Plans and Test Reports resulting from Annual Surveys
- viii) Previous Special Periodical Survey Test Plans and Reports, if applicable
- ix) 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 crew 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 Habitability shall be submitted in accordance with the criteria stated below. The approved Initial Test Plans can 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 of Habitability shall be followed:

Measurements shall be taken in all areas affected by vessel alterations. Measurements would be limited to the ambient environmental aspect affected by the alteration. For example, structural changes would require both vibration and noise measurements. Structural changes would not necessarily require indoor climate or lighting measurements. Changes to luminaries would require lighting measurements but not vibration, noise or indoor climate measurements.

- i)* Measurements shall be taken in all worse case or problem area locations. Worse case or problem area locations for a particular ambient environmental aspect shall be selected 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, worse case for vibration is described in 3/7.4.1i).
- ii)* For whole-body vibration, additional measurements shall be taken in crew cabins and staterooms throughout the vessel. For vessels with fewer than one hundred (100) crew cabins and staterooms, ten (10) percent of cabins and staterooms shall be measured.
- For vessels with one hundred (100) or more crew cabins and staterooms, apply the following:
- In the forward one-third ($1/3$) of the vessel, three (3) percent or 1 in 33 of cabins and staterooms shall be measured
 - In the midsection (center $1/3$) of the vessel, two (2) percent or 1 in 50 of cabins and staterooms shall be measured
 - In the aft one-third ($1/3$) of the vessel, five (5) percent 1 in 20 of the cabins and staterooms shall be measured.
- Within each one-third ($1/3$) section of the vessel, measurement locations shall be distributed throughout the length of each section and on each deck.
- iii)* Regardless of the number of crew cabins and staterooms on a vessel, attention must be given to selecting a variety of locations port, starboard, fore, amidships and aft. The worst case locations can be considered part as the representative sample for crew cabins and staterooms, if applicable.
- iv)* For whole-body vibration, additional measurements shall also be taken in crew living and working spaces other than crew cabins and staterooms. Where a single instance of one (1) type of manned crew space exists within the vessel (e.g., bridge, radio room, officer's mess, gymnasium, library, etc.), that location shall be selected for measurement. Where multiple instances of manned crew recreational spaces exist, a representative sample of at least ten (10) percent of each type shall be selected for measurement. The worst case locations are to be considered part of the representative sample, if applicable.
- v)* 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 and on each deck. Additionally, attention must be given to selecting a variety of locations port, starboard, amidships, fore and aft.
- vi)* For noise, indoor climate and lighting, where a single instance of a particular crew space exists, a representative sample of at least ten (10) percent of these spaces shall be selected for measurement. The worst case locations can be considered part of the single instance representative sample, if applicable.
- vii)* For noise and indoor climate, where multiple instances of a particular type of crew space exist, a representative sample of at least ten (10) percent of these spaces shall be selected for measurement. The worst case locations can be considered part of the multiple instance representative sample, if applicable.
- viii)* For lighting, select a sample of at least ten (10) percent of spaces where crew are involved in recreational activities (e.g., mess rooms or recreation areas) for measurement.

Where a number of cabins, staterooms and sanitary 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. A sample of at least fifteen (15) percent of the remaining spaces shall be visually inspected.

The worst case locations can be considered part of these lighting representative samples, if applicable.

For all ambient environmental conditions, visual inspections shall be conducted in accordance with 7.4.2 of the appropriate section of this Guide.

10.2.2 Special Periodical Survey Number 2 (5 Years < Age ≤ 10 Years)

The Survey will be comprised of ABS Engineering reviews, ABS Surveyor verifications and ambient environmental testing. The Survey will cover all five (5) habitability areas and will follow the same procedures and requirements as the Initial Survey except that for the drawing and information submittals stated here.

The following is to be submitted to an ABS Technical Office three (3) months prior to carrying out the ambient environmental testing:

- i)* Collision and grounding reports since previous Annual Survey
- ii)* Fire, repair and damage reports since previous Annual Survey
- iii)* A list of all alterations to the vessel since previous Annual Survey
- iv)* Notice of any change in geographical area of vessel operations since previous Initial, Annual or Special Periodical Survey
- v)* Any drawings/arrangements of crew spaces, HVAC, electrical, etc. affected by alterations
- vi)* Copy of the approved Initial Test Plans and Reports
- vii)* Test Plans and Test Reports resulting from Annual Surveys
- viii)* Previous Special Periodical Survey Test Plans and Reports
- ix)* 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 crew spaces against any alterations to the vessel since the initial and subsequent Special Periodical Surveys, with measurements verified by an ABS Surveyor. The second purpose is to provide a history of ambient environmental testing as well as new Special Periodical Survey ambient environmental testing plans for review and approval. The third is to allow scheduling of verification measurements and ambient environmental testing.

A Special Periodical Survey Test Plan for each ambient environmental aspect of habitability shall be submitted in accordance with Subsection 6, "Test Plans" and Subsection 7, "Test Requirements" of the appropriate ambient environment section. The Test Plan shall incorporate the same procedures and requirements as the Initial Survey with the following addition. Measurement locations will be specified for spaces where vessel alterations have occurred or where such alterations may affect the ambient environmental aspects associated with a space. Regardless, the approved Initial Test Plans can be used as a basis for creating the new Special Periodical Survey Test Plans.

10.2.3 Special Periodical Survey Number 3 (10 Years < Age ≤ 15 Years)

The Survey is to follow the same procedures and requirements as described in 1/10.2.1, "Special Periodical Survey Number 1 (Age < 5 Years)".

10.2.4 Subsequent Special Periodical Surveys (Age > 15 Years)

The Survey is to follow the same procedures and requirements as described in 1/10.2.2, "Special Periodical Survey Number 2 (5 Years < Age ≤ 10 Years)".

10.3 Requirements for Vessel Alterations

No alterations which affect or may affect the Habitability notation (**HAB** or **HAB+**), 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 and approved by an ABS Technical Office before the work of alteration is commenced. If the ABS Technical Office determines that the alteration will affect the Habitability notation, the altered vessel shall be subject to the review, verification and ambient environmental testing requirements of this Guide.

10.4 Requirements for Geographical Area of Vessel Operations

When it is intended to change the geographical area of vessel operations, which may affect the Habitability notation (**HAB** or **HAB+**), the details of such a change are to be submitted to the ABS Technical Office for review. If the review of the ABS Technical Office determines that the change will affect the Habitability notation, the vessel shall be subject to the review and ambient environmental testing requirements in Section 3, "Whole-body Vibration", Section 4, "Noise" and/or Section 5, "Indoor Climate" of this Guide.

11 Alternatives

11.1 General

ABS will consider alternative arrangements, criteria and procedures, which can be shown to meet the performance standards contained in 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 not less effective.

11.3 Departures from Criteria

The criteria contained in this Guide envision application 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 in Length*
- *ABS Guide for Building and Classing High Speed Craft*
- *ABS Guide for Building and Classing Passenger Vessels*
- *ABS Guide for Building and Classing Motor Pleasure Yachts*
- *ABS Guide for Building and Classing Aluminum Vessels*
- *ABS Rule Requirements for Materials and Welding: Aluminum and Fiber Reinforced Plastics*
- *ABS Rules for Building and Classing Steel Vessels for Service on Rivers and Intracoastal Waterways.*

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 accommodations or ambient environmental (e.g. vibration, noise, indoor climate and/or lighting) test results contain departures from the stated criteria, these will be the subject of special consideration upon the receipt of details about the departure. Depending on the degree and consequences of the departure, the 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 Accommodations**

1 Background

With reductions in staffing and increases in the complexity of on-board systems, it is vital that crew members maintain enhanced levels of mental and physical fitness while on board vessels. To maintain such fitness, crew members must be provided with supportive accommodations spaces. Proper accommodations design will promote reliable human performance by reducing the potential for fatigue and human errors. Appropriate accommodations design has the further potential to enhance morale, retention and comfort.

Conversely, improper accommodations design can adversely impact the crew members' ability to reliably perform their duties, fully relax, sleep and recover from mentally and physically demanding work activities. This in turn may impact their ability to carry out duties on succeeding watches with the required diligence and accuracy. Providing an on-board environment that increases crew member alertness and well-being should be of concern to responsible vessel owners.

2 Scope

This Section and Appendix 3, "Accommodations Criteria", provide the assessment and measurement criteria for accommodations spaces on vessels. In particular, Appendix 3 encompasses the criteria for berthing, sanitary spaces, offices, food services, recreation areas, laundry, medical spaces, as well as stairs, ladders and walkways. The criteria were selected to help increase crew member productivity, quality of work, retention and morale.

Compliance with this Section is a pre-requisite for the Habitability (**HAB**) or Habitability Plus (**HAB+**) notation confirmation. Meeting the requirements of this Accommodations Section will also fulfill the physical design (but not the procedural or managerial) requirements as contained in International Labor Organization (ILO) Conventions 92 and 133. However, additional criteria imposed by individual Flag Administrations may also be applicable.

3 Terminology

Accommodations: Vessel areas where the primary purpose is to rest or recreate. Accommodations spaces include cabins and staterooms, medical facilities (sick bays), offices, public and recreation rooms. For the purposes of this Guide, accommodations also include service spaces such as the mess rooms, laundry, storerooms and workshops.

4 Associated Documentation

Appendix 3, "Accommodations Criteria"

International Labor Organization (ILO) Conventions 92 and 133.

5 Criteria

The Accommodations criteria for the Habitability (**HAB** and **HAB+**) notations are provided in Appendix 3, "Accommodations Criteria".

The objective of the **HAB** notation is to furnish crew members with living and working arrangements to improve quality of work, enable adequate rest and recreation and increase productivity.

The **HAB+** notation has more stringent criteria than the **HAB** notation with the objective to provide enhanced living and working conditions to improve crew member comfort. This includes enhanced criteria for crew workspace design, equipment accessibility for maintenance, berthing and recreation/leisure.

6 Accommodations Documentation

As stated in 1/7.2, "Accommodations", accommodations 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 validating and verifying that the vessel meets the accommodations criteria specified in Appendix 3, "Accommodations Criteria".

6.1.1 New Construction

For new construction, scaled arrangement drawings of the accommodations spaces (elevation and plan views), details of the accommodations outfitting and vessel's design specification in relation to the accommodations spaces shall be submitted to ABS Engineering. The drawings and specifications shall be provided during the detailed design phase.

6.1.2 Existing Vessels

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

7 Submittal Review and Verification

Arrangement drawings, plans and vessel specifications for the accommodations 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 accommodations configurations shall be provided to ABS Engineering, in advance of on-board ABS Surveyor verifications.

ABS Engineering shall review the submitted accommodations 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. 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 actual ABS Surveyor verification shall be reviewed by the ABS Surveyor against the appropriate **HAB** and **HAB+** criteria for notation confirmation.



SECTION 3 Whole-body Vibration

1 Background

Working and/or living on board vessels, whether conventional or high speed, can impose a series of low- and high-frequency mechanical vibrations as well as single-impulse shock loads on the human body.

Low-frequency vibrations (i.e., oscillations) are generally imposed by vessel motions, which are produced by the various sea states in conjunction with vessel speed. Oscillation may 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 because of vessel size, speed and wave conditions.

High-frequency vibration is often associated with high-speed rotating machinery. The imposition of higher frequency vibrations 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 on board vessels. The criteria were selected to limit potential vibration interference with work tasks and to improve crew comfort.

Consideration of the external loads imposed is restricted to motions transmitted from surrounding structures to the entire human body through the feet of a standing person in the frequency range 0.5 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 motion to levels that are lower than those experienced when standing. The motions transmitted through the feet are expected to be the highest vibration levels to which crew will be exposed.

Whole-body vibration limits defined in this Section are based on currently available standards. Compliance with this Section is a pre-requisite for being awarded the Habitability (**HAB**) or Habitability Plus (**HAB+**) notation.

3 Terminology

Acceleration: A vector quantity that specifies the rate of change of velocity (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 or through zero calibration.

Crest Factor: The ratio of the peak value to the root-mean-square (rms) value of the acceleration after it has been frequency weighted by the appropriate frequency weighting network.

$$\text{Crest Factor} = \frac{\text{weighted peak acceleration}}{\text{weighted rms acceleration}}$$

Frequency: The number of complete cycles of a periodic process occurring per unit time. Frequency is expressed in Hertz (Hz) which corresponds to one (1) cycle-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 the various human responses. The units of a frequency weighting should be those of the response divided by those of the vibration waveform, but it is often assumed that the weighting is non-dimensional.

The two frequency weightings used to evaluate whole-body vibration in this Guide are as follows:

- i) W_b : Frequency weighting used to evaluate z-axis vibration when standing with respect to comfort
- ii) W_d : Frequency weighting used to evaluate x-axis and y-axis vibration when standing with respect to comfort.

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

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

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

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

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

Peak Value: The largest deviation of a signal from the arithmetic mean of that signal. The positive peak value is the maximum positive deviation; the negative peak value is the maximum negative deviation.

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

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.

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.

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:

BS 6841: 1987, Measurement and evaluation of human exposure to whole-body mechanical vibration and repeated shock

ISO 8041:1990/Amd.1:1999, Human response to vibration – Measuring instrumentation

ISO 5348:1987, Mechanical mounting of accelerometers for measuring mechanical vibration and shock

WMO: 1995, Sea State Code.

Further guidance can be found in:

ISO 2923: 1996, Acoustics – Measurement of noise on board vessels

ISO 4867: 1984, Code for the measurement and reporting of on board vibration data.

5 Criteria

The whole-body vibration criteria for the Habitability (**HAB** and **HAB+**) notations are provided in Section 3, Table 1, "Maximum 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: 1990/Amd.1:1999.

Vibration measurements shall only be taken in manned crew spaces. A space is considered "manned" if it is occupied by crew members 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".

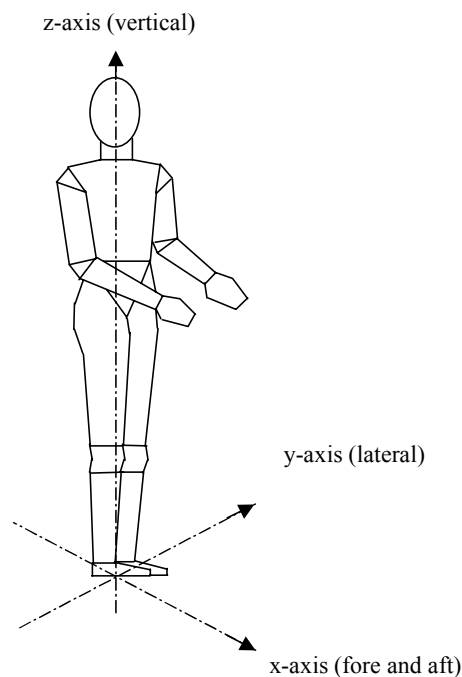
The maximum vibration levels in Section 3, Table 1, "Maximum Weighted Root-Mean-Square Acceleration Level", shall not be exceeded under normal operating conditions. The **HAB** notation maximum vibration level is primarily aimed at preventing severe discomfort and interference with crew task performance. The more stringent maximum level for the **HAB+** notation is aimed at improving crew comfort. In this instance, "comfort" means the ability of the crew to use a space for its intended purpose with minimal interference or annoyance from vibration.

TABLE 1
Maximum Weighted Root-Mean-Square Acceleration Level

<i>Notation</i>	<i>Frequency Range</i>	<i>Acceleration measurement</i>	<i>Maximum level</i>
HAB	0.5 - 80 Hz	a_w	0.4 m/s ²
HAB+	0.5 - 80 Hz	a_w	0.315 m/s ²

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 single-axis and multi-axis a_w level must be less than or equal to the maximum level expressed in Section 3, Table 1.

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 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 External Specialists who shall be conducting the test and their approval and certification in accordance with Appendix 2, "Procedural Requirements for External Specialists Performing Ambient Environmental Testing".

6.3 Test Conditions

The Test Plan shall detail the conditions under which the tests will be performed. Information shall be submitted to ABS Engineering within the Test Plan with regards to the most probable sea state expected for a vessel based on the geographical area of vessel operation. The sea state will be stated in accordance with the World Meteorological Organization (WMO) (1995) *Sea State Code*. 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

Information shall be provided 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 8041:1990/Amd.1:1999 and frequency range. More details on data acquisition and instruments are provided in 3/7.2, "Data Acquisition and Instruments".

6.6 Data Analysis

Information shall be provided regarding the methods, software and instrumentation to be used for data analysis.

6.7 Test Schedule

Information shall be provided regarding the proposed test schedule.

7 Test Requirements

7.1 General

Whole-body vibration measurements shall be in accordance with the procedures described in BS 6841. When the procedures described in this Guide deviate from any requirements or procedures mentioned in BS 6841, the requirements of this Guide 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". A comprehensive resource with regards to human response to whole-body vibration is provided in Griffin's (1990) *Handbook of Human Vibration*.

7.2 Data Acquisition and Instruments

For the **HAB** or **HAB+** notation, a single 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. In the case of high speed craft, each whole-body vibration measurement sample shall be at least 227 seconds in duration.

The above measurement samples shall all be taken using the appropriate Type 1 instrumentation (ISO 8041: 1990/Amd.1:1999), then frequency weighted and analyzed in accordance with BS 6841. It is desirable to employ equipment that records and stores acceleration time histories.

