STANDARD FOR CERTIFICATION
No. 1USFV

Domestic Fishing Vessels – U.S. Waters

DRAFT Interim Rules v5.0

November 2011

DET NORSKE VERITAS

FORWARD

DET NORSKE VERITAS (DNV) is an autonomous and independent foundation with the objectives of safeguarding life, property and the environment, at sea and onshore. DNV undertakes classification, certification, and other verification and consultancy services relating to quality of ships, offshore units and installations, and onshore industries worldwide, and carries out research in relation to these functions.

Standards for Certification
Standards for Certification (previously Certification Notes) are publications that contain principles, acceptance criteria and practical information related to the Society's consideration of objects, personnel, organizations, services and operations. Standards for Certification also apply as the basis for the issue of certificates and/or declarations that may not necessarily be related to classification.
A list of Standards for Certification is found in the latest edition of Pt.0 Ch.1 of the "Rules for Classification of Ships" and the "Rules for Classification of High Speed, Light Craft and Naval Surface Craft".

The list of Standards for Certification is also included in the current "Classification Services – Publications" issued by the Society, which is available on request. All publications may be ordered from the Society's Web site http://webshop.dnv.com/global/.
The Society reserves the exclusive right to interpret, decide equivalence or make exemptions to this Standard for Certification.

Amendments and Corrections
This document is valid until superseded by a new revision or withdrawn. Minor amendments and corrections will be published in a separate document normally updated twice per year (April and October).
For a complete listing of the changes, see the "Amendments and Corrections" document located at: http://webshop.dnv.com/global/, under category "Standards for Certification".
The electronic web-versions of the DNV Standards for Certification will be regularly updated to include these amendments and corrections.

MAIN CHANGES

Review by Hiscock– 5/26
Need to Add:

Public Comments

Date	Reviewer	Content
07/11-07/22/2011	RCH	Review / revise / highlight internal references / correct spelling. Begin draft of Appendix. Tasks ahead Paragraph numbering Is it going to be 001 or 101? Measure Put English measure in ( ) after metric Formulas Convert metric formulas to English and include both (side-by-side if possible? Internal references to other section need to be checked to make sure they refer to the correct paragraph (section) Appendix for Pollution Prevention requirements Medical kits
07/25 – 08/0127 Jul 2011	RCH/DBS	Review document for additions of English units, degree symbol °, spelling changes, and Guidance Note formatting. Piping Systems and Tanks: Fuel Systems – Deleted references to FRP and PE tanks. Added reference from “46 CFR 182.455 Fuel piping “ to expand explanation of fuel shut-off valves.
7/27/2011	Randy W	Reviewed Section 5 – Electrical Systems Revised Lighting requirements under 240 VAC power systems spec. Added Instructions 003 / 004 / 005 / 006 to Switchgear and Control Gear Specs – and removed previous comment 003 concerning Shore Connections.
8/6/2011	RCH	1) Chapter II, Section 1 (a) ‘bulkheads’- add after ‘3’ the word ‘transverse’ So it will read “Vessels with length L exceeding 15 meters (49 feet) shall be arranged with at least 3 transvers watertight bulkheads,” 2) Chapter V, Section 4, Bilge System, Alarm should read “Engine, fish hold, cargo spaces and all other compartments (with the exception of tanks) shall be fitted with bilge alarm.”
09/21/2011	RCH	Strip out all reference to materials other than steel and include comments from West Coat F/V meetings, especially addition of wording “industry accepted standard” in lieu of dedicated CMC requirement. Also stripped operational requirements and deferred to USCG CFR 46 Sections 28 and other.
10/3/2011	DBS	Edit and reformat
11/4/2011	DBS/PMCI	Edit application, machinery and systems and include required drawings and documentation based on comments from F/V mtg Bayou La Batre
11/8/2011	PSZA/DBS	Revised Section IV Structural to better reflect design of size of F/V 50 to 145 feet with final comments and edits
11/11/2011	RCH/DBS	Review and make corrections and release v5.0 for internal comment

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Chapter I

Section 1 – General

A. Introduction

001 The statistics published by the U.S. Bureau of Labor Statistics, Department of Labor 2010, indicate that the fishing industry leads the workplace in fatal injuries per 100,000 workers. Through the years Congress has passed laws and the U.S. Coast Guard has established various programs to promote fishing vessel safety. Public Law 111-281, enacted October 15, 2010, requires vessels over 50 feet to be classed by an internationally recognized Classification Society. This Standard is developed by the DNV and is based on previous Society Rules for Certification, and the U.S. Federal requirements for commercial fishing industry vessels.

002 By definition, Classification is a service which comprises the development of independent technical standards for vessels, the rules, and to verify compliance with the rules throughout the vessels' life. Classification is a system for safeguarding life and property at sea, and the environment due to operational consequences. It implies a process of verifying ship standards against a set of requirements. The requirements are laid down in the rules established by the Society. Classification comprises those services rendered by the Society in accordance with the rules. Classification of Fishing Vessels is conducted in accordance with the requirements of the rules and any other standards to which reference therein may be made.

003 Classification also implies a service, in which the vessel is surveyed during construction on the basis of design approval, tested before being taken into service, and surveyed regularly during its whole operational life until it is scrapped. The aim is to verify that the required rule standard is built in, observed and maintained.

004 Certification is also a Classification Society service and is not to be confused with Classification. Certification is by definition a service confirming compliance with applicable requirements on the date that the survey was completed. Certification is an activity focusing on acceptance criteria that could be met by machinery (objects), personnel, organizations, services and operations, and in fact may not be related to Class. Unlike Classification, Certification does not employ an ongoing maintenance program designed to retain or maintain a prescribed standard. Certification is employed in these Class Rules during the new-build phase of construction as a means to ensure that elements of design, manufacturing, and fabrication meet minimum technical standards for fishing vessels constructed to these Rules.

005 Classification is not performed as a substitute for the client's own quality and safety control and related duties, or the client's obligations to third parties, nor to relieve the client of any consequences of default. Classification implies that rule requirements are verified at regular intervals. It is the owner's responsibility to maintain the ship so as to comply with the rules at all times.

006 The Society keeps complete files on all classed ships covering the documentation required by the rules. Reports will not be disclosed to any party, apart from the national authorities involved, without the owner’s consent. The Society also undertakes all reporting to national authorities required in connection with the safety certificates.

007 The Society is recognized as an international classification society by virtue of its position in the marine industry, founded on the following criteria:

- Independence - By classing a substantial share of the world fleet and through high equity and financial independence, the economic basis for independent decisions in classification matters is ensured.
- High technical competence - Extensive research and development in class related fields sustains a process where the rules are continuously extended and improved in pace with new technology and experience gained. Research and development also contributes to a high level of staff competence.
- Continuous Monitoring - Continuous monitoring of a large classed fleet ensures valuable feedback from casualties, damage incidents and operational experience in general. Analyses of these data is one important source of improvements of the rules.

008 The Society runs a program for training and qualification of its technical personnel to ensure correct, uniform quality of approval and survey work throughout the organization.

009 World-wide survey station network - The Society operates survey stations in ports all over North America. Efficient reporting and information systems support the operations, and provide service to clients and national authorities

B. Application to Vessels

001 The technical and safety standards prescribed are considered adequate for commercial fishing vessels with overall lengths in the approximate range 15.24m (50 ft.) to 45 m (148 ft.). Fishing vessels with lengths less than indicated may be certified upon special consideration. Fishing vessels with lengths exceeding those indicated shall be certified using DNV's Rules for Classification of Ships, with reference to Part 5 Chapter 6.

002 Referencing paragraph B.001 above, these Rules will apply to commercial fishing vessels constructed of steel. For commercial fishing vessels constructed of aluminum, FRP, and wood please refer to DNV's *Standards for Certification 2.21 – Craft*. The "Craft Rules" contain the structural references pursuant to these materials.

003 Where applicable, Notations for service areas will be defined. The design principles and design loads for commercial vessels are included in this document to ensure that these class rules can accommodate a wide range of commercial fishing applications.

C. Objectives

001 This classification document aims to meet the requirements of the law, and provide an appropriate safety level for commercial fishing vessels and commercial vessels of various types, their intended application and design limitations. The purpose of this Standard is to provide a certification service for new built vessels employed in the commercial fishing vessel industry. The Rules lay down technical and procedural requirements related to obtaining and retaining a Class Certificate. It is used as a contractual document and includes both requirements and acceptance criteria. Certification according to this Standard does not ensure compliance with any mandatory national or international regulations

D. Scope

001 This document also describes the definition of Classification services for new-build fishing vessels summarized below.

- **New building plan approval** - The builder initiates the process by submitting a request for classification to the Society. In response to a list of documentation issued by the Society for the specific class notations requested, the builder and sub-suppliers submit plans, specifications, related technical descriptions and data, including specification of materials as required by the rules, for approval. After examining the above documents, the Society informs the builder and sub-supplier whether the design and arrangement of structure, machinery and equipment is acceptable. If not, the Society may propose modifications needed to meet the classification requirements.

- **Periodic yard Inspection** - During the building period the Society will carry out surveys at the building yard and its suppliers. The method and extent of survey will be decided by the Society based on the acceptance of their quality system. The purpose of the surveys is to verify that the construction, components and equipment satisfy the rule requirements and are in accordance with the approved plans, that required materials are used, and that functional tests are carried out as prescribed by the rules.

- **Testing** – Functional Tests of major equipment, key systems, or items of particular importance for safe operation, may require tests witnessed by the surveyor. Newly launched commercial fishing vessels will require a surveyor aboard to document functionality of all systems during sea trials.

- **Maintenance of Class** - Compliance with the rule requirements in the operational phase is verified by the Society through a system of periodical surveys. The most comprehensive survey is the one carried out in connection with the renewal of the five-yearly classification certificate. During the five year period the ship undergoes annual and intermediate surveys covering various parts, equipment and systems, depending on the class assigned.

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001 For fishing vessels with more than 12 persons aboard, scope of class may upon special consideration be subject to additional requirements.

002 This document can also be used as a reference for bringing existing commercial fishing vessels into class. However, it is anticipated that the upgrading of existing vessels to meet the standards in these current rules for new-build commercial fishing vessels could be quite costly. For this reason the Society is working with the USCG to develop an Alternative Compliance Program (ACP) to satisfy USCG requirements for existing commercial fishing vessels operating after the year 2020. ACP documentation is not included in this document.

003 The relation between the Customer and DNV is regulated in an Agreement signed by both parties. The agreement specifies the scope of the certification service, the fee, terms of payment and legal obligations.