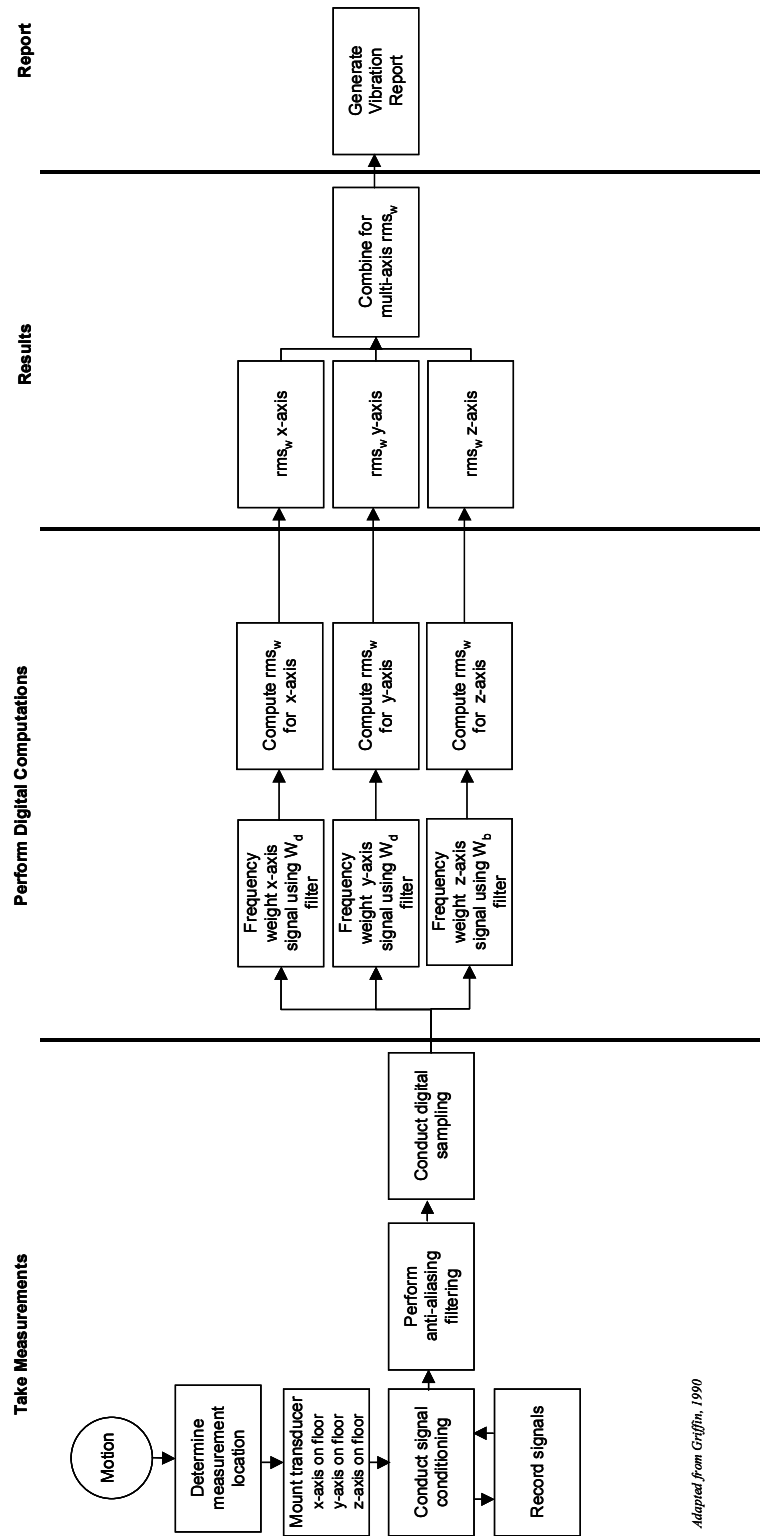
7.3 Test conditions

The test conditions required for the whole-body vibration measurements shall be in accordance with the following subparagraphs, which are taken or adapted from ISO 4867 and ISO 2923. These conditions are consistent with those for noise measurements covered in 4/7.3, "Test Conditions".

7.3.1 Power Output

The propulsion machinery shall run at normal service speed and at no less than eighty (80) percent of the maximum continuous rating (MCR).

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



Adapted from Griffin, 1990

7.3.2 Equipment Operation

All other rotating 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

Where possible, whole-body vibration measurements are to be taken with the vessel in a depth of water not less than five (5) times the draft of the vessel. For vessels that do not operate in water depths of five (5) times draft, measurements shall be taken under normal operating and steady state transit conditions. Measurements shall be taken under the predicted worst case condition with regards to heading (e.g., dead into the swell, 90° to the swell). The vessel shall maintain a single heading and a constant speed during the test.

7.3.4 Rudder Angle

The rudder angle shall be restricted to a range of $0^\circ \pm 2^\circ$. Minimal rudder action is desirable.

7.3.5 Sea Conditions

Based on the most probable sea state condition stated in the Vibration Test Plan (see 3/6.3, "Test Conditions"), the tests will be conducted at that value plus or minus one (1) sea state condition. For example, if Sea State 5 was predicted as most probable, then vibration measurements should be taken in sea conditions between Sea State 4 to 6 on the World Meteorological Organization (WMO) (1995) *Sea State Code*.

Test measurements may be taken under more severe sea state conditions, however, the resulting values must conform to the vibration limits presented in 3/5, "Criteria", to be acceptable.

The Habitability notations (**HAB** and **HAB+**) are awarded for a specific geographical area. If the vessel changes geographical operational area and the predicted most probable sea state changes, testing may need to be repeated (see 1/10.4, "Requirements for Geographical Area of Vessel Operations".)

7.3.6 Loading Conditions

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

7.3.7 Test Interference

During the whole-body vibration measurements, noise and 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 crew 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 manned crew spaces, crew accommodations and crew recreation areas via the vessel's structure. Measurements shall be taken in all identified worst case locations (e.g., engine control room).
- ii)* Where a single instance of one (1) type of manned crew space exists within the vessel (e.g., bridge, radio room, officer's mess, gymnasium, library, etc.), that location shall be selected for measurement.
- iii)* Select a representative sample of crew cabins and staterooms throughout the vessel. For vessels with fewer than one hundred (100) crew cabins and staterooms, twenty (20) percent of cabins and staterooms shall be measured.

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

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

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

- iv)* Regardless of the number of crew cabins and staterooms on a vessel, attention must be given to selecting a variety of 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.
- v)* Where multiple instances of manned crew recreational spaces exist, a representative sample of at least twenty (20) 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 and 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

An additional sample of at least twenty-five (25) percent of all manned crew spaces not covered by physical measurements shall be subject to a walkthrough verification inspection. The ABS Surveyor shall identify these spaces from those that were not selected for physical measurement under 3/7.4.1, "Selection of Spaces where Measurements are to be Conducted". The purpose of the walkthrough verification is to subjectively assess the whole-body vibration qualities of the selected spaces. The walkthrough verification inspection shall be conducted by the External Specialist during on-board testing. If any space is deemed to deviate from the whole-body vibration requirements provided in this Guide, it shall be verified by the External Specialist by conducting spot measurements and the results recorded in the Vibration Test Report.

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: 1987. When the vibration enters the human body from a non-rigid or resilient material (e.g., floor covering) it shall be necessary to interpose the transducer between the foot of a standing person and the contact areas of the surface (i.e., the point where the foot comes into contact with the deck, with floor covering). This may be best achieved by securing the transducers within a suitably formed mount that does not greatly alter the pressure distribution on the surface of the resilient 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 fairly 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

<i>Space size</i>	<i>Minimum number of measurement positions in room</i>
Less than 40 m ² (431 ft ²)	1
Less than 80 m ² (861 ft ²)	2
Less than 200 m ² (2142 ft ²)	3
Greater than or equal to 200 m ² (2142 ft ²)	4

For vessels without crew cabins and staterooms, such as smaller vessels or high speed craft on limited service, transducers shall be located at standing positions normally occupied by crew near the port side, near the centerline and near the starboard side. Transducers shall be evenly distributed fore and aft.

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

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 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, number of passengers and number of other persons on board during tests
- iii)* Machinery operating conditions (including all shaft RPM – power output)
- iv)* Vessel course and speed and latitude and longitude coordinates of tests
- v)* Average water depth under keel
- vi)* Weather conditions and meteorological data (i.e., ambient outdoor air temperature, outdoor humidity, wind speed and direction)
- vii)* Sea state
- viii)* Indications of number of instances of rudder angle exceeding $\pm 2^\circ$
- ix)* Vessel equipment operated during the test
- x)* Any indications of abnormal activity during the test that might skew results
- xi)* Direction of swell relative to vessel heading.

8.2 Transducer Measurement Positions

Actual transducer positions within the measured spaces 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 and resolution), including frequency analysis parameters (e.g., resolution, averaging time, filtering and window functions) 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 notation, shall be provided in table format:

- i)* Measurement position (i.e., space and location within space)
- ii)* Axis (See Section 3, Figure 1, "Measurement Axes")
- iii)* Measurement period
- iv)* Sample number
- v)* Weighting filter used (e.g., W_d or W_b) See BS 6841
- vi)* Weighted rms per axis (a_w)
- vii)* Weighted Maximum Peak Value per axis
- viii)* Crest Factor per axis
- ix)* Multi-Axis weighted rms
- x)* Note 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 verification inspection results
- iii)* Spot measurement results (where appropriate).

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 his/her satisfaction. A copy of the witnessing document shall be given to the person conducting the on-board testing, for insertion into the final Vibration Test Report. The original shall be retained for the ABS files.

9 Results

The Whole-body Vibration Test Report and test results shall be reviewed by the ABS Surveyor against the appropriate **HAB** and **HAB+** criteria for notation confirmation.

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SECTION 4 Noise

1 Background

Numerous studies have been conducted on the effects of noise on humans. Established or commonly used criteria exist for the effects of noise on speech communication, hearing loss, sleep and "annoyance". These have provided the basis for the criteria in this Guide.

The criteria in this Section, to determine appropriate noise levels for a habitable space, are based on the answers to the following questions and a review of available noise data:

- i) What activities typically take place in the space?
- ii) What is the frequency of occupation of the space (e.g., continuous, intermittent, or infrequent)?
- iii) What are the communication requirements within the space?
- iv) What noise levels do people typically expect in the space?

Based on the answers to the preceding questions and a review of available noise data, the criteria in this Section were selected.

A more detailed discussion of noise is provided in Kryter (1994) *The Handbook of Hearing and the Effects of Noise: Physiology, Psychology and Public Health*.

2 Scope

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

For the most part, the noise criteria presented in this Guide are below the levels considered to cause noise-induced hearing loss. For prevention of hearing loss, appropriate legislation or regulations, such as IMO Resolution A.468(XII) (1981) *Code on Noise Levels On Board Ships*, should be followed for noise levels and exposure duration, particularly for areas with noise levels in excess of 85 dB(A).

This Section primarily applies to manned crew spaces and open deck recreation areas occupied by crew for twenty (20) minutes or longer at any one time. Examples of such spaces include workspaces (duty stations), cabins, staterooms, dining and recreation spaces.

Compliance with this Section is one requirement for the Habitability (**HAB**) or Habitability Plus (**HAB+**) notation confirmation.

3 Terminology

A-weighted sound pressure level: The magnitude of a sound, expressed in decibels (re. 20 micropascals); the various frequency components are adjusted according to the A-weighted values given in IEC 60651 in order to account for the frequency response characteristics of the human ear. The symbol is L_A ; the unit is dB(A).

Calibration Checks: Field calibration of a sound measuring instrument, conducted before and after a field test using a reference sound signal of known frequency and sound pressure level.

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 signal or through zero calibration.

4 Associated Documentation

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

ISO 140-7, (1998): Acoustics – Measurement of sound insulation in buildings and of building elements – Part 7: Field measurements of impact sound insulation of floors

ISO 717-1, (1996): Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation

ISO 717-2, (1996): Acoustics – Rating of sound insulation in buildings and of building elements – Part 2: Impact sound insulation

ISO 2923, (1996): Acoustics – Measurement of noise on board vessels

IEC 60804, (2000): Integrating-averaging sound level meters

IEC 60651, (1979): Sound level meters

IMO Resolution A.468(XII) (1981): Code on noise levels on board ships

WMO, (1995): Sea State Code.

Further guidance can be found in:

ISO 4867, (1984): Code for the measurement and reporting of on board vibration data.

5 Criteria

5.1 Equivalent Continuous A-weighted Sound Pressure Level

The noise criteria are the same for both the Habitability (**HAB** and **HAB+**) notations and 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 for each type of space or area. The maximum acceptable noise levels given in Section 4, Table 1 are L_{Aeq} values, determined as appropriate to the character of the noise (see 4/7.5, "Measurement Procedures and Recorded Results"). These limit values are for sea-going conditions only and do not include any in-port activities such as loading or offloading.

TABLE 1
Noise Criteria

<i>Space</i>	<i>Maximum Acceptable Noise L_{Aeq} Level dB(A)</i>
Crew Accommodations Spaces and Open Deck Recreation Areas	
Cabins, Staterooms, Berthing and Sanitary Spaces	50
Dining Spaces	55
Indoor Recreation Spaces	60
Passageways in Accommodations Areas	60
Gymnasiums	65
Open Deck Recreation Areas	65
Medical, Dental and First Aid Center	50
Navigation and Control Spaces	
Wheelhouse, Pilothouse, Bridge	55
Chart Room	55
Radio Room	55
Radar Room	55
Ship's Offices	55
Machinery Control Rooms	65
Cargo Control Room (on a Tanker)	65
Service Spaces	
Food Preparation (i.e., Galley, Scullery, Butcher Shop, Thaw Room)	70
Pantries	70
Storerooms	70
Passageways between Service Spaces	70
Laundries	75
Operating and Maintenance Spaces	
Continuously Manned Machinery Spaces	85*
Not Continuously Manned Machinery Spaces	108*
Workshops	80
Cargo Handling Spaces/Areas Near Cargo Handling Equipment	80
Fan Rooms	85*

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

5.2 Acoustic Insulation

Acoustic insulation between spaces and between decks shall be provided such that the criteria stated in Section 4, Table 1, "Noise Criteria", is achieved under normal operating conditions with crew members on board the vessel.

In order to meet this requirement, acoustic insulation requirements shall be calculated using ISO 717-1 and ISO 717-2. The airborne sound pressure levels to be considered when designing acoustic insulation are provided in Section 4, Table 2, "Maximum Sound Pressure Levels".

In addition, the shipyard or owner shall conduct noise testing to demonstrate that sufficient acoustic insulation has been installed. The noise testing shall be conducted with all noise attenuating components installed and finished. Sound transmission avenues (such as open cabin or stateroom doors) shall be closed or sealed, as appropriate for testing. Laboratory testing shall be conducted in accordance with IMO Assembly Resolution A.468(XII) Chapter 6 – *Insulation between Accommodation Spaces*. Noise field measurements/testing shall be conducted in accordance with ISO 140-7 for impact sound.

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 to 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 by ABS Engineering. With the Test Plan, the acoustic insulation test results (see 4/5.2, "Acoustic Insulation") shall be submitted for review.

6.2 Test Personnel

The Test Plan shall provide information about the External Specialists who will be conducting the test and their approval and certification in accordance with Appendix 2, "Procedural Requirements for External Specialists Performing Ambient Environmental Testing".

6.3 Test Conditions

The Test Plan shall detail the conditions under which the tests will be performed. Information shall be submitted to ABS Engineering within the Test Plan with regards to the most probable sea state expected for a vessel based on the geographical area of vessel operation. The sea state will be stated in accordance with the World Meteorological Organization (WMO) (1995) *Sea State Code*. Further details about test conditions are given in 4/7.3, "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 shall be indicated. Details on selecting measurement locations are provided in 4/7.4, "Measurement Locations".

TABLE 2
Maximum Sound Pressure Level

<i>Space</i>	<i>dB(A)</i>
Crew Accommodations Spaces and Open Deck Recreation Areas	
Cabins, Staterooms, Berthing and Sanitary Spaces	80
Dining Spaces	80
Indoor Recreation Spaces	85
Passageways in Accommodations Areas	85
Gymnasiums	85
Open Deck Recreation Areas	90
Medical, Dental and First Aid Center	85
Navigation and Control Spaces	
Wheelhouse, Pilothouse, Bridge	85
Chart Room	85
Radio Room	85
Radar Room	85
Ship's Offices	95
Machinery Control Rooms	95
Cargo Control Room (on a Tanker)	85
Service Spaces	
Food Preparation (i.e., Galley, Scullery, Butcher Shop, Thaw Room)	95
Pantries	95
Storerooms	95
Passageways between Service Spaces	95
Laundries	95
Operating and Maintenance Spaces	
Continuously Manned Machinery Spaces	100
Not Continuously Manned Machinery Spaces	110
Workshops	100
Cargo Handling Spaces/Areas Near Cargo Handling Equipment	100
Fan Rooms	100

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

6.5 Data Acquisition and Instruments

Information shall be provided 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

Information shall be provided regarding the methods, software and instrumentation to be used for data analysis.

6.7 Test Schedule

Information shall be provided 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 the IMO Resolution A.468(XII) (1981) *Code on Noise Levels On Board Ships*. However, where the IMO requirements differ from those in this Guide, this Guide 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 60651 and IEC 60804.

7.3 Test Conditions

The test conditions required for the noise measurements shall be in accordance with the following subparagraphs, which are taken or adapted from ISO 4867 and ISO 2923. These conditions are consistent with those for whole-body vibration measurements covered in 3/7.3, "Test Conditions".

7.3.1 Power Output

The propulsion machinery shall run at normal service speed and at no less than eighty (80) percent of the maximum continuous rating (MCR).

7.3.2 Equipment Operation

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

For the galley/scullery, all equipment that runs for ten (10) minutes or more (e.g., dishwasher) should be running during the noise measurements. Equipment that is used only intermittently (e.g., blender) need not be running during the noise measurements. Note the equipment that is running in the Noise Test Report.

In the laundry equipment area, all equipment which runs for ten (10) minutes or more should be operating during the noise measurements, either alone or simultaneously with other appliances, per normal practice. Measurement should be made at approximately 1000 mm (40 in) from each such appliance.

7.3.3 Course and Water Depth

Where possible, 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 steady state transit conditions. The course of the vessel shall be as straight as possible and at a constant speed.

7.3.4 Rudder Angle

The rudder angle shall be restricted to a range of $0^\circ \pm 2^\circ$. Minimal rudder action is desirable.

7.3.5 Sea Conditions

Based on the most probable sea state condition stated in the Noise Test Plan (see 4/6.3, "Test Conditions"), the tests will be conducted at that value plus or minus one (1) sea state condition. For example, if Sea State 5 was predicted as most probable, then noise measurements should be taken in sea conditions between Sea State 4 to 6 on the World Meteorological Organization (WMO) (1995) *Sea State Code*.