E. Class Assumptions and Obligations

001 This certification service is performed on the basic assumption that all parties involved (designer, builder/yard, manufacturer, design-owner, sub-contractor, owner, etc.) fulfill their individual obligations. The certification service is not performed in substitution of other parties' role or obligations. Nothing contained in DNV services, certificate, report or document issued in connection with or pursuant to these requirements, shall relieve any designer, engineer, builder, manufacturer, yard, seller, owner, operator or other parties from any obligations or consequences of default whatsoever. In particular, compliance with the requirements does not imply acceptance or commissioning of a vessel. This is the exclusive responsibility of the owner. As previously stated, it is the Owner's responsibility to maintain the vessel to Class Rules.

F. Service Area and Other Notations

001 Generally speaking, the fishing vessels designed and built to these class rules will be capable of operating in North Atlantic, ice free regions, These rules include notations for FISHING and TRAWLING and other as required by service. Should design calculations indicate that a vessel cannot operate in waters of this severity, service area notations will be used to define the vessel's operating limits. The notations reference and are defined by the USCG regional designations below, and will be equated with DNV's service area notations as defined.

002 The notation **R** followed by a number or a letter will be given to F/Vs with certain modifications to arrangement, equipment, or scantlings in relation to boats normally built for winter weather conditions in the North Atlantic. Service area restrictions are given in nautical miles and represent the maximum distance from nearest harbor or safe anchorage as referenced in DNV's Rules for Classification of Ships Part 1, Ch.1 Sec. 2 B excerpted below:

Table B1 Service area restrictions

Service area notations	*Seasonal zones*		
	Winter	*Summer*	*Tropical*
R0	250	No restrictions	No restrictions
R1	100	200	300
R2	50	100	200
R3	20	50	100
R4	5	10	20
RE	Enclosed waters		

003 USCG service area restrictions (see Section 2 of this Chapter "References") generally equate to DNV's service areas as follow and the USCG's more detailed definition will be referenced in the notations below:

- Open Waters - No service restriction "**R0**"
- Partially Protected Waters – Service restrictions "**R3**"
- Protected Waters – Service restriction "**RE**"

004 For fishing vessels built to operate in ice, DNV's typical ice class notations will be used.

005 Notations may also be used to indicate vessels built to specifications exceeding these F/V Class Rules

G. Document Structure

001 *DNV's Rules for Ships, also Part 5 Chapter 6 Fishing Vessels, and Certification of Craft 2.*21 in addition to references to pursuant sections of the U.S. Code of Federal Regulations, are combined in this document to offer a comprehensive resource for classing U.S. domestic fishing vessels.

Section 2 - References

001 References

a. *DNV's Rules for Ships*, January 2011 http://exchange.dnv.com/publishing/RulesShip/2011-07/ToC.asp
b. The Society's Standards for Certification, Series No. 2 Approval Schemes, No 2.21 "Craft," Dated April 2010
c. The Society's *Rules for Ships*, dated July 2011, Part 5 Chapter 6 "Fishing Vessels"

d. The *Commercial Fishing Vessel Safety Digest*, published by the Alaska Marine Safety Education Association at http://www.amsea.org/downloads.html
e. 46 CFR Chapter 1 (10-1-10 edition) part 175.120 to 175.540
f. 46 CFR Part 28 Applicable to Fishing Vessel Safety
g. NVICs, 7-91 and 1-92 including changes 1 & 2.
h. NVICs 1-87 and 1-92
i. Others as mentioned in the text of this Certification Standard which can be found on DNV's website http://www.dnv.com/resources/rules_standards/

002 General Terminology, Definitions, and Abbreviations

Symbol	Unit	Description
L	M(f)	Length of hull but excluding rub-rails, outside rudders, outdrives, outboard motors, diving platforms, bowsprits, fittings.
Loa	M9(f)	Length overall in meters (feet) For these rules "length" means the horizontal distance of the hull between the foremost part of the stem and the aftermost part of the stern excluding fittings and attachments.
LWL	M(f)	Length of hull along waterline measured at the foremost intersection of the stem with the flotation plane and the aftermost intersection of the hull and the flotation plane.
B	M(f)	Maximum beam of hull measured on the outside of the hull shell.
BWL	M(f)	Beam of hull in the waterline. For catamarans: sum of waterline beam for both hulls.
S	M(f)	Stiffener spacing - In fore and aft body, the spacing is to be measures along the plating
Ss	M(f)	stiffener spacing
T	M(f0	Maximum draught of hull in fully loaded condition.
D	M(f)	Depth, measured as the vertical distance between the sheerline at the half-length of the waterline and the lowest point of the keel.
Δ	Kg(lb)	Displacement in fully loaded condition.
l	M9f)	stiffener span
V	knots	Maximum speed.
β	°	Deadrise angle is the angle of the bottom from the horizontal measured athwartship at a specific
LCG	M(f)	Longitudinal position of the center of gravity from a chosen datum.
VCG	M(f)	Vertical position of the center of gravity from a chosen datum.
RM	Nm	Righting moment.
GM	M(f)	Transverse metacentric height.
GZ	M(f)	Righting lever = righting moment (Nm)/(mass (kg) x 9,806).
Decked vessel		Vessel with deck that can be closed weather tight from stem to stern uninterrupted by other than a strong superstructure or a cockpit so designed that shipping sea will not fill spaces below deck.
Open vessel		Vessel that is not a decked vessel.
Flooded vessel		A flooded vessel is a vessel in a condition in which it can not be filled with more water.
Superstructure		Decked structure on the freeboard deck, extending from side to side of the ship or with the side plating not inboard of the shell plating more than 4% of the breadth (B).
Deckhouse		Decked structure above the strength deck with the side plating being inboard of the shell plating more than 4% of the breadth (B).
Long deckhouse		Deckhouse having more than 0,2 L of its length within 0,4 L amidships.
Short deckhouse		Deckhouse not defined as a long deckhouse.
Mean freeboard	Mm(in)	F = (ff + fm +fa)/3
ff	Mm(in)	Freeboard measured at extreme forward end.
fa	Mm(in)	Smallest freeboard measured at extreme aft end or, for vessel with engine wells to the point where water first may enter the vessel.
fm	Mm(in)	Freeboard measured at LH/2.
Headroom	M(f)	Vertical distance between top of compartment floor and underside of the deck beam or deck head (whichever is the lower).
Readily accessible		Capable of being reached for operation, inspection or maintenance without the use of tools or the removal of any vessel structure or any item of portable equipment.
Accessible		Capable of being reached for operation, inspection or maintenance without the removal any permanent vessel structure.
M	kNm	Maximum longitudinal bending moment.
Z	mm3(in3)	Section modulus of hull girder.