Test measurements may be taken under more severe sea state conditions, however, the resulting values must conform to the noise limits presented in 4/5.1, "Equivalent Continuous A-Weighted Sound Pressure Levels", to be acceptable.

The Habitability notations (**HAB** and **HAB+**) are awarded for a specific geographical area. If the vessel changes geographical operational area and the predicted most probable sea state changes, testing may need to be repeated (see 1/10.4, "Requirements for Geographical Area of Vessel Operations".)

7.3.6 Loading Conditions

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

7.3.7 Test Interference

During the noise measurements, noise and 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.

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

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 the manned crew spaces listed in Section 4, Table 1, "Noise Criteria". 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 equipment, noise sources, or where noise is likely to be transmitted to manned crew spaces, crew accommodations and crew recreation areas via the vessel's structure. Measurements shall be taken in all identified worst case locations.
- ii)* Areas where speech communication and audibility are of particular importance shall be included in the measurement locations. Examples include the bridge, radio room and cargo control room.
- iii)* Where a single instance of a particular type of space exists within the vessel (e.g., bridge, radio room, officer's mess, gymnasium, library, etc), the location shall be selected for measurement.
- iv)* Where multiple instances of a particular type of space exist (e.g., cabins/staterooms, passageways or recreation areas), a representative sample of at least twenty (20) percent of each type shall be selected for measurement. The worst case locations shall be included in the representative sample.
- v)* Measurements in passageways shall be conducted at distances not smaller than 2 m (6.5 ft) and not greater than 7 m (23 ft) throughout the space. The worst case locations (e.g. inlets and outlets of air-circulation systems, locations adjacent to stairwells and elevator shafts) shall be considered part of the measurements, if applicable.
- vi)* If any of the spaces or passageways 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 and 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

An additional sample of at least twenty-five (25) percent of all manned crew spaces not covered by physical measurements shall be subject to a walkthrough verification inspection. The ABS Surveyor shall identify these spaces from those that were not selected for physical measurement under 4/7.4.1, "Selection of Spaces where Measurements are to be Conducted", above. The purpose of the walkthrough verification is to subjectively assess the noise qualities of the selected spaces. The walkthrough verification inspection shall be conducted by the External Specialist during on-board testing. If any space is deemed to deviate from the noise requirements provided in this Guide, it shall be verified by the External Specialist by conducting spot measurements and the results recorded in the Test Report.

7.4.3 Measurement Positions

The measurement positions described below are taken or adapted from ISO 2923 and IMO Resolution A.468(XII) (1981).

Measure at positions where persons will be seated or standing. The microphone shall be at a height of approximately 1200 mm (47 in) from the deck to represent seated persons and approximately 1600 mm (63 in) from the deck to represent standing persons as appropriate for the measurement position.

In crew accommodation spaces, measure in the middle of the space.

For cargo handling activities performed at sea, measurements shall be conducted with the appropriate ship's cargo handling equipment in operation. Measurements are to be taken on board ship at crew duty stations affected by cargo handling operation noise. Measurements are not required at cargo handling locations on the dock.

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 (40 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 External Specialist personnel are conducting noise level measurements in any space, only crew members necessary for the operation of that space should 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.

7.5.3 Intermittent Noise

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

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 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 crew, number of passengers and number of other persons on board during testing
- iii)* Machinery operating conditions (including all shaft RPM – power output)
- iv)* Vessel course and speed and latitude and longitude coordinates during the test
- v)* Average water depth under keel
- vi)* Weather conditions and meteorological data (i.e., ambient outdoor air temperature, outdoor humidity, wind speed and direction)
- vii)* Sea state
- viii)* Indications of number of instances of rudder angle exceeding $\pm 2^\circ$
- ix)* Vessel's equipment operated during the test
- x)* Any indications of abnormal activity during the test that might skew results.

8.2 Measurement Positions

Actual measurement location 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 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.

8.4 Results

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

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

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 verification inspection results
- iii)* Spot measurement results (where appropriate).

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 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 his/her 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 the ABS files.

9 Results

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

SECTION 5 Indoor Climate

1 Background

Thermal comfort is defined in ISO 7730:1994(E) 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 a difference in metabolism, there are distinct individual differences between people’s perception of comfort and temperature. Acclimatization, habits and established traditions may also affect the comfort temperature. Because of these individual differences, it is difficult to specify a thermal environment that will satisfy everyone. A thermal environment is therefore normally specified to be acceptable to at least eighty (80) percent of the occupants of an interior space.

Thermal comfort is largely determined by the interaction of thermal environmental factors such as air temperature, mean radiant temperature, air velocity, relative humidity and the personal factors of 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

This Section provides the assessment criteria, verification and measurement methodology for indoor climate relating to habitability on vessels. The criteria are based on currently available standards and were selected to provide an index of crew thermal comfort.

The thermal environmental variables covered by this Guide include the ambient qualities of air temperature, air velocity and relative humidity. Vertical gradient was chosen for measurement to indicate areas where temperature differentials might exist between a person’s head and feet. The berthing area horizontal gradient temperature differential between the temperature of inside bulkhead surfaces adjacent to berthing and the average air temperature within the space was another parameter selected as an indication of potential thermal discomfort.

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 manned crew spaces occupied by crew members for twenty (20) minutes or longer at any one time for normal, routine daily activities. Examples of crew spaces include crew accommodations, bridge, engine control room, hospital and indoor workspaces.

Compliance with this Section is a pre-requisite for the Habitability (**HAB**) or Habitability Plus (**HAB+**) notation confirmation.

3 Terminology

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).

Air Temperature: The temperature of the air surrounding a person, measured with a standard thermometer whose bulb is kept dry and shielded from radiation.

Comfort Zone: That range of environmental conditions in which at least eighty (80) percent of crew members experience thermal comfort.

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

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

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

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

Thermal Comfort: An ordinal ranking or subjective index of "that condition of mind which expresses satisfaction with the thermal environment" (ISO 7730: 1994).

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

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

4 Associated Documentation

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

ANSI/ASHRAE 55a, (1995). Thermal environmental conditions for human occupancy

ISO 7726 (E), (1998), Ergonomics of the thermal environment – Instruments for measuring physical quantities

NEBB, (1998). Procedural standards for testing, adjusting, balancing of environmental Systems

5 Criteria

The indoor climate criteria for the Habitability (**HAB** and **HAB+**) notation are provided in Section 5, Table 1, "Summary of Indoor Climate Requirements".

Indoor climate measurements shall be taken only in manned crew spaces. A space is considered "manned" if it is occupied by crew members for twenty (20) minutes or longer at a time. Specific locations are referred to 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 selected manned spaces.

The **HAB** notation criteria provide for a preset return air temperature maintained by a temperature controller for each zone and is primarily aimed at HVAC systems that do not make provision for individual adjustment to suit personal preferences and activities within a specific space. The **HAB+** notation is aimed at enhancing crew comfort by making provision for adjusting indoor climate conditions, with regard to air temperature and air velocity, to suit personal needs within a particular space.

5.1 Air Temperature

5.1.1 For a HAB notation:

The Heating, Ventilation and Air Conditioning (HVAC) system shall be capable of providing a preset return air temperature of $22^{\circ} \pm 1^{\circ}\text{C}$ ($71.5^{\circ} \pm 2^{\circ}\text{F}$) 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.

5.1.2 For a HAB+ notation:

The HVAC system shall be capable of sustaining an adjustable range of air temperatures between 18°C (64°F) and 26.5°C (80°F) inclusive in all manned crew spaces. This temperature shall be maintained by a temperature controller. Each manned crew space shall have its own individual thermostat for temperature regulation 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 Enclosed Space Vertical Gradient

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

5.4 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.

5.5 Berthing Area Horizontal Gradient

In berthing areas, the difference between the inside bulkhead surface temperature adjacent to berthing and the average air temperature within the space shall be less than 10°C (18°F).

5.6 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

<i>Item</i>	<i>Requirement or Criterion</i>	
	HAB	HAB+
Air Temperature	Non-adjustable air temperature of $22^{\circ} \pm 1^{\circ}\text{C}$ ($71.5^{\circ} \pm 2^{\circ}\text{F}$)	Adjustable range of air temperatures between $\geq 18^{\circ}\text{C}$ (64°F) and $\leq 26.5^{\circ}\text{C}$ (80°F)
Relative Humidity	A range from 30% minimum to 70% maximum	
Vertical Gradient	The acceptable range is $0 - 3^{\circ}\text{C}$ ($0 - 6^{\circ}\text{F}$)	
Air Velocity	Not exceed 30 meters-per-minute or 100 feet-per-minute (0.5m/s or 1.7 ft/s) at the center of the space	
Horizontal Gradient (Berthing areas)	The horizontal temperature gradient in berthing areas shall be $<10^{\circ}\text{C}$ (18°F)	

By fulfilling the requirements of this Section for the **HAB** or **HAB+** notation, the requirements of ILO Convention 92, Article 7 (numbers 1 to 5) and Article 8 (numbers 1, 2, 3 and 5), are met.

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

- 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 for review of indoor climate suitability. 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. The NEBB is a nonprofit organization that establishes and maintains HVAC system industry standards, procedures and specifications.

6.2 Test Personnel

The Test Plan shall provide information about the External Specialists who will be conducting the testing and their approval and certification in accordance with Appendix 2, "Procedural Requirements for External Specialists Performing Ambient Environmental Testing".

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 crew spaces or areas where measurements will be taken. In addition, transducer measurement positions shall be indicated. Details on selecting measurement locations and determining transducer positions are provided in 5/7.4, "Measurement Locations".

6.5 Data Acquisition and Instruments

Information shall be provided 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

Information shall be provided regarding the methods, software and instrumentation to be used for data analysis.

6.7 Test Schedule

Information shall be provided 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-1995. When the procedures described in this Guide deviate from those in ANSI/ASHRAE 55a-1995, the requirements of this Guide 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 7726:1998(E).

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
- iv)* Vertical gradient
- v)* Horizontal gradient (in berthing spaces only).

The air temperature and humidity measurements shall be made at least every five (5) minutes for a minimum period of two (2) hours. The minimum, maximum and average values for the 2-hour period shall be reported for each space measured. For the **HAB+** notation, the temperature control for a specific space shall be set to the lower requirement level of 18°C (64°F) for the first hour and to 26.5°C (80°F) for the second hour of measurement.

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

Surface temperatures for all wall surfaces that are adjacent to berthing shall be measured for determining the horizontal gradient in berthing spaces.

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 at Sea

Testing of identified spaces shall be accomplished at sea with all normally functioning equipment in its operational mode.

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 should 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 occupied zone have a high sensitivity to time of day and weather conditions, 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.

The Habitability notations (**HAB** and **HAB+**) are awarded for a specific geographical area. If the vessel changes geographical operational area and the predicted most probable sea state changes, testing may need to be repeated (see 1/10.4, "Requirements for Geographical Area of Vessel Operations".)

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 (such as the door on the lee side of the navigation bridge, which may normally be open). Any open doors or windows shall be noted in the Indoor Climate Test Report. 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 crew 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 problem areas where the influence of internal conditions or factors may adversely impact the quality of the indoor climate in manned crew spaces, crew accommodations and crew recreation areas. Internal conditions include space proximity to equipment that radiates or absorbs heat (e.g., engine exhaust trunks, freezer spaces, galley, scullery, etc.) and surfaces with thermal differentials in excess of 10°C (18°F) from the ambient temperature in the space. 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 crew spaces, crew accommodations and crew recreation areas which may be outboard or adjacent to the vessel's hull. Measurements shall be taken in all identified problem areas.
- iii)* Where a single instance of one (1) type of space exists within the vessel (e.g., bridge, radio room, officer's mess, gymnasium, library, etc), the location shall be selected for measurement.
- iv)* Where multiple instances of one (1) type of space exist (e.g., cabins/staterooms, or recreation areas), a representative sample of at least twenty-five (25) percent of each type 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

An additional sample of at least twenty-five (25) percent of all manned crew spaces not covered by physical measurements shall be subject to a walkthrough verification inspection. The ABS Surveyor shall identify these spaces from those that were not selected for physical measurement under 5/7.4.1, "Selection of Spaces where Measurements are to be Conducted". The purpose of the walkthrough verification is to subjectively assess the indoor climatic qualities of the selected spaces. The walkthrough verification inspection shall be conducted by the External Specialist during on-board testing. If any space is deemed to deviate from the indoor climate requirements provided in this Guide, it shall be verified by the External Specialist by conducting spot measurements and the results recorded in the Test Report.

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 crew spaces, as applicable (to assure air velocity is not excessive). This measurement should be taken in the center of the space.
- iii)* Inside wall surface temperatures shall be captured from all walls surrounding berthing at a location of approximately 1100 mm (43 in) from the deck on all the wall surfaces.

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)* Loading condition
- ii)* Crew size and total number of persons on board during testing
- iii)* Machinery operating conditions
- iv)* Vessel course and speed and latitude and longitude coordinates during testing
- v)* Weather conditions and meteorological data (i.e., wind speed and direction, ambient outdoor air temperature, outdoor humidity, barometric pressure)
- vi)* Sea state
- vii)* 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 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)* Vertical gradient (Average air temperature at 1700 mm (67 in) minus average air temperature at 100 mm (4 in) above deck)
- xi)* Horizontal gradient (Side wall surface temperature in berthing space minus average air temperature at 1100 mm (43 in) above deck)
- xii)* 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 verification inspection results
- iii)* Spot measurement results (where appropriate).

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 his/her 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 the ABS files.

9 Results

The Indoor Climate Test Report and test results shall be reviewed by the ABS Surveyor against the appropriate **HAB** and **HAB+** criteria for notation confirmation.

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SECTION **6** **Lighting**

1 **Background**

The lighting of crew spaces should facilitate visual task performance and facilitate the movement of crew members 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 crew as well as for the various tasks performed on board vessels.

The selection of appropriate illuminance levels for specific tasks and crew 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 on board 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.

Visual tasks encountered on vessels vary widely. In addition to the illuminance level, external factors such as contrast with respect to the background, object size, brightness, the time available for viewing or recognition and reflectance determine the visibility of an object within the visual field. Other considerations include task duration, visual fatigue, task criticality, discomfort glare, veiling reflections, shadows and the age and visual acuity of the observer. From a subjective viewpoint, aesthetics, color and the psychological effects of lighting should also be considered. These factors are all interrelated and should be considered together with objective qualities during the process of selecting illuminance levels, but shall not be separately quantified.

2 **Scope**

This Section provides criteria for assessing the illuminance levels of general lighting and task lighting on vessels. The main objective of the assessment is to determine whether the various lighting systems comply with minimum standards to accommodate crew visual task performance and facilitate crew movements and well-being on board vessels.

Lighting criteria are defined based on currently available objective standards and research data. Compliance with this Section is a pre-requisite for the Habitability (**HAB**) or Habitability Plus (**HAB+**) notation 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. (IESNA RP-12-97)

Discomfort Glare: Glare which produces viewer discomfort, but which does not interfere significantly with visual task performance or visibility. (IESNA RP-12-97)

General Lighting: Lighting designed to provide a substantially uniform level of illuminance throughout an area, exclusive of any provision for special, localized task requirements (IESNA RP-12-97). 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. (CIBS Code, 1984)

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. (Ryer, 1997). 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. (CIBS Code, 1984)

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. (ANSI/IESNA RP-1-1993)

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). (CIBS Code, 1984)

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. (CIBS Code, 1984)

Red or Low-level White Illuminance: Lighting provided to accommodate efficient dark adaptation in areas where seeing tasks are performed during nighttime operations and in areas where people need to move from a lit interior into a dark environment and maintain good vision. (DEF STAN 00-25 (Part 6)/2; IESNA RP-12-97)

Reference Calibration: Calibration of a measuring instrument, conducted by an accredited Testing and Calibration Laboratory, with traceability to a signal or through zero calibration.

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

Uniformity Ratio: The ratio of the minimum illuminance (or luminance) to the average illuminance (or luminance) applied to the values on the working plane. (DEF STAN 00-25 (PART 6)/2)

4 Associated Documentation

IESNA RP-12-97, Recommended Practice for Marine Lighting, provides details about test plan preparation, test measurement procedures and test reporting.

5 Criteria

The lighting criteria for the Habitability (**HAB** and **HAB+**) notation are provided in:

- Section 6, Table 1, "Lighting Criteria for Crew Accommodations Spaces"
- Section 6, Table 2, "Lighting Criteria for Navigation and Control Spaces"
- Section 6, Table 3, "Lighting Criteria for Service Spaces"
- Section 6, Table 4, "Lighting Criteria for Operating and Maintenance Spaces"
- Section 6, Table 5, "Lighting Criteria for Red or Low-level White Illuminance".

For lighting, the criteria for **HAB** and **HAB+** are the same. In this Section, general lighting and task lighting requirements are provided for crew tasks and spaces normally encountered on vessels. The lighting levels provided in the tables are for new lamps.

Emergency lighting is covered in SOLAS and IMO Resolutions and was not considered in the selection of the lighting levels provided in this Guide.

5.1 General and Task Lighting

The minimum maintained illuminance levels in Lighting Criteria Tables 1 through 5 of this Section 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. These levels were selected from a variety of sources that are listed in Appendix 1, "References". Where human factors data existed with regard to recommended lighting levels, these values are provided in parentheses in the Tables. It is strongly recommended that these values are adhered to, in order to facilitate efficient and safe task performance above and beyond the minimum required lighting levels.