Manufacturer		The entity putting the product on the market.
OCMI		U.S. Coast Guard term referring to the Officer in charge of Marine Inspection
Protected Waters		A term used in connection with stability criteria and means sheltered waters presenting no special hazards such as most rivers, harbors, and lakes, and that is not determined to be exposed waters or partially protected waters by the cognizant OCMI.
Partially Protected Waters		A term used in connection with stability criteria and means: (1) Waters not more than 20 nautical miles from the mouth of a harbor of safe refuge, unless determined by the cognizant OCMI to be exposed waters; (2) Those portions of rivers, estuaries, harbors, lakes, and similar waters that the cognizant OCMI deter-mines not to be protected waters; and (3) Waters of the Great Lakes from April 16 through September 30 of the same year (summer season).
Exposed waters		A term used in connection with stability criteria and means: (1) Waters, except the Great Lakes, more than 20 nautical miles from a harbor of safe refuge; (2) Those portions of the Great Lakes more than 20 nautical miles from a harbor of safe refuge from October 1 of one year through April 15 of the next year (winter season); and (3) Those waters less than 20 nautical miles from a harbor of safe refuge that the cognizant Officer in Charge, Marine Inspection, determines are not partially protected waters or protected waters because they present special hazards due to weather or other circumstances.
Verbal Forms		Shall – indicates a mandatory requirement that is to be followed for fulfillment with the present standard Deviations are not permitted unless formally and rigorously justified and accepted by all relevant contracting parties. Should – indicates a recommendation that a certain course of action is preferred. Alternative courses of action are allowable under the standard where agreed between contracting parties but shall be justified and documented. May – indicates a permission or an option which is permitted as part of conformance with the standard
Industry accepted standard		Generally accepted requirements followed by the members of an industry.

Note: Technical or other Chapter Specific definitions will appear in the Section to which they are related

Section 3 - General Requirements for Classification

A. Certification Procedures

001 Application for certification shall be sent to the local DNV office and include:

- name and address of the applicant
- name and address of the owner of the design.
- name and address of the builder (yard, manufacturer) vessel specification and type designation
- chosen procedure(s)
- technical documentation

002 The Applicant has to be authorized by the Owner of the design to act on his behalf.
003 If the Applicant subcontracts design or production, the applicant remains responsible for the execution of conformity assessment for all technical documentation, sub-supplies and the finished vessel.
004 Any Subcontracting will be subject for separate agreement, handling and approval.
005 The Society decides the extent of examinations, tests and inspections required to complete the relevant procedure in each case.

B. Technical documentation

001 The Applicant shall submit Technical Documentation for approval irrespective of certification procedure.
002 Technical Documentation shall enable understanding of the design and construction of the vessel, and shall confirm compliance with the requirements given in this Standard.
003 Documentation of Quality Assurance System shall be according to the format and content distributed to the boat yard and boat owner at time of contract

004 The detailed technical documentation including a list of drawings and other items required under this certification can be found under each relevant chapter heading.

C. Certificates

001 The type of certificates to be issued by DNV will be:

- Product Certificate. "Certificate" being defined as a document confirming compliance with the Society's rules or with other rules and regulations for which the Society has been authorized to act.
- Type Approval Certificate
- Quality System Production Certificate

002 The certificates shall contain the following information as applicable:

- the name and address of the Builder (yard, manufacturer)
- the identification of the product- vessel type designation and reference to Owner of the design
- reference to the Standard and regulations applied
- notations
- specification of exemptions or equivalent standards
- any restrictions/limitations in the use of the vessel
- validity
- date of issue and signatures.

Section 4 - Certification of One-off and a Series of Vessels

A. One-off vessel

001 General
002 The following procedure is applicable for One-off certification, i.e. a design on which only one vessel is built.

B. Procedure

001 DNV will verify that the Technical Documentation complies with the requirements.
002 DNV will carry out surveys during production, examine the complete vessel and carry out the appropriate tests as set out in the relevant requirements to ensure its conformity.
003 Upon successful completion of the certification procedure DNV will issue a Product Certificate.