TABLE 1
Lighting Criteria for Crew Accommodations Spaces

<i>Space</i>	<i>Illuminance level in Lux</i>	<i>Space</i>	<i>Illuminance level in Lux</i>
Entrances and Passageways			
Interior Walkways, Passageways, Stairways and Access Ways	110 (215)	Exterior Walkways, Passageways, Stairways and Access Ways (night)	110
Cabins, Staterooms, Berthing and Sanitary Spaces			
General Lighting	150 (See Note 3)	Bath/Showers (General Lighting)	325
Reading and Writing (Desk or Bunk Light)	540	All other Areas within Sanitary Space (e.g., Toilets, Change Room)	150
Mirrors (Personal Grooming)	540		
Dining Spaces			
Mess Room and Cafeteria	300	Snack and Coffee Bar	500
Vending Machine Area	75		
Recreation Spaces			
Lounges	300	Gymnasiums	300 (500)
Library	540	Bulletin Boards/Display Areas	150
Multimedia Resource Center	300	All other Recreation Spaces (e.g., Game Rooms)	300
TV Room	150	Training/Transit Room	540
Medical, Dental and First Aid Center			
Dispensary	540	Wards	
Medical and Dental Treatment/Examination Room	810 (1075)	- General Lighting	100
Medical Waiting Areas	540	- Critical Examination	810 (1075)
Laboratories	810	- Reading	540
All other Medical and Dental Spaces	325	- Toilets	150

Notes:

- Values in parenthesis are recommended, but not required, illuminance levels.
- One Lux equals 0.093 foot-candle.
- If there is any opportunity for light to enter cabins or staterooms at the times of day or night when people sleep (e.g., port lights, transoms, etc.), the maximum lighting level shall be 30 Lux.

TABLE 2
Lighting Criteria for Navigation and Control Spaces

<i>Space</i>	<i>Illuminance level in Lux</i>	<i>Space</i>	<i>Illuminance level in Lux</i>
Wheelhouse, Pilothouse, Bridge - When Underway	325	Offices - General Lighting - Computer Work - Passenger Service Counters	540
Chart Room - General Lighting - On Chart Table	150 810 (1075)		300 540
Other Control Rooms (e.g., Cargo Transfer etc.) - General Lighting - Computer Work	540	Control Stations - General Lighting - Control Consoles and Boards, Panels, Instruments & Gauges - Switchboards - Log Desk	325 325 (540)
	300		325 (540) 540
Radar Room	200	Gyro Room	540
Radio Room	540		200

Notes:

1. Values in parenthesis are recommended, but not required, illuminance levels.
2. Night values are provided in 6/5.2, "Red or Low-level White Illuminance".
3. One Lux equals 0.093 foot-candle.

TABLE 3
Lighting Criteria for Service Spaces

<i>Space</i>	<i>Illuminance level in Lux</i>	<i>Space</i>	<i>Illuminance level in Lux</i>
Food Preparation - General Lighting - Galley - Pantry - Butcher Shop - Thaw Room - Working Surfaces, Food Preparation Counter and Range Tops - Food Serving Lines - Scullery (Dishwashing) - Extract Hood above Cooking Area Worktop	540	Laundries	540 750
	755	- General Lighting	
	325	- Machine, Pressing, Finishing and Sorting	
	755 (1075)	Chemical Storage	300
	325	Storerooms	200
	755 (1075)	- Large Parts	300
	450	- Small Parts	540
	500	- Issue Counters	
	540	Elevators	215
	540	Food Storage	200
		- Non-refrigerated	100
		- Refrigerated (Ship's Stores)	
Mail Sorting	540		

Notes:

1. Values in parenthesis are recommended, but not required, illuminance levels.
2. One Lux equals 0.093 foot-candle.

TABLE 4
Lighting Criteria for Operating and Maintenance Spaces

<i>Space</i>	<i>Illuminance level in Lux</i>	<i>Space</i>	<i>Illuminance level in Lux</i>
Machinery Spaces (General)	150	Cargo Holds (Portable Lighting) - General Lighting - During Cargo Handling - Passageways and Trunks	30 300 80
Engine Room	300 (540)		
Generator and Switchboard Room	300 (540)		
Fan Room (Ventilation and Air Conditioning)	150	Inspection and Repair Tasks - Rough - Medium - Fine - Extra Fine	325 (540) 540 (1075) 1075 (2155) 2155 (3230)
Motor Room	300 (540)		
Motor-Generator Room (Cargo Handling)	150		
Pump Room	300 (540)	Bilge/Void Spaces	75
Steering Gear Room	300 (540)	Unmanned Machinery Room	325 (540)
Windlass Rooms	100	Shaft Alley	100
Battery Room	200 (540)	Escape Trunks	30
Boiler Rooms	200	Workshops	325 (540)
Cargo Handling (Weather Decks)	150	Muster Area	200
		Embarkation Area	200

Notes:

1. Values in parenthesis are recommended, but not required, illuminance levels.
2. One Lux equals 0.093 foot-candle.

5.2 Red or Low-level White Illuminance

In workspaces where red or low-level white illuminance is provided to facilitate dark adaptation, the maintained illuminance levels in Section 6, Table 5, "Lighting Criteria for Red or Low-level White Illuminance", shall be achieved. Lighting in different areas of the bridge should be adjustable in brightness and direction to achieve the illuminance range in Section 6, Table 5.

TABLE 5
Lighting Criteria for Red or Low-level White Illuminance

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

Note: One Lux equals 0.093 foot-candle.

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 survey points (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 External Specialists who will be conducting the test and their approval and certification in accordance with Appendix 2, "Procedural Requirements for External Specialists Performing Ambient Environmental Testing".

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 shall be indicated. Details on selecting measurement locations are provided in 6/7.4, "Measurement Locations".

6.5 Data Acquisition and Instruments

Information shall be provided 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

Information shall be provided regarding the methods used for data analysis.

6.7 Test Schedule

Information shall be provided regarding the proposed test schedule.

7 Test Requirements

7.1 General

Illuminance measurements shall be carried out in accordance with the requirements of IESNA RP-12-97. When the procedures described in this Guide deviate from those in IESNA RP-12-97, the requirements of this Guide shall take precedence.

7.2 Data Acquisition and Instruments

The illuminance meter (light meter) shall meet the requirements specified in Section B.5 of IESNA RP-12-97. This defines the instrumentation requirements for measuring white light.

Instruments used to measure red illuminance shall meet the requirements specified in Section B.8.4 of IESNA RP-12-97.

7.3 Test Conditions

The test conditions specified in Section B.4 of IESNA RP-12-97 shall apply. In addition, the following test conditions shall apply:

7.3.1 Location

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

7.3.2 Spaces with Windows/Port Lights

In spaces with windows or port lights where the minimum lighting level should be provided by artificial light sources only, lighting measurements shall be taken after dark.

7.3.3 Spaces without Windows/Port Lights

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

7.3.4 Stray Light

Stray light (e.g., dock lighting and moonlight) shall be 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 for the normal operation of the equipment in the space and those carrying out the measurements shall be present in the space being tested.

Doors and windows shall be closed, except where they are normally left open (such as the door on the lee side of the navigation bridge, which may normally be open). Any open doors or windows shall be noted in the 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 crew spaces listed in Lighting Criteria Tables 1 to 5 of this Section. 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 (e.g., bridge). Measurements shall be taken in all identified problem areas.
- ii)* Select potential problem areas based on the positioning of luminaires in the space as indicated on the drawings (e.g., uneven spacing of luminaires resulting in non-uniform illuminance levels and dimly lit areas). Measurements shall be taken in all problem areas.
- iii)* Where a single instance of one (1) type of space exists within the vessel (e.g., bridge, radio room, officer's mess, gymnasium, library, etc), the location shall be selected for measurement.
- iv)* Where multiple instances of one (1) type of space exist (e.g., crew recreation areas or crew mess) with the exception of cabins/staterooms, a representative sample of at least twenty (20) percent of each type shall be selected for measurement. The problem area locations are to be considered part of the representative sample, if applicable.
- v)* Where a number of crew cabin/stateroom spaces are identical in configuration in terms of lighting systems, surface treatments, geometry, furnishings and equipment layout, only two (2) of the spaces shall be selected to determine whether the lighting requirements are met. A sample of at least twenty-five (25) percent of the remaining spaces shall be visually inspected.

7.4.2 Visual Inspection Locations

A sample of at least twenty-five (25) percent of the spaces and task areas listed in Lighting Criteria Tables 1 to 5 of this Section, not covered by physical measurements, shall be subject to a walkthrough verification inspection by the External Specialist to verify that the lighting equipment is installed as specified. The ABS Surveyor shall identify these spaces. In spaces where the External Specialist regards the lighting levels to be below the minimum required levels, spot checks shall be made of the general and task lighting levels. Checks will be made in such spaces by taking a single lighting measurement in the center of the space at a height of approximately 750 mm (30 in) and a single lighting measurement on each work surface or task plane.

If the measured spot check lighting level is below the required minimum level, the space shall be subjected to a full lighting test as described in 6/7.4.3, "General Illuminance Measurement Positions" and 6/7.4.4, "Activity Lighting Measurement Positions".

When assessing task illuminance, the presence of disability glare and discomfort glare at critical workstations (e.g., the bridge, radar room and control stations) where visual displays and dials are used shall be assessed by means of visual inspection.

Disability glare is caused by specular reflections from glossy surfaces such as dials and metallic surfaces. To assess disability glare, visual inspections shall be conducted from the normal viewing position of the crew member to determine whether there are any specular reflections from instrument and display surfaces caused by luminaires.

Discomfort glare is caused by a light source positioned close to the line of sight, a high source luminance, large source area and low background luminance. A visual inspection from the normal viewing position of the crew member at critical workstations shall be conducted to determine whether luminaires might be sources of discomfort glare.

Any glare should be noted in the Lighting Test Report.

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 (30 in) above the deck. For traffic areas, readings shall be taken on the deck.

General lighting measurements in selected manned crew spaces shall be conducted in accordance with the measurement techniques presented in Section B.8 and Section B.10.3 in IESNA RP-12-97.

Average illuminance of regular spaces with symmetrically spaced luminaires and spaces with asymmetrical luminaire arrangements shall be measured and calculated in accordance with the sampling technique presented in Section B.10.3 in IESNA RP-12-97. This technique uses the relationship of symmetry and incorporates a statistical averaging procedure to minimize the required number of data points.

The method presented in Section B.10.3 in IESNA RP-12-97 assumes that there is a large overlap in the luminaire light distribution (low uniformity ratios), that the illuminance variation between maximum, middle and minimum data points is approximated by a straight line and that identical luminaires are installed in a regular grid pattern throughout the space. This method is not valid where these assumptions are not correct and may not reveal areas in the space where lighting levels are inadequate.

In situations where the statistical averaging method is not valid, the space must be divided into a grid and measurements shall be taken as described in Section B.8 in IESNA RP-12-97.

7.4.4 Task Lighting Measurement Positions

Task lighting measurements in selected manned crew spaces shall be conducted in accordance with the measurement technique presented in Section B.8 and Section B.10.4 in IESNA RP-12-97.

For task lighting, a representative set of readings as indicated in Table B.1 in IESNA RP-12-97 shall be taken over the task surface with the worker in the normal working position. Task lighting shall be measured with both general and supplementary task lighting turned on. Daylight shall be excluded during the measurements.

Measurements of task lighting shall be made on the surface or in the plane of the task (horizontal, vertical or at an angle). For small task surfaces (smaller than 0.2 m² (2.15 ft²)), a single measurement shall be taken at the center of the task surface. For larger task surfaces (0.2 m² (2.15 ft²) or larger), the illuminance shall be measured by dividing the task surface into a grid and averaging the measurements taken at the grid intersections. The recommended number of measurements for task surfaces is provided in Table B.1 in IESNA RP-12-97.

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.

7.4.5 Red and Low-level White Illuminance

Lighting measurements of red illuminance systems shall be taken in accordance with Section B.8.4 in IESNA RP-12-97.

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
- 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)* Lighting level in cabins/staterooms with lights turned off and curtains, shutters, deadlights, etc. closed
- vi)* Presence of glare at specific workstations within the space.

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

- i)* Name and number of space
- ii)* Visual inspection results
- iii)* Task areas (if any) in space
- iv)* Single lighting level for general lighting (where appropriate)
- v)* Single lighting level for task lighting on each task surface or plane in space (where appropriate).

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 his/her 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 the 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.

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APPENDIX 1 References

1 General References

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APPENDIX 2 Procedural Requirements for External Specialists Performing Ambient Environmental Testing

1 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.

External Specialists: Companies providing test or measurement services on behalf of the owner of a vessel or shipyard for the purposes of meeting ABS Habitability (**HAB** or **HAB+**) or Comfort (**COMF** or **COMF+**) notation requirements.

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 External Specialists performing ambient environmental testing and evaluation.

3 Application

This procedure applies to the approval of External 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 External Specialists are given in this Appendix's 4.2, "General Requirements". Specific requirements for the test services listed above are in this Appendix's 8, "Detailed Requirements by Ambient Environmental Aspect".

4 Procedure for Approval and Certification

4.1 Submission of Documents

The following documents are to be submitted to an ABS Technical Office 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 relevant
- iv)* Description of equipment used for the measurement and analysis of the particular ambient environmental aspect for which approval is sought (e.g., calibration, accuracy, etc.)
- v)* A guide for operators of such equipment
- vi)* Training programs for test personnel
- vii)* Draft checklists and data recording sheets for recording results of the services referred to in this Appendix's 3, "Application"
- viii)* Quality Manual and/or documented procedures covering requirements in this Appendix's 4.5, "Quality Assurance System"
- ix)* Evidence of approval/acceptance by certifying bodies, if any
- x)* Information about other activities which may present a conflict of interest
- xi)* Record of customer claims and of corrective actions requested by certification bodies for the past year
- xii)* Where relevant, list and documentation of licenses granted by equipment's manufacturer.

4.2 General Requirements

4.2.1 Extent of approval

The External Specialist shall demonstrate, as required by this Appendix's 4.2.2 through 4.2.9, "General Requirements", 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 External 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 External 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. Test personnel shall have had a minimum of one (1) year tutored on-the-job training.

4.2.3 Supervision

The External 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 External Specialist is approved.

4.2.4 Personnel records

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

4.2.5 Equipment and facilities

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

4.2.7 Subcontractors

The External 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 External Specialist in following-up of such subcontracts. Subcontractors providing anything other than subcontracted personnel or equipment shall also meet the requirements of this Appendix's 4.2, "General Requirements" and 4.5, "Quality Assurance System".

4.2.8 Verification

The External 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 the ABS Technical Office as outlined within this Guide. The report shall include a copy of the Certificate of Approval.

4.3 Auditing of the External Specialist

Upon reviewing the submitted documents with satisfactory result, the External Specialist shall be audited every three (3) years in order to ascertain that the External 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 the ABS Technical Office 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 External 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 ensure compliance with test procedures
- v)* Recording and reporting of information
- vi)* Quality management of subsidiaries and sub-contractors
- 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 External 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 an External Specialist in this field) shall be assessed by the manufacturer(s) and nominated as their agent. The manufacturer shall ensure that appropriate instruction manuals, material, etc., are available for the agent as well as ensuring proper training of the agent's technicians has occurred. Such External Specialists shall be approved either on a case by case basis or as follows:

If a manufacturer of equipment (and External 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. The ABS Technical Office 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 External Specialist and practical demonstration, the ABS Technical Office shall issue a Certificate of Approval stating that the External 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 Habitability/Comfort classification notations. The Certificate shall clearly state the type and scope of services and any limitations or restrictions imposed. The External Specialist shall also be included in ABS's records of approved External Specialists.

Where several ambient environmental aspect measurements are conducted by a given company, each aspect is to be assessed and approved except as specified in this Appendix's 4.6, "External 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 External Specialist procedure. The renewal or endorsement shall be accomplished by verification through audits to ensure that approved conditions are maintained.

6 Alterations

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

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 approved services of the External Specialist and appropriate corrective action is not taken
- iii)* Where the External Specialist fails to inform the ABS Technical Office of any alteration, as in this Appendix's Subsection 6, "Alterations"

- iv)* Where a renewal audit, if requested per this Appendix's 5.1, "Renewal", has not been carried out
- v)* Where willful acts or omissions are ascertained.

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

An External Specialist whose approval was cancelled may apply for re-approval provided the non-conformities, which resulted in cancellation, have been corrected and that the ABS Technical Office 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 External Specialists are engaged to conduct vibration measurements and analyses on board vessels.

8.1.2 Supervisor

The supervisor shall:

- i)* be qualified to Level II according to a recognized national or international Non-Destructive 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 on board marine vessels.

The supervisor shall have sufficient knowledge of vessel structures and equipment, measurement and analysis of whole-body vibration according to BS 6841, to ensure 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 Non-Destructive Testing (NDT) standard (ANSI/ASNT CP-189, ISO 9712 or EN 473) or
- ii)* have a documented history of at least two (2) years supervised experience in performing vibration environmental testing on board marine vessels.

The test personnel shall have adequate knowledge of vessel structures and equipment.

8.1.4 Equipment

The ABS Technical Office shall verify that the equipment to be used is in accordance with the applicable measurement standard. It shall be demonstrated to the ABS Technical Office 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 3/8, "Test Report".

8.1.7 Verification

The External Specialist must include a copy of the ABS Surveyor's witness documentation in the Test Report.

8.2 Noise

8.2.1 Extent of engagement

Noise measurement External Specialists are engaged to conduct noise measurements and analyses on board vessels.

8.2.2 Supervisor

The supervisor shall:

- i)* be qualified to Level II according to a recognized national or international Non-Destructive 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 on board marine vessels.

The supervisor shall have sufficient knowledge of vessel structures, measuring equipment, ISO 2923, IEC 60651 and IEC 60804, to ensure 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 Non-Destructive Testing (NDT) standard (ANSI/ASNT CP-189, ISO 9712 or EN 473) or
- ii)* have a documented history of at least two (2) years supervised experience in performing noise testing on board marine vessels.

The test personnel shall have adequate knowledge of vessel structures and measuring equipment.

8.2.4 Equipment

The ABS Technical Office shall verify that the equipment to be used is in accordance with the applicable measurement standard. It shall be demonstrated to the ABS Technical Office 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 4/8, "Test Report".

8.2.7 Verification

The External Specialist must include a copy of the ABS Surveyor's witnessing documentation in the Test Report.

8.3 Indoor Climate

8.3.1 Extent of engagement

Indoor climate measurement External Specialists are engaged to conduct indoor climate measurements and analyses on board vessels.

8.3.2 Supervisor

The supervisor shall:

- i)* be qualified to Level II according to a recognized national or international Non-Destructive 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 on board marine vessels.

The supervisor shall have sufficient knowledge of vessel structures, measuring equipment, ANSI/ASHRAE 55a and ISO 7726, to ensure 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 Non-Destructive Testing (NDT) standard (ANSI/ASNT CP-189, ISO 9712 or EN 473) or
- ii)* have a documented history of at least two (2) years supervised experience in performing ambient environmental testing on board marine vessels.

The test personnel shall have adequate knowledge of vessel structures and equipment.

8.3.4 Equipment

The ABS Technical Office shall verify that the equipment to be used is in accordance with the applicable measurement standard. It shall be demonstrated to the ABS Technical Office 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 5/8, "Test Report".

8.3.7 Verification

The External Specialist must include a copy of the ABS Surveyor's witnessing documentation in the Test Report.

8.4 Lighting

8.4.1 Extent of engagement

Lighting measurement External Specialists are engaged to conduct illuminance measurements and analyses on board vessels.

8.4.2 Supervisor

The supervisor shall:

- i)* be qualified to Level II according to a recognized national or international Non-Destructive 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 on board marine vessels.

The supervisor shall have sufficient knowledge of vessel structures, measuring equipment and IESNA RP-12, to ensure 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 Non-Destructive Testing (NDT) standard (ANSI/ASNT CP-189, ISO 9712 or EN 473) or

- ii)* have a documented history of at least two (2) years supervised experience in performing ambient environmental testing on board marine vessels.

The test personnel shall have adequate knowledge of vessel structures and equipment.

8.4.4 Equipment

The ABS Technical Office shall verify that the equipment to be used is in accordance with the applicable measurement standard. It shall be demonstrated to the ABS Technical Office 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 6/8, "Test Report".

8.4.7 Verification

The External Specialist must include a copy of the ABS Surveyor's witnessing documentation in the Test Report.

9 References

- 1 American National Standards Institute. (1995). *Thermal environmental conditions for human occupancy* (ANSI/ASHRAE 55a-1995). Atlanta: The American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.
- 2 American Society for Nondestructive Testing. (1995). *Qualification and certification of nondestructive testing personnel* (ANSI/ASNT CP-189-1995). Washington, DC: American National Standards Institute.
- 3 British Standards Institution. (1987). *Guide to measurement and evaluation of human exposure to whole-body mechanical vibration and repeated shock* (BS 6841: 1987). London: Author.
- 4 European Committee for Standardization. (1993). *Qualification and certification of NDT personnel – General principles* (EN 473). Brussels: Author.
- 5 Illuminating Engineering Society of North America. (1997). *Recommended practice for marine lighting* (IESNA RP-12-97). New York: Author.
- 6 International Electrotechnical Commission. (1979). *Sound level meters* (International Standard IEC 60651). Geneva: IEC Central Office.
- 7 International Electrotechnical Commission. (1985). *Integrating-averaging sound level meters* (International Standard IEC 60804). Geneva: IEC Central Office.
- 8 International Organization for Standardization. (1996). *Acoustics – Measurement of noise on board vessels* (ISO 2923: 1996). Geneva: Author.
- 9 International Organization for Standardization. (1998). *Ergonomics of the thermal environment – Instruments for measuring physical quantities* (ISO 7726: 1998 (E)). Geneva: Author.
- 10 International Organization for Standardization. (1999). *Non-destructive testing – Qualification and certification of personnel* (ISO 9712:1999). Geneva: Author.



APPENDIX 3 Accommodations Criteria

Instructions: For a **HAB** Notation, the unshaded boxes under “Meets **HAB** Requirements” must be met. For an **HAB+** Notation, the unshaded boxes under “Meets **HAB+** Requirements” need to be met as well as **HAB** requirements.

Accommodations Criteria – Access/Egress			
	Requirement	Meets HAB Requirements	Meets HAB+ Requirements
DOORS			
1	Doors in all accommodations spaces, stairways, stair towers and corridors are oriented vertically.		
2	Horizontal doors (installed in decks) are only for access to crew spaces and are used only by crew members.		
3	All doors are capable of operation from either side by one person.		
4	If doors are equipped with rectangular vision panels, the panels are approximately 200 mm (8 in) wide by 500 mm (20 in) high, or 400 mm (16 in) by 400 mm (16 in) and centered 1600 mm (63 in) above the deck.		
5	If doors are equipped with round vision panels, the panels are approximately 250 mm (10 in) in diameter and are centered 1600 mm (63 in) above the deck.		
6	Every door, hatch, or scuttle used as a means of escape is capable of being operated by one person, from either side, in both light and dark conditions.		
7	The method of opening a means of escape is obvious and rapid.		
8	Doors in accommodations spaces (with the exception of staterooms), stairway, stair tower, passageway, or control spaces, open in the direction of escape, where practicable.		
9	Deck scuttles that serve as a means of escape are fitted with a quick acting release and a holdback device to hold the scuttle in an open position.		
10	The means of escape is adequately marked if it is not readily apparent to a person from both the inside and outside.		
11	Glass sliding doors have a means to show if they are open or closed.		
12	Handles for sliding doors are designed to avoid accidental crushing of fingers.		
13	High voltage electrical room doors: <ul style="list-style-type: none"> ▪ are lockable with keys provided to qualified personnel ▪ are equipped with a manual panic device or push-button operated opening device on the inside, which overrides the lock mechanism without the use of hands. 		
14	All doors are operable with one hand by persons wearing gloves.		

Accommodations Criteria – Access/Egress			
	Requirement	Meets HAB Requirements	Meets HAB+ Requirements
DOOR DIMENSIONS AND FORCES			
15	Horizontal doors are self-closing with a time of not less than 5 seconds or more than 10 seconds and capable of closing against a 3.5-degree list.		
16	The initial force required to open a <u>frequently</u> used vertical door (doors in major traffic, escape routes and likely to be used at least 10 times a day), does not exceed: <ul style="list-style-type: none"> ▪ hinged doors: 65 Newton (14.6 pounds) ▪ sliding doors: 50 Newton (11.2 pounds). 		
17	The initial force required to open an <u>infrequently</u> used vertical door (doors not in major traffic, escape routes, or likely to be used at least 10 times a day), does not exceed: <ul style="list-style-type: none"> ▪ hinged doors: 130 Newton (29.2 pounds) ▪ sliding doors: 105 Newton (23.6 pounds). 		
18	The forces required to open a horizontal door do not exceed: <ul style="list-style-type: none"> ▪ 17.8 Newton (5 pounds) to release the latch ▪ 44.5 Newton (10 pounds) to set the door in motion ▪ 17.8 Newton (5 pounds) to fully open the door. 		
19	Deck scuttles that serve as a means of escape have the following dimensions: <ul style="list-style-type: none"> ▪ at least 455 mm (18 in) in diameter if round ▪ at least 670 mm (26.5 in) in diameter if round ▪ at least 330 mm (13 in) by 670 mm (26.5 in) if rectangular. 		
20	Vertical doors have the following dimensions: <ul style="list-style-type: none"> ▪ doors (other than emergency egress) used solely by crew members have a clear opening width of at least 710 mm (28 in) or ASTM size 4 doors ▪ the minimum clear opening width of a door not used solely by crew members as means of escape is not less than 810 mm (32 in) ▪ the distance from the deck to the top of the door is at least 1980 mm (78 in) ▪ the maximum width of an individual door is not more than 1200 mm (48 in) ▪ the distance from the deck to the top of the door is at least 2030 mm (80 in). 		

Accommodations Criteria – Access/Egress			
	Requirement	Meets HAB Requirements	Meets HAB+ Requirements
RAILINGS			
21	<p>Rails are installed parallel to the deck along deck edges and walkways and around open hatches, elevators, antenna platforms and along other boundaries in the following areas:</p> <ul style="list-style-type: none"> ▪ wherever there is danger of crew members falling to a lower level of 610 mm (24 in) or more in the ship ▪ wherever there is danger of crew members becoming enmeshed with hazardous operating machinery ▪ around hatches with coaming height below 760 mm (30 in) ▪ around every unprotected opening in a floor or deck into which a person may slip, trip or fall. 		
22	<p>Suitable storm rails/handrails are provided in all interior passageways and at all deckhouse sides where persons on board might have normal access:</p> <ul style="list-style-type: none"> ▪ storm rails/handrails are installed on both sides of passageways that are 1830 mm (72 in) or more in width ▪ storm rails/handrails are 865 mm (34 in) to 965 mm (38 in) high ▪ the distance between storm rails/handrails and any obstruction is 75 mm (3 in) or greater. 		
23	<p>Deck/guard railings have the following design:</p> <ul style="list-style-type: none"> ▪ the heights of rails or bulwarks are at least 1070 mm (42 in) from the deck except where this height would interfere with the normal operation of the vessel ▪ rail courses or equivalents are installed between a top rail and the deck so that the opening below the lowest course does not exceed 230 mm (9 in) and the distance between the remaining courses is not more than 380 mm (15 in) ▪ toeboards which are 100 mm (4 in) in height and have no more than a 6 mm (0.25 in) clearance between the bottom edge of the toeboard and the walking surface ▪ vertical stanchions for railings are spaced no more than 1525 mm (60 in) apart horizontally ▪ at least every third vertical stanchion is supported by a bracket or stay ▪ chain or wire rope used as a rail is set such that the sag is not greater than 25 mm (1 in) at the chain/ropes centerspan ▪ maximum lengths of openings protected by wire or chain are 1830 mm (72 in). 		
STAIRS			
24	Curved, spiral, or winding stairways have the specific approval of the Flag Administration.		
25	A clear landing at least as wide as the tread width and a minimum of 915 mm (36 in) long is provided at the top and bottom of each stairway.		

Accommodations Criteria – Access/Egress			
	Requirement	Meets HAB Requirements	Meets HAB+ Requirements
26	Any change of direction in a stairway is accomplished by means of an intermediate landing at least as wide as the tread width and a minimum of 915 mm (36 in) long.		
27	An intermediate landing is provided at each deck level serviced by a stair, or a maximum of every 3600 mm (144 in) of vertical travel for stairs with a vertical rise of 6100 mm (240 in).		
28	Crew member stairways have a maximum angle of inclination from the horizontal of: <ul style="list-style-type: none"> 45 degrees 38 degrees. 		
29	Stair risers and treads have the following design: <ul style="list-style-type: none"> the riser height is no more than 230 mm (9 in) and the tread depth is approximately 280 mm (11 in), including a 25 mm (1 in) tread nosing stairs in a stairway or stair tower, the depth of the tread and the height of riser are consistent the minimum tread width on one-way stairs is at least 710 mm (28 in) the minimum tread width on two-way stairs is at least 915 mm (36 in) the minimum tread width for stairs used in emergencies is at least 1120 mm (44 in) once a minimum tread width has been established at any deck, it is not decreased in the direction of escape all nosings have a non-slip surface. 		
30	Stairway or stair towers are fitted with handrails with the following design: <ul style="list-style-type: none"> the handrail is on both sides of the stair the vertical height above the tread at its nosing is at least 890 mm (35 in) the handrails are parallel to the pitch line of the stair flight and level at landings the handrail is continuous from the top to the bottom of the stairway and terminates in a safe manner at both ends the distance between handrails and any obstruction is 75 mm (3 in) or greater stairways or stair towers of more than 1680 mm (66 in) in width are also fitted with a center handrail handrails on adjacent, parallel stair flights have a minimum of 100 mm (4 in) clear distance between rails. 		
31	Clear headroom (free height) maintained in all stairs is at least 1980 mm (78 in).		
LADDERS			
32	All ladders and handrails are located so as not to interfere with the opening and closing of hatches, doors, gratings, or manholes.		

Accommodations Criteria – Access/Egress			
	Requirement	Meets HAB Requirements	Meets HAB+ Requirements
33	Inclined ladders over stowage spaces, other inclined ladders, machinery, etc. have shields underneath. The shields are readily removable for cleaning or preservation.		
34	Inclined ladders are between 50° and 60° from the horizontal.		
35	A ladder leading to a deck scuttle is not used as a means of escape except on vessels less than 19.8 m (65 ft.) in length, or as not more than one of the means of escape from any crew accommodations space or work space.		
36	Each ladder used as a means of escape has the following design features: <ul style="list-style-type: none"> ▪ the ladder is mounted at least 205 mm (8 in) from the nearest permanent object in the back of the ladder ▪ rungs are at least 410 mm (16 in) in width ▪ rungs are between 275 mm (11 in) and 300 mm (12 in) apart ▪ rungs are uniformly spaced for the length of the ladder. 		
37	The side rails of an open-air vertical ladder extend at least 1070 mm (42 in) above the top level.		
38	Where vertical ladders lead to hatches, manholes or passageways horizontal or vertical handgrabs or grab bars are provided that extends at least 1070 mm (42 in) above the landing platform or access/egress level served by the ladder.		
39	Ladder landings at the top and bottom of inclined ladders: <ul style="list-style-type: none"> ▪ at least 760 mm (30 in) clear in length ▪ at least 915 mm (36 in) clear in length. 		
40	There is at least 760 mm (30 in) clearance in front of the ladder (climbing space).		
41	Ladders are less than 9.1 m (30 ft.) tall. Where the vertical height exceeds 9.1 m (30 ft.) intermediate landings and separate, multiple ladder runs of equal length are provided to cover the required vertical distance.		
42	Vertical ladders exceeding 4.5 m (15 ft.) and other especially exposed ladders are provided with continuous safety cages from a height of 2.1 m (7 ft.) above base and upward: <ul style="list-style-type: none"> ▪ the safety cage extends at least 1.4 m (54 in) above the upper level ▪ the distance from the ladder rung to the back of the cage does not exceed 700 mm (27.5 in) except at the cage entrance where it does not exceed 780 mm (31.5 in). 		
43	A climber safety rail or cable is installed at each permanently installed topside ladder on masts, kingposts and other similar topside structures providing access to fall hazard locations.		
44	Climber safety rails or cables begin approximately 915 mm (36 in) above the standing surface and extend to approximately 1065 mm (42 in) above the surface of the upper landing.		
45	Each ladder rung is skid/slip resistant.		
46	Access to lifeboats is provided such that a person in a stretcher can be easily embarked into the survival craft (e.g., a ramp).		

Accommodations Criteria – Access/Egress			
	Requirement	Meets HAB Requirements	Meets HAB+ Requirements
RAMPS			
47	Ramps are sloped: <ul style="list-style-type: none"> ▪ between 8 and 15 degrees for inclined walking surfaces ▪ at a maximum of 4 degrees for hand and powered trucks. 		
48	Ramps have a non-skid surface.		
49	Ramps have a handrail on any open side of the ramp if the distance from the ramp to the nearest adjacent surface is 610 mm (24 in) or more.		
PASSAGEWAY/WALKWAY DESIGN			
50	Passageways or walkways have the following design features: <ul style="list-style-type: none"> ▪ designed so that passenger areas can be evacuated as quickly as possible in an emergency ▪ free from obstructions and ▪ for ease of crewmember orientation, passageways, stairways, connection doors, emergency exits, etc., should be located in the same place and direction at each level. 		
51	Maximum opening in grating shall be 22 mm (0.875 in) diameter. Grating will not allow a ball with greater diameter to pass through. This applies above places with the presence of persons, otherwise the maximum diameter can be 35 mm (1.375 in).		
52	The walkway width for one person in an unrestricted area, where two persons could pass is at least 710 mm (28 in).		
53	The walkway width for normal two-way traffic or any means of egress that leads to an exit or entrance is at least 915 mm (36 in).		
54	Corridor/passage widths that are required exits are at least 1.1 m (44 in).		
55	The sum of the width of all doors and passageways used as means of escape is greater than 8.5 mm (0.333 in) multiplied by the number of persons for which the space is designed.		
56	Headroom in all passageways is at least 1980 mm (78 in).		
57	Headroom in all passageways is at least 2030 mm (80 in).		
WINDOWS			
58	Screens are easily removable for cleaning.		
59	Windows or port lights in bulkheads adjacent to passageways do not extend below a point 910 mm (36 in) above the deck unless storm rails/handrails (structurally independent of the glass) are fitted in the passageways.		
60	The design of windows is such that all maintenance, repair and replacement of glass can be carried out from the inside.		
61	All port lights are equipped with a cover or shade. In air conditioned spaces, the cover is fitted on the air conditioned side.		
62	Hinged windows, in enclosed or semi-enclosed stations, hinge upwards.		
63	Windows equipped with window wipers are provided with a window washing system and can be maintained/refilled from inside the ship.		

Instructions: For a **HAB** Notation, the unshaded boxes under “Meets **HAB** Requirements” must be met. For an **HAB+** Notation, the unshaded boxes under “Meets **HAB+** Requirements” need to be met as well as **HAB** requirements.

Accommodations Criteria – Berthing			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
ROOM SIZE FOR CREW MEMBERS ON NON-PASSENGER SHIPS			
Note: 1) For all room size criteria, the berthing floor area includes berths, lockers, chest of drawers and seats. 2) Tons = gross registered tons.			
Non-passenger ships under 800 tons:			
1	Berthing floor area per crew member is:		
+	<ul style="list-style-type: none"> ▪ at least 1.85 m² (20 ft²) ▪ at least 4.8 m² (52 ft²). 		
Non-passenger ships over 800 tons but under 1000 tons:			
2	Berthing floor area per crew member is:		
+	<ul style="list-style-type: none"> ▪ at least 2.35 m² (25 ft²) ▪ at least 4.8 m² (52 ft²). 		
Non-passenger ships over 1000 tons but less than 3000 tons:			
3	Berthing floor area per crew member in rooms intended for one person is:		
*	<ul style="list-style-type: none"> ▪ at least 3.75 m² (40.5 ft²). ▪ at least 4.8 m² (52 ft²). 		
4	Berthing floor area per crew member in rooms intended for two persons is:		
*	<ul style="list-style-type: none"> ▪ at least 2.75 m² (29.5 ft²) ▪ at least 5.34 m² (57.5 ft²). 		
Non-passenger ships over 3000 tons but less than 10,000 tons:			
5	Berthing floor area per crew member in rooms intended for one person is:		
*	<ul style="list-style-type: none"> ▪ at least 4.25 m² (45.75 ft²) ▪ at least 4.8 m² (52 ft²). 		
6	Berthing floor area per crew member in rooms intended for two persons is:		
*	<ul style="list-style-type: none"> ▪ at least 3.25 m² (35 ft²) ▪ at least 5.34 m² (57.5 ft²). 		
Non-passenger ships over 10,000 tons:			
7	Berthing floor area per crew member in rooms intended for one person is:		
*	<ul style="list-style-type: none"> ▪ at least 4.75 m² (51 ft²). 		
8	Berthing floor area per crew member in rooms intended for two persons is:		
*	<ul style="list-style-type: none"> ▪ at least 3.75 m² (40.5 ft²) ▪ at least 5.34 m² (57.5 ft²). 		