C. Series of vessel

001 General
002 The procedures described in B, C and D are applicable to one design on which a series of vessel is manufactured. B covers the design phase and shall always be followed by a procedure covering the production phase (C or D)

D. Type Approval

001 The procedure shall normally be used for approval of a design produced in series and must be followed by a procedure covering the production phase.
002 The procedure shall be according to: DNV Standard for Certification - No.1.2 Type Approval.

Guidance note: Overall principles for Type Approval (TA):

- Application for TA
- Quotation
- Approval of the design
- Initial survey
- Type testing
- Issuance of TA certificate

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003 DNV verifies that the Technical Documentation complies with the requirements.
004 DNV verifies, by performing examinations and tests that one prototype complies with the applicable requirements and is built in accordance with the Technical Documentation.
005 Upon successful completion with the certification procedure, DNV will issue a Type Approval Certificate with validity of 4 years.

E. Product verification for the Parts and Machinery

001 This process covers the production phase and follows Procedure for Type Approval.
002 The builder shall take necessary actions to ensure that the manufacturing process ensures conformity of the products with the types as described in the approved Technical Documentation.
003 If required, DNV will carry out the appropriate examinations and tests in order to check the conformity of the product with the approved technical documentation, either by examination and testing of every product or alternatively by examination and testing of products on a statistical basis
004 Normally all products will be individually examined and appropriate tests carried out in order to verify their conformity with the type as described in the Type Approval Certificate and the approved Technical Documentation. However, DNV may determine that "Industry Accepted Standard" may apply to certain components and systems typically and successfully used in fishing vessels.
005 If statistical verification is agreed, the method shall be according to ISO 2859-1 or equivalent. Referencing ISO 2859-1:

- Each relevant section shall be considered as an inspection item.
- Sample size shall be based on Table 1, General Inspection Level "I"
- Sampling plan shall be according to Table 2-A
- Acceptance Quality Limit (AQL) shall be 1,0

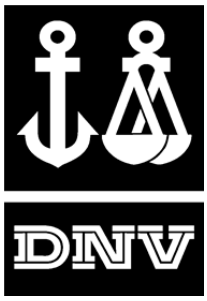
006 If a lot is found not acceptable, all items shall be re-examined until DNV is satisfied that all nonconforming items have been rectified/replaced. DNV will determine whether the re-examination shall include all inspection items, or only the particular types of nonconformities which caused initial non-acceptance.
007 Upon successful completion of the certification procedure, DNV will issue a Product Certificate.

F. Production verification for the Quality Assurance System

001 The procedure covers the production phase and follows procedure for Type Approval
002 The builder shall operate an approved Quality Assurance System (QA-system) for manufacturing, final product inspection and testing. The QA-system shall be subject to monitoring as specified below.
003 The procedure may cover several designs with valid Type Approval Certificate.
001 The builder shall submit the documentation concerning the QA-system. The QA-system shall ensure compliance of the products with the type(s) as described in the Type Approval Certificate(s) and the approved Technical Documentation.
002 All the elements, requirements and provisions adopted by the manufacturer shall be documented in a systematic and orderly manner in the form of written policies, procedures and instructions.
003 The QA-system documentation must permit a consistent interpretation of the quality programs, plan, manuals and records.
004 The QA-system shall contain in particular an adequate description of:

- the quality objectives and the organizational structure, responsibilities and powers of the management with regard to product quality
- the manufacturing, quality control and quality assurance techniques, processes and systematic actions that will be used
- the examinations and tests that will be carried out before, during and after manufacture, and the frequency with which they will be carried out
- the quality records, such as inspection reports and test da ta, calibration data, qualification reports of personnel concerned, etc.
- the means to monitor the achievements of required product quality and the effective operation of the quality system.

005 Upon successful approval of the QA-system DNV will issue a Quality System Production Certificate valid for 4 years.
006 DNV will carry out audits to make sure that the builder maintains and applies the quality system. The audit will include spot checks on vessel under building and review of quality records of built vessel.
007 Additionally DNV may pay unexpected visits.



STANDARD FOR CERTIFICATION
No. 1USFV
Interim Rules v5.0

Chapter II – Arrangement and Stability

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Section 1 Arrangement

A. Documentation

(a) Documentation Required - Drawings

001 General Arrangement
- a. Engine and machinery
- b. Tanks and pressure vessels
- c. Sea chests

002 Steering, shafting and propeller
003 Body/lines plan
004 Freeboard/weathertight integrity plan
005 Vents, sounds and overflows
006 Deck machinery, anchor, and winches
007 Arrangement of fishing gear and rigging
008 Lifesaving Appliances
009 Escape routes
010 Navigation lamps

(b) Documentation Required – Specifications

001 All relative manufacturers data
- a. Specifications
- b. Certifications
- c. USCG approvals
- d. Type Approvals
- e. Any other industry accepted standard documentations

B. General

(a) Bulkheads

001 Vessel with length L exceeding 15 meters (49.2 feet) should be arranged with at least four transverse watertight bulkheads, of which one shall be a collision bulkhead with minimum distance 0.05L from forward perpendicular (exceptions for locations of collision bulkhead can be made after a design review by Class). The number of bulkheads may be reduced to three if the engine room is located aft.
002 Watertight bulkheads shall be carried up to freeboard (bulkhead) deck, or may end at first deck above waterline based on special consideration of watertight division and integrity of the hull.
003 Engine compartment and cargo hold are to be separated from each other and from rest of the hull by watertight bulk heads. Minor steps or recesses in the bulkhead may be accepted.
004 Doors and hatches in watertight bulkhead may be accepted.
005 Small openings for penetrating pipes and electrical cables shall be sealed and arranged in top of bulkheads

(b) Accommodation

001 General
002 Accommodation areas shall be without sharp corners and protruding parts and shall not be made of material which may break into dangerous fragments. It shall not contain unshielded, high temperature areas, high pressure or rotating items, and shall not contain operating controls located in a way to be impeded by persons during normal and emergency conditions.