Accommodations Criteria – Berthing			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
ROOM SIZE FOR CREW MEMBERS ON PASSENGER SHIPS			
Note: 1) For all room size criteria, the berthing floor area includes berths, lockers, chest of drawers and seats. 2) Tons = gross registered tons.			
Passenger ships under 800 tons:			
9	Berthing floor area per crew member is:		
*	▪ at least 1.85 m ² (20 ft ²)		
	▪ at least 4.8 m ² (52 ft ²).		
Passenger ships over 800 tons but under 1000 tons:			
10	Berthing floor area per crew member is:		
*	▪ at least 2.35 m ² (25 ft ²)		
	▪ at least 4.8 m ² (52 ft ²).		
Passenger ships over 1000 tons but less than 3000 tons:			
11	Berthing floor area in a one-person room is:		
*	▪ at least 2.35 m ² (25.5 ft ²)		
	▪ at least 6.0 m ² (65 ft ²).		
Passenger ships over 3000 tons:			
12	Berthing floor area in a one-person room is:		
*	▪ at least 3.75 m ² (40.5 ft ²)		
	▪ at least 6.0 m ² (65 ft ²).		
13	Berthing floor area in a two-person room is:		
*	▪ at least 6.0 m ² (64.5 ft ²)		
	▪ at least 10.68 m ² (115 ft ²).		
14	Berthing floor area in a three-person room is:		
*	▪ at least 9.00 m ² (97 ft ²)		
	▪ at least 17.6 m ² (189 ft ²).		
15	Berthing floor area in a four-person room is:		
*	▪ at least 12 m ² (129 ft ²)		
	▪ at least 24.8 m ² (267 ft ²).		
ALL SHIPS LESS THAN 3000 TONS:			
16	Officer berthing floor area per person is 6.50 m ² (70 ft ²) or more, unless a private sitting or day room is provided.		
*			
ALL SHIPS AT LEAST 3000 TONS:			
17	Officer berthing floor area per person is 7.50 m ² (80.75 ft ²) or more, unless a private sitting or day room is provided.		
*			
OCCUPANCY LEVEL			
18	Individual berths are provided for each crew member.		
+			

Accommodations Criteria – Berthing			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
19 *	Sleeping rooms in non-passenger ships are not occupied by more than two persons.		
20 *	No more than four persons are occupying sleeping rooms in passenger ships, under normal circumstances.		
21 * * * *	Individual sleeping rooms are provided for: <ul style="list-style-type: none"> ▪ officers in charge of a department ▪ navigating officers ▪ engineering officers in charge of a watch ▪ senior radio officers. 		
22 *	No more than two petty officers occupy a single sleeping room.		
23 +	Crew members sharing rooms are in same occupation group and day persons do not share a room with watch-keepers.		
24 +	Maximum number of persons to be accommodated in any sleeping room is marked indelibly and legibly in some conveniently seen place: <ul style="list-style-type: none"> ▪ in the room ▪ outside the room. 		
25	Each crew member has a private sleeping room.		
BERTHING LOCATION			
26 + + + +	Location, means of access, structure and arrangement in relation to other spaces of crew accommodations is to: <ul style="list-style-type: none"> ▪ ensure adequate security ▪ protect against weather and sea ▪ insulate from heat and cold ▪ insulate from undue noise and effluvia from other spaces. 		
27 +	There is no direct communication into sleeping areas from cargo areas, machinery spaces, chain lockers, galleys, lamp and paint rooms or from engine, deck and other bulk storerooms, drying rooms, communal wash places or water closets.		
28 + + + +	Crew quarters are not located: <ul style="list-style-type: none"> ▪ further forward in the vessel than a vertical plane located at 5 percent of the vessel’s length abaft of the forward side of the stem at the designed summer load water line ▪ immediately beneath working alleyways ▪ below the load line amidships or aft unless approved by Flag Administration ▪ below load line, unless, satisfactory arrangements are made for lighting and ventilation and approved by the Flag Administration ▪ forward of the collision bulkhead. 		
29	Main steam and exhaust pipes for winches, electric cableways, ducting and similar gear/equipment do not pass through alleyways leading to crew accommodations or through the crew accommodations.		

Accommodations Criteria – Berthing			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
30	Officer and crew cabins and staterooms are secluded from passengers and grouped by on-board department.		
31	The Master’s stateroom and office is located directly under or adjacent to the navigation bridge.		
ROOM DESIGN			
General			
32	An individual letter or number clearly visible from outside the room identifies each sleeping room.		
33	Deck coverings (e.g., mats, carpeting, etc.) are supplied where slips are possible due to occasional water, oil or liquid on the floors.		
34 +	Wall surfaces and decks in sleeping rooms are washable and impervious to damp or moisture absorption.		
35 +	Painted wall surfaces in sleeping rooms are light in color.		
36 +	Internal bulkheads are of approved material that is not likely to harbor vermin.		
37 +	Wall surfaces are not constructed from tongued and grooved boarding or any other form of construction likely to harbor vermin.		
38	Where practicable a sitting or day room, adjoining the sleeping room is provided for:		
*	<ul style="list-style-type: none"> ▪ the Chief Engineer and Chief Navigating Officer ▪ the Master and Chief Mate. 		
39	Pipes, ventilation ducts, or other installations do not obstruct berths.		
40 +	Sleeping rooms are ventilated and heated.		
41	HVAC vents shall not be directed at the heads of berths.		
42 +	Radiators and other heating apparatus are so placed and, where necessary, shielded as to avoid risk of fire or danger or discomfort to the occupants.		
43 *	Sleeping rooms are lighted with natural light and are provided with artificial light (subject to special arrangements as may be permitted in passenger ships).		
44	Crew living and work spaces have different color schemes to provide personnel with a visual change in environment in their daily routines.		
45	Port lights are installed in each sleeping room that has an outboard or exterior wall surface, on the basis of one for each 3048 mm (10 linear ft.) of weather boundary.		
Berths			
46 +	Berths are not side by side so that access to one berth can only be obtained over another.		
47	Berths are generally oriented fore and aft on cargo ships.		
48	Berths installed over manholes or other deck fittings are easily removable.		

Accommodations Criteria – Berthing			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
49	Berths have solid partitions on three sides where multiple persons are housed in the same room.		
50	Berths contain individually operated privacy curtains and fans/blowers.		
51 +	Berthing arrangements are either single tier or double tiered.		
52 +	Berths with port lights above them are only in a single tier arrangement.		
Emergency			
53	Each berth is immediately adjacent to an aisle leading to a means of escape from the accommodations space.		
54	An emergency alerting system (e.g., an audible alarm) is present for all berthing spaces.		
55	A means of escape that is not readily apparent to a person from both the inside and outside of the space is adequately marked.		
Outfitting			
56 +	Sleeping rooms with port lights, have curtains.		
57	Grab bars and stepping surfaces are provided for access to upper berths.		
58 *	An electric reading light is provided at the head of each berth.		
59	A means of switching on/off room lighting is provided so that no person must enter a darkened room.		
60 +	The top berth in a tier has a dust-proof bottom of wood, canvas, or other suitable material.		
61	Mattresses are innerspring construction. The finished thickness is 180 ± 13 mm (7 ± 0.5 in).		
62	In sleeping rooms with more than one occupant, furniture (beds, lockers, drawers, etc.) are labeled identifying which furniture is dedicated to which berth.		
63	Furniture and equipment in berthing spaces do not block access to: <ul style="list-style-type: none"> ▪ damage control fittings ▪ hull, mechanical, or electrical distributive systems that require periodic inspection and maintenance. 		
64 + + + + + +	Each sleeping room is provided with the following furniture (in addition to berths and clothes lockers): <ul style="list-style-type: none"> ▪ a table or ▪ 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. 		

Accommodations Criteria – Berthing			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
65 +	Furniture is of smooth, hard material not liable to warp or corrode.		
66	Each crew member’s room is provided with a: <ul style="list-style-type: none"> ▪ television antenna outlet ▪ radio antenna outlet. 		
67	Each crew member’s room is provided with an HVAC temperature control.		
68 +	In ships regularly trading to mosquito-infested ports, suitable screens are fitted to side scuttles, ventilators and doors to the open deck.		
DIMENSIONAL ASPECTS			
General			
69	Outside corners of berthing bulkheads, doors, etc. have a radius of 0.75 mm (0.03 in) or more.		
70	All edges that crew members may strike are rounded to a radius of 0.75 mm (0.03 in) or more.		
71 +	Headroom in all sleeping rooms is: <ul style="list-style-type: none"> ▪ at least 1980 mm (78 in) ▪ at least 2050 mm (80 in). 		
Aisles			
72	Aisle widths in sleeping areas are: <ul style="list-style-type: none"> ▪ at least 610 mm (24 in), between a single berth and the nearest obstruction ▪ at least 915 mm (36 in), between facing berths ▪ at least 1065 mm (42 in), when joining two or more aisles. 		
Berths			
73 +	The lower berth in a tier is at least 300 mm (12 in) above the deck.		
74 +	The upper berth is placed approximately midway between the bottom of the lower berth and the lower side of the deck head beams.		
75	Head clearance above each berth is: <ul style="list-style-type: none"> ▪ at least 610 mm (24 in) ▪ at least 810 mm (32 in). 		
76 *	Berth inside dimensions are: <ul style="list-style-type: none"> ▪ at least 1980 mm (78 in) by 800 mm (31.5 in) ▪ at least 2020 mm (80 in) by 965 mm (38 in). 		
77 +	The framework and lee-board of a berth is of approved material, hard, smooth and not likely to corrode or to harbor vermin.		
78 +	Berths constructed from tubular frames are completely sealed and without perforations which would give access to vermin.		

Accommodations Criteria – Berthing			
Requirement + = ILO 92 Requirement * = ILO 133 Requirement		Meets HAB Requirements	Meets HAB+ Requirements
Storage Space			
79	Sleeping rooms provide storage space for each occupant:		
+	<ul style="list-style-type: none"> ▪ the clothes locker is fitted with a shelf and hasp 		
+	<ul style="list-style-type: none"> ▪ the clothes locker is at least 1520 mm (60 in) tall with a cross section area of 0.19 m² (2.1 ft²) 		
+	<ul style="list-style-type: none"> ▪ drawer space is at least 0.056 m³ (2 ft³) for each occupant ▪ drawers and doors are arranged to prevent inadvertent opening and closing due to ship movement ▪ kick space 100 mm (4 in) high by 100 mm (4 in) deep is provided around clothes lockers, berths, etc. ▪ the clothes locker is at least 1830 mm (72 in) tall, 610 mm (24 in) deep and 610 mm (24 in) wide. 		
80	Accommodations for the hanging of oilskins is:		
+	<ul style="list-style-type: none"> ▪ sufficient 		
+	<ul style="list-style-type: none"> ▪ adequately ventilated 		
+	<ul style="list-style-type: none"> ▪ provided outside but convenient to the sleeping rooms. 		
Doors			
81	Doors to sleeping rooms have the following dimensions and features:		
	<ul style="list-style-type: none"> ▪ 1980 mm (78 in) high by 660 mm (26 in) wide or more ▪ escape panels are provided in doors when there is not a secondary means of escape ▪ every door used as a means of escape is capable of being operated by one person, from either side, in both light and dark conditions ▪ the method of opening a means of escape is obvious and rapid ▪ the initial force required to open the door does not exceed 65 Newton (14.6 pounds) ▪ doors to sleeping rooms can be locked from the inside with an ability to override the lock from the outside in the event of an emergency. 		

Instructions: For a **HAB** Notation, the unshaded boxes under “Meets **HAB** Requirements” must be met. For an **HAB+** Notation, the unshaded boxes under “Meets **HAB+** Requirements” need to be met as well as **HAB** requirements.

Accommodations Criteria – Sanitary Spaces			
Requirement + = ILO 92 Requirement * = ILO 133 Requirement		Meets HAB Requirements	Meets HAB+ Requirements
GENERAL			
1	Sanitary spaces are:		
+	▪ lighted		
+	▪ heated		
+	▪ ventilated.		
2	Floors in sanitary spaces are:		
	▪ non-slip type deck covering		
+	▪ easily cleaned		
+	▪ impervious to damp or moisture absorption		
+	▪ properly drained.		
3	Sanitary spaces are gender identifiable without entering the space.		
4	Single occupancy toilets located in convenient access to the weather decks and workspaces such as the bridge, engine rooms and other normally manned spaces are gender neutral.		
5	For every six crew members who do not have a private sanitary space, there is:		
*	▪ one or more tubs and/or shower baths		
*	▪ one or more toilets		
+	▪ washbasins.		
6	Where the radio officers or operators are accommodated in an isolated position, sanitary facilities are provided near or adjacent thereto.		
7	Someone standing on a wet deck in sanitary spaces cannot reach light switches or electrical outlets without ground fault interrupters.		
8	Radiators and other heating apparatus are placed and where necessary, shielded to avoid risk of fire or danger or discomfort to the occupants.		
9	Separate multiple occupancy sanitary spaces are provided for men and women.		
10	All edges that crew members may strike are rounded to a radius of 0.75 mm (0.03 in) or more.		
11	Bulkheads in sanitary spaces are:		
+	▪ steel or other approved material		
+	▪ watertight up to 230 mm (9 in) above deck level.		
12	Outside corners of sanitary space bulkheads, doors, etc., have a radius of 0.75 mm (0.03 in) or more.		
13	A kick space 100 mm (4 in) high by 100 mm (4 in) deep is provided at the base of dressers, counters, etc.		

Accommodations Criteria – Sanitary Spaces			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
14	Ingress and egress to sanitary spaces are arranged to avoid the need to pass through the toilet area en route to or from the shower or washbasin areas.		
15	Showers and toilets are located as far from access doors into the sanitary space, as practicable.		
16	Free space area per person in sanitary spaces is: <ul style="list-style-type: none"> ▪ at least 0.75 m² (8 ft²) ▪ at least 1.1 m² (12ft²). 		
17	Drawers and doors have latches: <ul style="list-style-type: none"> ▪ to prevent opening and closing due to ship motion ▪ that are operable with one hand ▪ that are designed so that it is obvious when the drawer or door is not fastened/locked. 		
18	Headroom in all sanitary spaces: <ul style="list-style-type: none"> ▪ is at least 1980 mm (78 in) ▪ is at least 2050 mm (80 in). 		
19	Single or double occupancy sleeping rooms have a private sanitary space with a toilet, shower or tub and sink modules.		
20	Washbasins and urinals, if equipped, are located so that, when in use, crew members face forward or aft.		
GENERAL – BASED ON SHIP’S SIZE			
Note: tons = gross registered tons			
21	On ships over 1,600 tons, a toilet and washbasin having hot and cold running potable water is within easy access of the: <ul style="list-style-type: none"> ▪ navigation bridge deck and primarily for those on duty in the area ▪ machinery space if not fitted near the engine room control center. 		
22	On ships over 1,600 tons, without private or semi-private sleeping rooms or sanitary spaces, clothes changing facilities are provided for engine department personnel. These facilities are: <ul style="list-style-type: none"> ▪ outside but within easy access of the machinery space ▪ fitted with individual lockers ▪ fitted with tubs and/or showers and washbasins. 		
23	In ships between 5,000 and 15,000 tons, at least five officers have sleeping rooms with an attached private sanitary space with a toilet, tub and/or shower and washbasin. The washbasin may be in the sleeping room.		
24	In ships between 10,000 and 15,000 tons, all officers without private sanitary spaces have private intercommunicating sanitary spaces fitted with a toilet, tub and/or shower and washbasin.		
25	In ships over 15,000 tons, all officers have sleeping rooms with an attached private sanitary space fitted with a toilet, tub and/or shower and washbasin. The washbasin may be in the sleeping room.		

Accommodations Criteria – Sanitary Spaces			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
26 *	In non-passenger ships over 25,000 tons, a sanitary space is provided for every two ratings, either in an intercommunicating space between adjoining sleeping rooms or opposite the entrance of such rooms. The sanitary spaces are fitted with a toilet, tub and/or shower and washbasin.		
27 *	In non-passenger ships over 5,000 tons, each sleeping room (both officer and ratings) is provided with a washbasin with hot and cold running potable water (except when a private sanitary space is provided).		
SHOWERS/BATHS			
28	All showers and baths are equipped with adequate plumbing, including hot and cold potable running water.		
29	Water heaters supplying showers: <ul style="list-style-type: none"> ▪ do not support areas that have higher water temperature requirements, such as food service areas ▪ are provided with anti-scalding devices. 		
30	Handholds are provided for shower and bath sanitary spaces.		
31	Showers are individual stall types with minimum dimensions of: <ul style="list-style-type: none"> ▪ 760 mm (30 in) by 760 mm (30 in) ▪ 900 mm (36 in) by 900 mm (36 in). 		
32	In sanitary spaces intended for more than one person, the shower is screened.		
33	Baths, where provided, are of adequate size with the following dimensions: <ul style="list-style-type: none"> ▪ tub baths are at least 1420 mm (56 in) long, 665 mm (26 in) wide and 380 mm (15 in) deep ▪ tub baths are at least 1680 mm (66 in) long by 690 mm (27 in) wide and 560 mm (22 in) deep. 		
34	Hot water is supplied to showers within 10 seconds.		
CLEANING/MAINTENANCE			
35 +	Clearance is provided around and behind sanitary fixtures: <ul style="list-style-type: none"> ▪ to easily adjust, service, or repair them ▪ to reach important plumbing connections and pipes ▪ to facilitate cleaning. 		
36 +	Decks and bulkhead surfaces are easily cleaned and impervious to damp or moisture absorption.		
37	Areas likely to get soiled are accessible for cleaning.		
38	Fixtures are bulkhead mounted for ease of cleaning.		
39	Cleaning gear locker with service sink and deck drain is located near sanitary spaces.		
TOILETS			
40 +	Where there is more than one toilet in a space, they are sufficiently screened to ensure privacy.		
41	Toilet room doors are self-closing and lockable from the inside.		