(c) Seats

001 A seat shall be arranged for every person onboard.
002 A seat shall have the following minimum size:

- beam 500 mm (19.68 in)
- depth 750 mm (29.52 in) , free space for legs measured from persons back
- height 900 mm(35.43 in) , from seat to free height for head.

003 Sharp edges, arm rest etc. which may cause injury are not accepted.
004 The strength of a seat shall be in accordance with the relevant horizontal longitudinal acceleration of the vessel. In general a minimum static load of 1125 N may be used as basic for the scantling. The point of application of the horizontal longitudinal load shall be at the top of the backrest. Seats shall be designed for a vertical load equal to 2 250 N. The point of application of the vertical load shall be at the center of the seat.

(d) Ventilation

001 Accommodation spaces shall have separate inlet and exhaust of air, with documented capacity of ventilation for comfort of persons with closed windows and doors.
002 Heating, cooking and similar installations shall have separate ventilation.
003 Inlets and outlets of ventilation shall be well separated from engine exhausts.
004 All compartments, holds and void spaces shall normally have natural ventilation.
005 Any space intended for flammable liquids etc. shall have separate ventilation.

(e) Sanitary

001 All vessels shall normally be arranged with basic sanitary facilities (shower, toilet and wash basin).

(f) Exit, Passages, etc.

001 All accommodation, and machinery-spaces that are possible to enter, shall normally be arranged with two exits, for which one may be an emergency exit. The exits shall be located as far as possible from each other, and be suitable to use in emergency situation.
002 Width of passages shall be minimum 28-inches general, but may be reduced to 23-inches for spaces not normally used.
003 Accommodation for maximum 4 persons may be accepted with only one exit if this cannot be blocked in case of fire or other emergency situation and if it leads directly to open deck.

(g) Emergency exit

001 The emergency exit can be an approved hatch, door or window complying with the following:

- minimum light opening 500 x 500 mm (19.68 x 19.68 in) , or diameter 450 mm 17.7 in)
- easy access with fixed step, ladder and handholds as necessary
- clearly marked and with appropriate instructions for use.
- readily opened from both sides without tools in daylight and dark
- direct access to open deck, or via short passages without any lockable door.

(h) Emergency light

001 Emergency light is to be arranged for accommodation and exits.

(i) Wheelhouse

001 General

002 The design and layout of the wheelhouse shall allow the crew to perform their duties without difficulty, fatigue or loss of concentration. The headroom in the wheelhouse shall be minimum 78 inches.
003 The wheelhouse shall normally not be used for purposes other than navigation, communication and functions essential to the operation of the vessel. Fixed seats shall be arranged for crew.

(j) Field of vision

001 The wheelhouse shall be so arranged and positioned to provide view all-round the horizon from the steering and navigation workstations. Where this is not possible, the all-round view of the horizon may be obtained by using two combined workstations, or by another approved means.
002 The view of the sea surface from the operating station when seated, shall not be obscured by more than two vessel length forward of the bow to 90° on either side irrespective of the vessel's draught and trim.
003 Blind sectors shall be as few and as small as possible, and not adversely affect the keeping of a safe lookout from the operating station. The total arc of blind sectors from right ahead to 22.5° abaft the beam on either side shall not exceed 20°. Each individual blind sector shall not exceed 5°. The clear sector between two blind sectors shall not be smaller than 10°.
004 Arrangement shall be provide so that forward view is not adversely affected by solar glare. Neither polarized nor tinted window glass shall be fitted in the front and side of the wheelhouse. Removable sunscreens/curtains may be provided. Windows should preferably be angled top outboard approx. 15° from vertical to reduce unwanted reflection.
005 Tinted glass or material which may easily be scratched is not accepted in front and side of wheelhouse windows. Special arrangement where free sight is arranged above the tinted glass may be accepted. Windows shall not break into dangerous fragments if fractured.

(k) Instruments and equipment

001 The equipment and means for navigation, maneuvering, control, communication and other essential instruments shall be located sufficiently close together to enable personnel to receive information and to use the equipment. If necessary some functions may be duplicated. A table for chart work shall normally be arranged.
002 Instrument, their panels and controls shall be permanently mounted in console(s) convenient for operation and maintenance. The surface of console tops and instruments shall prevent light reflections.
003 All instruments shall be logically grouped according to their functions, plainly visible and easily readable. Means for screening and dimming of internal and external lights in order to minimize glare and reflections, shall be arranged.
004 All vessels shall be provided with a magnetic compass which is capable of operating without electrical supply, and which may be used for steering. This compass shall be mounted in a suitable binnacle containing the required corrective devices and shall be suitable for the speed and motion of the actual vessel. SEE: 46 CFR 28.230

(l) Deck Arrangement

001 Masts, rigging, superstructures, deckhouses and other items on deck are to be arranged to minimize tripping hazards.
002 On vessels intended for service in Arctic waters are to be so designed and arranged that excessive accumulation of ice is avoided.
003 The rigging is to be kept at a minimum, and the surfaces of superstructures and other erections are to be as even as possible and free from projections and irregularities.