Accommodations Criteria – Sanitary Spaces			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
42	The width of the toilet stall is 810 mm (32 in) or greater.		
43	The clearance in front of the toilet and the stall door is 915 mm (36 in) or greater.		
44	All toilets:		
+	▪ have flush water available at all times		
+	▪ are independently controllable		
	▪ have adequate plumbing for flushing		
	▪ have a hand washing station.		
45	Toilets are conveniently located to the workplace, recreation areas, dining rooms and shower rooms.		
46	Toilets, intended for more than one crew member, are situated convenient to, but separate from, sleeping rooms and wash rooms without direct access from:		
+	▪ the sleeping rooms		
	▪ toilets to which there is no other access.		
	(This requirement does not apply where a toilet is located in a space between two sleeping rooms having a total of not more than four persons.)		
47	All toilets have ventilation to the open air, independent of any other part of the space.		
+			
48	All toilet spaces are ventilated sufficiently to be reasonably free of disagreeable odors and condensation.		
49	Gravity flush toilets face fore and aft to minimize the siphoning effect on traps due to ship roll.		
50	The following minimum number of separate toilets are provided:		
+	▪ 3 in ships under 800 tons		
+	▪ 4 in ships 800 tons or over but under 3,000 tons		
+	▪ 6 in ships 3,000 tons or over.		
51	Toilet enclosures begin no more than 300 mm (12 in) above the floor.		
WASHBASINS			
52	All washbasins are equipped with adequate plumbing, including hot and cold potable running water.		
53	Water heaters supplying washbasins:		
	▪ do not support areas that have higher water temperature requirements		
	▪ are provided with anti-scalding devices.		
54	The following are provided for each washbasin:		
	▪ a mirror with light		
	▪ toiletry shelf		
	▪ two electrical outlets with ground fault interrupters.		
55	Facilities to dry hands are provided at all washbasins.		

Accommodations Criteria – Sanitary Spaces			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
56	Washbasins are:		
	▪ large enough so that users can get their hands and faces inside it without bumping their heads on the faucet or having water run down their arms		
+	▪ constructed of approved material		
+	▪ smooth surfaced		
+	▪ not liable to crack, flake or corrode.		
57	The dimension between the centerlines of two hand washbasins side-by-side is 710 mm (28 in) or greater.		
58	The dimension between the centerline of a hand washbasin and a bulkhead next to the hand washbasin is 380 mm (15 in) or greater.		
59	The top of the washbasin is between 735 mm (29 in) and 915 mm (36 in) above the deck surface.		
60	Sanitary spaces do not have medicine cabinets with doors that can open over a washbasin and have shelves with battens.		
61	Hot water is supplied to washbasins within 10 seconds.		
URINALS			
62	Urinals have privacy partitions between units and at the end of rows if not provided by permanent structures.		
63	The dimension between the centerline of two urinals side-by-side is 690 mm (27 in) or greater.		
64	The dimension between the centerline of a urinal and a bulkhead next to the urinal is 380 mm (15 in) or greater.		
65	The height of the front edge of a urinal is between 455 mm (18 in) and 605 mm (24 in) above the deck surface.		
66	Handholds are provided for use of urinals.		
67	Partitions between urinals start 530 mm (21 in) or less above and run to 1450 mm (57 in) or more above the deck.		
68	Partitions between urinals mounted against the bulkhead protrude at least 460 mm (18 in) toward the user.		

Instructions: For a **HAB** Notation, the unshaded boxes under “Meets **HAB** Requirements” must be met. For an **HAB+** Notation, the unshaded boxes under “Meets **HAB+** Requirements” need to be met as well as **HAB** requirements.

Accommodations Criteria – Office			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
GENERAL			
1	In ships of over 3000 tons:		
+	▪ One room is provided and equipped for use as an office for the deck department		
+	▪ One room is provided and equipped for use as an office for the engine department.		
2	Painted wall surfaces and deck heads in offices are light in color.		
3	If the chief officer’s office is located adjacent to his stateroom there is a separate entrance into the office.		
4	Headroom in all offices:		
*	▪ is at least 1980 mm (78 in)		
	▪ is at least 2050 mm (80 in).		
OUTFITTING			
5	The ship’s office shall contain a desk, chair and other requisite office furniture and equipment.		
6	The ship’s office has a toilet, shower and washbasin in close proximity to the office.		
7	Drawers and doors have latches:		
	▪ to prevent opening and closing due to ship motion		
	▪ that are operable with one hand		
	▪ that are designed so that it is obvious when the drawer or door is not fastened/locked.		
8	Open shelves have battens and upward flanged edges on open sides to retain their contents.		
9	Port lights are installed in each office, based on each 3 m (10 ft.) of weather boundary.		
DIMENSIONAL ASPECTS			
10	Offices have the following seated work dimensions:		
	▪ desk height: 685 mm (27 in) to 785 mm (31 in)		
	▪ clearance for legs below work surface is at least 510 mm (20 in) wide and 380 mm (15 in) deep at knee level and 600 mm (23.5 in) at floor level		
	▪ drafting table top height: 965 mm (38 in) to 1040 mm (41 in).		

Accommodations Criteria – Office			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
	Offices that must accommodate up to two visitors: <ul style="list-style-type: none"> ▪ have a minimum desk working/meeting surface area of 1.7 m² (18.3 ft²) ▪ occupy a floor area of at least 2590 mm (102 in) by 2590 mm (102 in). 		
12	The clearance between the front of a filing cabinet and a bulkhead or obstruction in front of the cabinet is at least 915 mm (36 in).		
13	Service counters are between 1015 mm (40 in) and 1040 mm (41 in) above the finished floor surface.		
14	A kick space of approximately 100 mm (4 in) high by 100 mm (4 in) deep is provided at the base of counters.		
15	Offices that require the computing, reading, writing, sorting or filing of paperwork: <ul style="list-style-type: none"> ▪ have a minimum desk working surface area of 1.2 m² (12.9 ft²) ▪ occupy a floor area of at least 1675 mm (66 in) by 2285 mm (90 in) (these minimum dimensions do not allow for visitors or visitors chair). 		
16	Outside corners of office bulkheads, doors, etc. have a radius of 0.75 mm (0.03 in) or more.		
17	All edges (e.g., on furniture) that crew members may strike are rounded to a radius of 0.75 mm (0.03 in) or more.		

Appendix 3 Accommodations Criteria

Instructions: For a **HAB** Notation, the unshaded boxes under “Meets **HAB** Requirements” must be met. For an **HAB+** Notation, the unshaded boxes under “Meets **HAB+** Requirements” need to be met as well as **HAB** requirements.

Accommodations Criteria – Food Service Areas			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
GENERAL			
1	Food service areas are on or above the strength deck or damage control deck.		
2	Non-slip type deck covering is supplied where occasional water, oil or liquid on the floors is expected. Deck covering allows frequent wash downs with disinfectant without cracking.		
3 +	Painted wall surfaces and deck heads are light in color.		
4 +	Wall and deck surfaces are capable of being easily cleaned and impervious to damp or moisture absorption.		
5	Access is provided to all areas requiring cleaning, painting, or treating with pesticide/insecticide.		
6	There are no crevices or inaccessible voids, which might harbor vermin, cooking or food waste, or other extraneous matter.		
7 +	Places where food is prepared, served or stored are not used as sleeping areas.		
8	Food service areas are protected against leakage or seepage of lubricants or other extraneous or foreign substances.		
9	Deck drains are provided in all food service areas subject to flood type cleaning or where normal operations release or discharge water or other liquid onto the deck.		
10	Deck drains for food service areas are provided in number and location so that complete drainage is possible under normal conditions of list and trim.		
11	Distributive systems such as piping, wiring and HVAC ducts are minimized in food service areas.		
12	Where distributive systems are located in food service areas, they are installed as close as practicable to the overhead in order to provide maximum headroom.		
13	Outside corners of food service bulkheads, doors, etc., have a radius of 0.75 mm (0.03 in) or more.		
14	All edges that personnel may strike are rounded to a radius of 0.75 mm (0.03 in) or more.		
15	Flow of food through vessel: <ul style="list-style-type: none"> ▪ is arranged in logical sequence that minimizes cross-traffic or backtracking ▪ allows for adequate separation of clean and soiled operations. 		

Accommodations Criteria – Food Service Areas			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
16 *	Headroom in food service areas is: <ul style="list-style-type: none"> ▪ at least 1980 mm (78 in) ▪ at least 2050 mm (80 in). 		
FOOD SERVICE DOORS			
17	Door characteristics: <ul style="list-style-type: none"> ▪ doors should be easily cleaned ▪ the tracks or guides of sliding doors are fabricated as to be free of inaccessible openings or slots ▪ if gaskets are used on insulated doors, they are easily cleanable, replaceable and should fit tight ▪ sliding doors in galley and pantry are removable ▪ door width to mess room is at least 915 mm (36 in) ▪ door widths for galley, pantry and storerooms are at least 760 mm (30 in) ▪ doors to freezer and cold storage rooms are at least 900 mm (36 in) wide and open 180 degrees ▪ traffic doors in mess and galley areas are provided with stainless steel push and kick plates. 		
18	Toilet room doors opening directly into food preparation or serving areas are self-closing and tight.		
19	Double swing doors are only used in bulkheads between a food preparation space, such as a galley or pantry and a mess room or dining room.		
FOOD SERVICE PASSAGEWAYS			
20	Passages in storerooms and issue rooms provide unobstructed access to manholes, or operating gear, within the storeroom.		
21	The passage width between storage shelves is at least 900 mm (35 in).		
MESS ROOM			
General			
22 + + +	Mess rooms are: <ul style="list-style-type: none"> ▪ located apart from sleeping rooms ▪ adequately ventilated ▪ adequately insulated to prevent condensation or overheating ▪ located as near to the galley as is practicable except where the mess room is equipped with a steam table. 		
23 +	Mess rooms have tables and seats sufficient for the number of persons likely to use them at any one time.		
24	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.).		

Accommodations Criteria – Food Service Areas			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
25 *	Lighting in mess rooms is provided by means of natural light and artificial light (subject to special arrangements as may be permitted in passenger ships).		
26 * * *	The following is available for crew use at all times: <ul style="list-style-type: none"> ▪ refrigerator ▪ facilities for hot beverages ▪ facilities for cool water. 		
27 + +	In ships less than 1,000 tons, three sufficient separate mess room accommodations are provided for: <ul style="list-style-type: none"> ▪ master and officers ▪ petty officers and other ratings ▪ catering staff. 		
28 + + +	In ships greater than 1,000 tons, four sufficient separate mess room accommodations are provided for: <ul style="list-style-type: none"> ▪ master and officers ▪ engine department petty officers and other ratings ▪ deck department petty officers and other ratings ▪ catering staff. 		
29 +	The tops of tables and seating are capable of being easily cleaned.		
30 +	Where available pantries are not accessible to mess rooms, adequate lockers for mess utensils and proper facilities for washing utensils are provided.		
Outfitting			
31	Telephones or other internal communications are provided in the officers' mess.		
32	Tray slides (or rails) are provided along food and beverage serving lines.		
33	A transparent sanitation shield is installed to completely shield the entire length of the food serving lines above the tray rail.		
34 +	Adequate lockers for mess utensils are provided.		
MESS ROOM DIMENSIONAL ASPECTS			
35	Tray rails are between 780 mm (31 in) and 940 mm (37 in) above the deck surface.		
36	The distance between the bottom of the sanitary shield protecting the food and the top of the tray rail is at least 255 mm (10 in).		
37	Table space for each diner is at least: <ul style="list-style-type: none"> ▪ 610 mm (24 in) wide by 380 mm (15 in) deep ▪ 740 mm (29 in) wide by 430 mm (17 in) deep. 		
38	Dining tables are between 710 mm (28 in) and 760 mm (30 in) high with at least 180 mm (7 in) clearance between the top of the seat and the bottom of the table structure.		

Accommodations Criteria – Food Service Areas			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
39	Deck area requirements for planned seating capacity are:		
*	<ul style="list-style-type: none"> ▪ at least 1 m² (10.8 ft²) per person for officers and ratings ▪ at least 1.7 m² (18.4 ft²) per person for officers and ratings. 		
40	The width of serving aisles, measured from service counter or outside edge of tray rail if present, is:		
	<ul style="list-style-type: none"> ▪ at least 914 mm (36 in) ▪ at least 1118 mm (44 in). 		
41	Distance between tables with back to back seating is:		
	<ul style="list-style-type: none"> ▪ at least 1195 mm (47 in) ▪ at least 1525 mm (60 in). 		
42	Distance between the seating side of a table and the nearest obstruction:		
	<ul style="list-style-type: none"> ▪ at least 760 mm (30 in) ▪ at least 1070 mm (42 in). 		
43	Table depth for facing diners:		
	<ul style="list-style-type: none"> ▪ at least 760 mm (30 in) ▪ at least 915 mm (36 in). 		
GALLEY/SCULLERY			
General			
44	All spaces in which food is prepared or stored and utensils washed are ventilated sufficiently to be reasonably free of disagreeable odors and condensation.		
45	Shelves are provided with sea rails.		
46	Protective shields are provided at hot and cold hazards.		
47	Containers used to receive and store garbage are watertight, easily cleanable and non-absorbent.		
48	Ventilation hoods:		
	<ul style="list-style-type: none"> ▪ are designed to prevent grease or condensation from dripping into food or onto food preparation surfaces ▪ have the capacity to extract grease from the exhaust so it is not deposited in the ventilation duct. 		
49	Deep fat fryers are installed so that the operator faces forward or aft. Shallow fryers (e.g., donut fryers) are oriented longitudinally.		
50	Sufficient storage for food based on the estimated mass and associated volume of food consumption of:		
	<ul style="list-style-type: none"> ▪ Dry provisions: 1.5 kg (3.3 lbs.) per day/per person (approximately 0.06 m² (0.65 ft²)) ▪ Chilled provisions: 1.4 kg (3.1 lbs.) per day/per person (approximately 0.017 m³ (0.6 ft³)) ▪ Frozen: 1.1 kg (2.4 lbs.) per day/per person (approximately 0.023 m³ (0.8 ft³)). 		

Accommodations Criteria – Food Service Areas			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
51	Drawers and doors have latches: <ul style="list-style-type: none"> ▪ to prevent opening and closing due to ship motion ▪ that are operable with one hand ▪ that are designed so that it is obvious when the drawer or door is not fastened/locked. 		
52	Cabinets and cupboards used for storing dishware are fitted with built-in retaining devices to prevent contents from spilling when door is opened.		
53	Toilet and washbasin facilities of suitable design and the following characteristics are provided for crew members: <ul style="list-style-type: none"> ▪ hand washing stations are provided so that no crew member must walk more than 7.5 m (25 ft.) to a station. Slop sinks and scullery sinks are not satisfactory hand washing stations ▪ crew members do not have to squat or reach excessively to wash hands at hand washing station ▪ crew members do not have to travel through a door to reach a hand washing station ▪ hand washing facilities in the galleys have mixing taps which can be operated without the use of the hands. 		
Potable Water			
54	A water system supplying hot and cold potable water to the galley and pantry is installed.		
55	Potable hot and cold water is easily accessible in all rooms where food is prepared and utensils are cleaned.		
56	Only potable water is piped to food storage, preparation, or service areas. The exceptions are a food waste grinder eductor (garbage disposal) line and deck washing facilities. The grinder delivery line is protected against back flow.		
57	Hot and cold potable water available in garbage rooms for washing garbage cans.		
58	Manholes are installed only on sides of potable water tanks.		
59	Potable water tanks are identified with a number and the words "POTABLE WATER" in letters at least 50 mm (2 in) high.		
60	Potable water piping and fittings are identified as follows: <ul style="list-style-type: none"> ▪ marked on each side of partitions, decks and bulkheads and ▪ striped with a 50 mm (2 in) wide blue band at 4575 mm (15 ft.) intervals or, ▪ use a pipe marker label with blue bands with letters ▪ piping marked with flow direction arrows. 		
61	Potable water piping and fittings are labeled.		
62	Ice making facilities for 0.57 kg (1.25 pounds) of ice per person per day are provided.		

Accommodations Criteria – Food Service Areas			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
Drains			
63	Deck scupper drains are a minimum of 65mm (2 1/2 in) in diameter.		
64	There are no floor drains inside provision rooms except the thaw room.		
65	Drainage gutters for flood cleaning of decks are easily accessible for cleaning.		
66	Cover plates installed over drainage gutters are easily removable.		
67	Horizontal drain lines are a minimum of 100 mm (4 in) above the deck.		
Maintenance/Cleaning			
68	Cutting boards are: <ul style="list-style-type: none"> ▪ not made of wood ▪ readily removable for cleaning or easily cleanable in place. 		
69	Drawers and bins used as food contact surfaces are readily removable and easily cleaned.		
70	Covers, insets, or receptacles for unpackaged foods or beverages are easily removable or designed for easy cleaning in place.		
71	Stove top or range sea rails are readily removable and easily cleanable and brackets for sea rails are easily cleanable.		
72	Ventilation baffles, vanes, louvers, dampers, filters, etc., are easily accessible or removable (without tools) for cleaning.		
73	All deck-mounted equipment is elevated on legs that extend at least 150 mm (6 in) above the finished deck to allow for cleaning.		
74	Table mounted equipment, unless easily movable, is either sealed to the tabletop or mounted on legs at least 100 mm (4 in) above the table top to allow cleaning.		
75	Equipment can be operated, maintained and repaired from the front in order to minimize total ship area and volume requirements and to facilitate maintenance where possible.		
Refrigeration/Freezer			
76	There is an alarm which indicates if a person is “locked-in” in each freezer and cold storage room.		
77	It is possible to open the doors of the refrigerated or cold storage rooms from the inside even though they are locked from the outside.		
78	Exposed refrigerant coils, blower or fin type evaporators and water coils, are easily accessible for cleaning.		
79	Exposed refrigerant coils, blower or fin type evaporators and water coils, are enclosed or shielded to protect them from food spillage.		
80	A thermometer is placed in warmest zone of each refrigerator and freezer. A display of the temperature can be read with ease from the inside and outside of the unit.		
81	Refrigerators for the storage of foods are capable of maintaining a temperature at or below 7 °C (45 °F) at all times.		
82	The temperature of the freezer is –20 °C (–9 °F) or lower.		