(m) Forecastle

001 Fishing vessels are to have a forecastle if the sheer in the forebody is less than 1.5 times standard sheer according to the International Convention on Load Lines, 1966.
002 The length of the forecastle is not to be less than 0.07 L meters, and the mean height is not to be less than 1.5 m.

003 The forecastle is to be closed. When the length of the forecastle is greater than 0.07 L, the surplus part may be open if fitted with freeing ports according to the International Convention on Load Lines, 1966.
004 The required bow height is defined as the vertical distance at the forward perpendicular from the loaded waterline to the top of the exposed deck at side and given by

$$H_B = 56\,L\left(1-\frac{L}{500}\right)\frac{1.36}{C_B+0.68} \quad \text{(mm)}$$

CB = Block coefficient at loaded waterline or 0.5 if CB is not known.

SECTION 2 - STABILITY, WATER, AND WEATHERTIGHT INTEGRITY

C. General

Assumptions
001 No damage stability calculation is required.
002 Enclosed superstructure, deckhouses and trunks may be included as buoyancy elements provided they have approved strength and closing appliances.
003 Marks for maximum draught are to be arranged at bow and stern.
004 Permanent heel or trim which may generate danger for accumulation of water on deck is not accepted.

(b) Freeboard

001 The freeboard shall nowhere be less than 200 mm (7.87 in) measured from the deck.
002 The height of the forecastle or bulwark at stem shall normally nowhere be less than 0.12 L above deepest waterline. The height may be reduced to the level of freeboard deck at 0.25 L from the stem and aft.
003 A Fishing Vessel is to have a draught mark on each side. Draught marks are to be fitted on the sides at midship corresponding to the approved draught with respect to strength and stability. The draught marks shall be in the form of horizontal lines (450 mm (17.7 in) long, 25 mm (.98 in) in height) with the letters NV placed 25 mm (.98 in) above the lines (letter dimensions: height - 115 mm (4.52 in) , breadth - 75 mm (2.93 in), thickness - 25 mm (.98 in)). The marks shall be permanent, and be painted in contrasting color.
004 The freeboard measured from the loaded waterline to the surface of freeboard deck at side, shall in no circumstance be less than 0 mm (in).
005 If the freeboard deck surface outside of weathertight enclosed superstructure in any place is lower, measured to the design waterline, than at midship where the draught mark is placed, the minimum freeboard at midship shall be corrected accordingly, so that no part of exposed freeboard deck is lower than the loaded waterline.
006 Vessels with open connection to sea from fishing wells/tanks for live fish are to have the same freeboard for summer and winter. The freeboard is to be minimum 100 mm (3.93 in) .

(c) Stability

001 The following general criteria apply:
002 The area under the righting lever curve (GZ curve) is not to be less than 0.055 meter-radians up to $\theta = 30°$ angle of heel and not less than 0.09 meter-radians up to $\theta = 40°$ or the angle of flooding θf if this angle is less than 40°. Additionally, the area under the righting lever curve (GZ curve) between the angles of heel of 30° and 40° or between 30° and θf , if this angle is less than 40°, should not be less than 0.03 meter-radians.

003 The righting lever GZ is to be at least 0.20 m at an angle of heel equal to or greater than 30°.
004 The maximum righting arm should occur at an angle of heel not less than 25°.
005 When calculating the heeling moment due to operation of lifting gear, winch, towing hook etc., a dynamic factor of 1.4 is normally to be used to include effects from wind, waves etc.

Guidance note:

In case the vessel's characteristics render compliance with the above criterion impracticable, the alternative criteria as given in *DNV's Rules for Ships, Pt.3 Ch.3 Sec.9 D102* may be applied upon special consideration.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

001 The initial metacentric height is not to be less than 0.35 meters (13.78 ft) in any operating condition.
002 The metacentric height GM in light ship condition is to be positive.
003 Fishing vessels in the length range between 24 m (78.7 ft) and 45 m (147.6 ft) are to comply with the weather criterion referenced *in DNV's Rules for Ships, Pt.3 Ch.3 Sec.9 D201*, but the values of wind pressure are to be taken from Table F1.

Table F1 Wind pressure

h(m)	1	2	3	4	5	6 and over
P (N/m^2)	316	386	429	460	485	504

Where h is the vertical distance from the center of the projected vertical area of the ship above waterline, to the waterline.

(d) Loading conditions

001 Compliance with the stability criteria shall be documented for the following standard loading conditions:

- Departure for the fishing grounds with full fuel, fresh water, stores, ice, fishing gear, etc.
- Departure from the fishing grounds with full catch, at maximum draught and no more than 30% fuel, fresh water and stores
- Arrival at home port with full catch and 10% fuel, fresh water and stores remaining
- Arrival at home port with 20% of full catch and 10% fuel, fresh water and stores remaining
- At fishing grounds with maximum catch on deck, hold empty and 50% fuel, fresh water and stores remaining (if consistent with fishing method)

002 Special loading conditions associated with a change in the vessel's mode or area of operation which affect the stability, are to be considered.
003 If water ballast must be filled between departure and arrival in order to meet the stability criteria, a loading condition is to be included showing when the water ballast must be taken on board. The condition is to show the situation just before ballasting, with the maximum free surface moments of the ballast tank(s) included.
004 Allowance for the weight of wet fishing net and tackle on deck, is to be included if applicable.
005 Allowance for ice accretion according to A (e) 001 must be shown in the worst operating condition in the stability booklet, if consistent with area of operation.