Accommodations Criteria – Food Service Areas			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
83	There is an alarm in each freezer and cold storage room to warn when the temperature is out of specification.		
84	Light switches for lights inside the cold rooms are mounted on the outside wall adjacent to the handle side of the door.		
85	There is a control panel outside each freezer and cold storage room.		
Dishwashing			
86	Easy access is provided to a 3-space utensil washing sink or a dish washing machine equipped with a dump sink and a pre-wash hose.		
87	Dish washing machine installation provides: <ul style="list-style-type: none"> ▪ wash water in the machine in the temperature range of 60 - 71 °C (140 - 160 °F) ▪ adequate water supply at 103.4 to 172.4 kPa (15 - 25 psi) of flow pressure on the final rinse line at the machine and not less than 69 kPa (10 psi) at the rinse nozzles ▪ adequate water-heating facilities to maintain a temperature of 82 °C (180 °F) in the final wash-water rinse line ▪ sufficient racks and clean utensil storage area to permit air drying (i.e., 15 seconds) before removal of utensils from racks following washing ▪ an easily readable thermometer for each tank and the final rinse-water line. 		
GALLEY DIMENSIONAL ASPECTS			
88	Clearances between adjacent equipment or between equipment and a bulkhead are: <ul style="list-style-type: none"> ▪ at least 150 mm (6 in) for equipment less than 610 mm (24 in) long ▪ at least 200 mm (8 in) for equipment between 610 mm (24 in) and 1220 mm (48 in) long ▪ at least 300 mm (12 in) for equipment between 1220 mm (48 in) and 1830 mm (72 in) long ▪ at least 460 mm (18 in) for equipment longer than 1830 mm (72 in). 		
89	Food preparation counters and cabinets are between 410 mm (16 in) and 610 mm (24 in) deep and approximately 915 mm (36 in) above the finished deck.		
90	Kick space 100 mm (4 in) high by 100 mm (4 in) deep is provided around cabinets, counters, etc.		
91	Storage cabinets installed above food preparation counters and dressers are: <ul style="list-style-type: none"> ▪ a minimum of 355 mm (14 in) above the counter ▪ a maximum of 300 mm (12 in) deep ▪ less than 1830 mm (72 in) above the deck ▪ less than 1420 mm (56 in) above the deck if direct vision of the contents is required. 		
92	Food dressing tables accessible from both sides are at least 1525 mm (60 in) wide.		

Accommodations Criteria – Food Service Areas			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
93	All work tables and equipment providing permanent work places are adjustable in height from 800 mm (31.5 in) to 1150 mm (45 in) above the floor level. The height adjustment shall be easy to perform.		
94	Tops of food dressing tables, counters and drain boards are constructed with 300 mm (12 in) high integral splash-backs.		
95	Uncovered water sources, such as water contained in sinks, are located at least 1220 mm (48 in) from deep fat fryers, griddles, ranges, or other equipment having external cooking surfaces.		
96	Steam jacketed kettles mounted on work surfaces are installed with the height of the rim of the kettle no more than 1170 mm (46 in) above the finished deck.		

Instructions: For a **HAB** Notation, the unshaded boxes under “Meets **HAB** Requirements” must be met. For an **HAB+** Notation, the unshaded boxes under “Meets **HAB+** Requirements” need to be met as well as **HAB** requirements.

Accommodations Criteria - Recreation			
Requirement		Meets HAB Requirements	Meets HAB+ Requirements
+ = ILO 92 Requirement * = ILO 133 Requirement			
GENERAL			
1 + *	Recreation accommodations, conveniently situated and appropriately furnished are provided for the crew. (Where this is not provided separately from the mess rooms the latter is planned, furnished and equipped to give recreational facilities.)		
2 +	Vessel has an open deck space or spaces to which the crew can have access when off duty. The space or spaces are of adequate area, having regard to the size of the ship and the crew.		
3	Non-slip type deck covering is supplied where occasional water or liquid on the floors is expected.		
4	Outside corners of recreation area bulkheads, doors, etc. have a radius of 0.75 mm (0.03 in) or more.		
5	All edges that crew members may strike are rounded to a radius of 0.75 mm (0.03 in) or more.		
6	Painted wall surfaces and deck heads are light in color.		
7 *	Headroom in recreational areas: ▪ is at least 1980 mm (78 in) ▪ is at least 2050 mm (80 in).		
8	The recreational area(s)' goal is to provide space for 1/3 of the crew to participate simultaneously in some form of leisure activity.		
EXERCISE AREAS			
9 *	Consideration has been given for a swimming or splash pool.		
10	If a swimming pool is a recirculating pool, it is to be capable of complete circulation, replacement and/or filtration of the pool water every six hours or less.		
11	If a swimming pool is a flow-through salt water pool: ▪ the water delivery pipe to the pool is separate from any other pipes ▪ the water delivery pipe originates at a point where maximum flushing of the pump and pipe line is effected after leaving polluted waters ▪ it is capable of complete circulation, replacement and/or filtration of the pool water every six hours or less.		
12	Exercise equipment is provided for crew members.		
13	Physical conditioning equipment is sufficient to provide crew members with 3, 30-minute exercise periods per week.		

Accommodations Criteria - Recreation			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
14	Physical conditioning equipment should permit aerobic, flexibility and strength training capabilities.		
15	The deck area provided for crew member exercise for each physical fitness station within the space: <ul style="list-style-type: none"> ▪ is at least 1.85 m² (20 ft²) ▪ is at least 4.5 m² (48 ft²). 		
RECREATIONAL AREAS			
16	In ships of 8,000 tons or over, the following shall be provided:		
*	▪ a smoking room or library room in which films or television may be shown		
*	▪ a hobby and game room.		
17	Facilities for recreation accommodations include as a minimum: <ul style="list-style-type: none"> ▪ a bookcase or bookrack ▪ facilities for reading, writing and games. ▪ tables, chairs, lamps. 		
18	A central stowage area for books is provided with at least 300 mm (12 in) of shelving for every five crew members.		
19	Shelves have battens and upward flanged edges on open sides to retain their contents.		
20	Consideration has been given for a recreational canteen.		
*			
21	Natural light shall be provided to the following (if applicable): <ul style="list-style-type: none"> ▪ recreation areas ▪ canteens ▪ coffee bars. 		
22	Recreation rooms in the crew accommodations spaces are adequately insulated to prevent condensation or overheating.		
+			
23	Ships regularly trading to or in the tropics and the Arabian Gulf, are equipped with awnings for use: <ul style="list-style-type: none"> ▪ over exposed decks above crew accommodations ▪ over recreation deck space or spaces. 		
+			
24	At least one seat and writing surface is provided in a recreation lounge for every six crew members.		
25	At least 1.39 m ² (15 ft ²) is provided for each seat in the lounge.		

Instructions: For a **HAB** Notation, the unshaded boxes under “Meets **HAB** Requirements” must be met. For an **HAB+** Notation, the unshaded boxes under “Meets **HAB+** Requirements” need to be met as well as **HAB** requirements.

Accommodations Criteria – Laundry			
Requirement		Meets HAB Requirements	Meets HAB+ Requirements
+ = ILO 92 Requirement * = ILO 133 Requirement			
GENERAL			
1 + *	Facilities exist for washing and drying clothes on a scale appropriate to the size of the crew and the normal duration of the voyage.		
2 *	Laundry facilities are located within easy access of crew accommodations.		
3	Laundry facilities are sufficient to ensure crew members: <ul style="list-style-type: none"> ▪ Provided clean and dry underwear once per day ▪ Provided clean and dry outerwear and bedding once per 5 days. 		
4	Appropriate clearance has been provided for equipment maintenance.		
5	Coamings are provided around washing machines, water heaters, etc. to contain spills.		
6	Coamings around the washing machine, water heaters, etc. is close enough to the machine to not be a tripping hazard for persons working around the machine.		
7	Air vents from laundry space are not re-circulated in the vessel.		
8	Washers and dryers (if provided) are placed relative to each other to facilitate the transfer of clothing from the washer to the dryer.		
9	Washer and dryer capacities are matched to assure a smooth workflow.		
10	A laundry is provided for the exclusive use of the Licensed Officers of the ship and it is located on the same deck as the Officers’ quarters.		
OUTFITTING			
11	Deck drains are provided in the laundry.		
12	Ironing boards are covered with a fireproof cloth cover.		
13	Means are provided for stowing the iron and ironing board.		
14	Tumble dryers, if provided, are exhausted directly into the weather, not into the vessel.		
15	Tumble dryers, if provided, are equipped with lint filters in the ventilation extract line and have hinged access panels designed for safe and effective daily cleaning.		
16	A kick space of 100 mm (4 in) high by 100 mm (4 in) deep is provided at the base of laundry folding and sorting tables.		

Accommodations Criteria – Laundry			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
17	The laundry facilities include:		
	▪ washing machines		
*	▪ drying machines (or adequately heated and ventilated drying rooms)		
*	▪ irons and ironing boards (or their equivalent)		
+	▪ suitable sinks with an adequate supply of cold potable water and hot potable water or means of heating water		
+	▪ sinks are installed in wash rooms, if separate laundry accommodations is not reasonably practical.		
18	The facilities for drying clothes are:		
+	▪ equipped with lines or other fittings for hanging clothes		
+	▪ separate from sleeping rooms and mess rooms		
+	▪ ventilated and heated		
	▪ equipped with an electric clothes dryer for every 10 crew members.		
19	A water system, supplying potable water for the laundering purposes, is installed.		
20	Laundry facilities have standing work surfaces approximately 915 mm (36 in) high for sorting and folding laundry.		
DIMENSIONAL ASPECTS			
21	All edges that crew members may strike are rounded to a radius of 0.75 mm (0.03 in) or more.		
22	Outside corners of laundry space bulkheads, doors, etc. have a radius of 0.75 mm (0.03 in) or more.		

Appendix 3 Accommodations Criteria

Instructions: For a **HAB** Notation, the unshaded boxes under “Meets **HAB** Requirements” must be met. For an **HAB+** Notation, the unshaded boxes under “Meets **HAB+** Requirements” need to be met as well as **HAB** requirements.

Accommodations Criteria – Medical			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
GENERAL			
1 +	Separate medical accommodations are provided in ships of 500 or more gross tonnage, carrying 15 or more seafarers and engaged in a voyage of more than three days’ duration.		
2	The medical accommodations are fitted with berths in the ratio of 1 berth to every 12 crew members or portion thereof who are not berthed in single occupancy rooms. The number of berths need not exceed 6.		
3	If double tier beds are provided, the upper tier shall be either hinged or removable.		
4	Interior finish materials and furnishings are designed to ease cleaning efforts and improve medical accommodations maintenance.		
5	The medical accommodations are always ready to receive sick or injured patients.		
6	The medical accommodations are not used as a storage area except for medical supplies.		
7	The medical accommodations are suitably located to allow for safe and efficient: <ul style="list-style-type: none"> ▪ access for sick or injured crew members ▪ stretcher transportation from accommodations or work areas. 		
8 +	The medical accommodations are suitably separated from other spaces and is used for the care of the sick and for no other purpose.		
9 +	The medical accommodations are suitably designed so that the occupants may be comfortably housed and may receive proper attention in all weathers.		
10	Painted wall surfaces and deck heads are light in color.		
11	Non-slip type deck coverings are supplied where occasional water or liquid on the floors is expected.		
12	If the vessel does not carry a doctor, it must have a person with suitable medical certification capable of rendering medical attention.		
13 +	The arrangement of the entrance, berths, lighting, ventilation, heating and water supply is designed to ensure the comfort and to facilitate the treatment of crew members.		
OUTFITTING			
14	The medical accommodations are equipped with a means of sterilizing instruments.		
15	The medical accommodations have the necessary suitable equipment such as a clothes locker, a table and a seat based on the number of possible patients.		
16 +	If the vessel does not carry a doctor, it must have an approved medicine chest with readily understandable instructions.		

Accommodations Criteria – Medical			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
17+	The medical accommodations have a toilet, washbasin and bathtub or shower conveniently situated for the use of patients.		
18	The door to the toilet and washbasin shall open outwards and any door latch shall be capable of being opened from the outside.		
19	The medical accommodations are equipped with a first aid kit, which is immediately available for each medically trained person.		
20	The medical accommodations are equipped with a bedside table with a drawer and cabinet for each berth.		
21	On vessels in which the crew is berthed in single occupancy rooms:		
	▪ one room is designated and fitted for use as a treatment or isolation room		
	▪ the room is available for immediate medical use		
	▪ a washbasin with hot and cold potable running water is installed either in, or immediately adjacent to, the space and		
	▪ other required sanitary facilities are conveniently located.		
22	The medical accommodations are equipped with stretchers that meet the following:		
	▪ the ability to winch a sick or injured person into a helicopter or vessel. Such a stretcher shall have the capability of floating and righting itself in the water		
	▪ collapsible and suitable for use in confined spaces.		
23+	Toilet accommodations are provided for the exclusive use of the occupants of the hospital accommodations.		
24	Medical accommodations sanitary facilities have a call system for emergency use by patients.		
25	A separate water system supplying potable water to the medical accommodations is installed when practical.		
26	The medical accommodations are equipped with a bed or couch approachable from at least three sides.		
27	Hospital and medical/first aid accommodations are situated and arranged so that a stretcher can be easily carried into it and placed alongside an examination table or bed.		
28	The medical accommodations are equipped with a bookrack with battens and upward flanged edges for patients.		
29	The medical accommodations have lockable storage for drugs, dressings and medical equipment.		
30	The medical accommodations have a bath accessible from three sides.		
31	The medical accommodations have an intercom or signaling system (e.g., an emergency call device) to the navigation bridge.		
32	The medical accommodations have morgue facilities.		

Accommodations Criteria – Medical			
	Requirement + = ILO 92 Requirement * = ILO 133 Requirement	Meets HAB Requirements	Meets HAB+ Requirements
33	Shelves and bookracks have battens and upward flanged edges on open sides to retain their contents.		
34	Drawers and doors have latches: <ul style="list-style-type: none"> ▪ to prevent opening and closing due to ship motion ▪ that are operable with one hand ▪ that are designed so that it is obvious when the drawer or door is not fastened/locked. 		
35	Radiators and other heating apparatus, which may cause a risk of fire, danger, or discomfort to the crewmembers, are shielded.		
36	If the medical/first aid accommodations have windows in the ward, then curtains or blinds are provided.		
DIMENSIONAL ASPECTS			
37	Headroom in the medical accommodations: <ul style="list-style-type: none"> ▪ is at least 1980 mm (78 in) ▪ is at least 2050 mm (80 in). 		
38	Outside corners of medical accommodations bulkheads, doors, etc. have a radius of 0.75 mm (0.03 in) or more.		
39	All edges (e.g., furniture) that crew members may strike are rounded to a radius of 0.75 mm (0.03 in) or more.		

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APPENDIX 4 Acronyms and Abbreviations

°C	Degrees Celsius
°F	Degrees Fahrenheit
ABS	American Bureau of Shipping
Amd	Amendment
ANSI	American National Standards Institute
API	American Petroleum Institute
ASNT	American Society of Non-destructive Testing
ASTM	American Society of Testing and Materials
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
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
BS	British Standard
cd/m ²	Candela-per-square meter
CIBS	Chartered Institution of Building Services
CIH	Certified Industrial Hygienist
dB(A)	Decibels measured using the A-weighted scale
DEF STAN	Defense Standard
DOD HDBK	Department of Defense Handbook
ed.	Edition
ft/s	Feet-per-second
fc	Foot-candle
ft	Feet
ft ²	Square feet
HAB	Habitability notation
HAB+	Habitability Plus notation
HFS	Human Factors Society
HVAC	Heating, Ventilation and Air Conditioning
Hz	Hertz
IEC	International Electrotechnical Commission
IESNA	Illuminating Engineering Society of North America
ILO	International Labor Organization
IMO	International Maritime Organization
in	Inch
ISO	International Organization for Standardization
kPa	Kilopascals

Appendix 4 Acronyms and Abbreviations

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-square second
Max	Maximum
MCR	Maximum Continuous Rating
MIL STD	Military Standard
Min	Minimum
mm	Millimeter
NASA STD	National Aeronautics and Space Administration Standard
NDT	Non-Destructive Testing
NEBB	National Environmental Balancing Bureau
NORSOK	Norwegian Engineering Industries
psi	Pounds-per-square inch
RH	Relative humidity
rms	Root-mean square
RP	Recommended Practice
rpm	Revolutions-per-minute
SI	International System of Units
SOLAS	Safety Of Life At Sea
TAB	Testing, Adjusting and Balancing
TX	Texas
USA	United States of America
W_b	Frequency weighting used to evaluate z-axis vibration when standing with respect to comfort.
W_d	Frequency weighting used to evaluate x-axis and y-axis vibration when standing 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	ANSI 1819 L Street, NW, 6th Fl. Washington, DC, 20036 USA www.ansi.org +1 202-293-8020
British Standard	BSI 389 Chiswick High Road London, W4 4AL United Kingdom www.bsi-global.com +44 (0) 20 8996 9001
IEC	IEC 549 West Randolph Street, Suite 600 Chicago, IL 60661-2208 USA www.iec.org +1 312-559-4100
IESNA	IESNA 120 Wall Street Floor 17 New York, NY, 10005 USA www.iesna.org +1 212-248-5000
ILO	ILO Branch Office in Washington, D.C. 1828 L Street N.W., Suite 600 Washington, DC 20036 USA www.ILO.org +1 202-6553-7652

Appendix 5 Associated Documentation

IMO	IMO 4 Albert Embankment London SE1 7SR United Kingdom www.imo.org +44 (0) 20 7735 7611
ISO	ISO 1, rue de Varembé, Case postale 56 CH-1211 Geneva 20, Switzerland www.iso.org + 41 22 749 01 11
NEBB	NEBB 8575 Grovemont Circle Gaithersburg, MD 20877 USA www.NEBB.org +1 301-977-3698