006 Homogeneous distribution of catch in all holds, hatch coamings and trunks is to be assumed, unless this is inconsistent with practice. (Volumetric center of gravity and identical specific gravity for all holds available for catch.)
007 Catch on deck is to be included in the loading conditions showing departure from fishing grounds and arrival at port, if this is consistent with practice.
008 Free surface effect of catch is to be included, if relevant.
009 Free surface effect of water in fish bins is to be included in loading condition at fishing grounds, if relevant.
010 Free surface effect of RSW tanks is to be included, if this is consistent with practice.
011 In all loading conditions, full fishing gear and equipment is to be assumed.

(e) Icing considerations

001 The calculation of weight and center of gravity of the ice accretion, is to be based on the following assumptions:

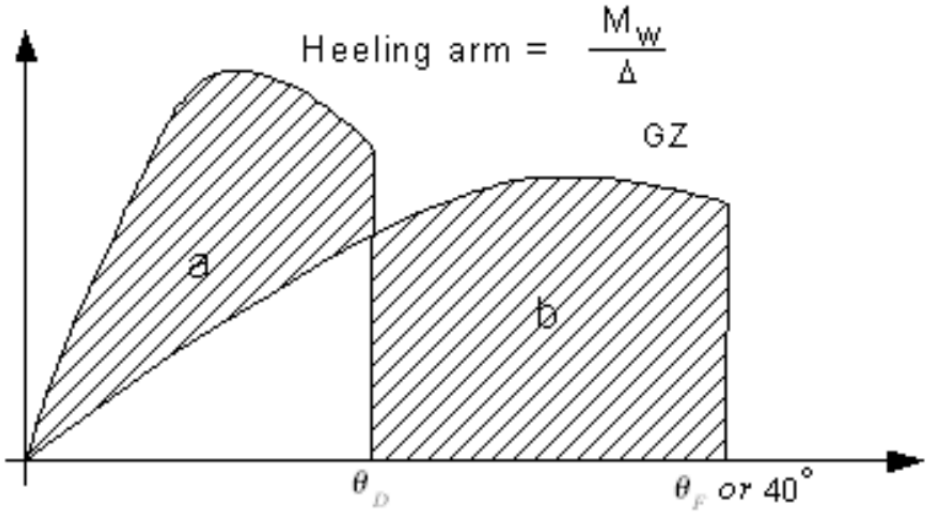
- 30 kg per square meter on exposed weather decks and gangways
- 7.5 kg per square meter for projected lateral area of each side of the vessel above the water plane
- The projected lateral area of discontinuous surfaces of rail, sundry booms, spars (except masts) and rigging of vessels having no sails and the projected lateral area of other small objects should be computed by increasing the total projected area of continuous surfaces by 5% and the static moments of this area by 10%.

(f) Roll reduction tanks

001 When equipped with roll reduction tanks, the reduction in stability due to the effect of these tanks must be allowed for in the loading conditions.
002 If the roll reduction tanks cannot be used in all conditions of loading, an instruction on the use of these tanks and corresponding limit conditions must be included in the stability booklet. These limit conditions must show the stability of the vessel just before emptying the roll reduction tanks.

(g) Water on deck and in compartments temporarily open to the sea

001 Accumulation of water on deck is to be assumed if the requirements on freeing port area (See C. "Openings and Closing Appliances") are not fully met, or if the design of the weather deck is such that water may be trapped. The stability calculations shall take the effect of this water into account according to the requirements of (g) 001 and (g) 002.
002 If hatches or similar openings have to be left periodically open during operation, the stability calculations shall take the effect of water in the open compartment(s) into account according to the requirements of (h) 001 to 003, provided that the angle of downflooding for the critical opening is less than 30°.



(h) Water on deck criterion

001 The ability of the vessel to withstand the heeling effect due to the presence of water on deck, is to be demonstrated by a quasi-static method. With reference to Fig. 1, the following criterion is to be satisfied with the vessel in the worst operating condition:

- area «b» shall be equal to or greater than area «a».
- The angle that limits area «b» shall be taken as the angle of downflooding ∅f or 40°, whichever is less.

002 The value of the heeling moment Mw (or the corresponding heeling arm), due to the presence of water on deck shall be determined assuming that the deck well is filled to the top of the bulwark at its lowest point (or the flooding point of the open compartment). The vessel is to be heeled up to the angle at which this point is immersed $\varnothing_D$ where the heeling moment Mw (or the corresponding heeling arm), shall be terminated.

003 When calculating Mw the following assumptions shall be made:

- at the beginning the vessel is in the upright condition
- during heeling, trim and displacement are constant and equal to the values for the vessel without the water on deck
- the effect of freeing ports shall be ignored.

(i) Onboard cranes

001 The effect on the stability of cranes when used for fishing operations, is to be considered in the stability calculations in accordance with the requirements given in (i) 002 to 004.

002 The maximum possible crane heeling moment is to be assumed. The following shall be considered in the calculation of this moment:

- -combination of safe working load on hooks and crane radius
- -weight and position of boom relative to crane axis
- -two cranes (or more) working in combination (if consistent with practice).

003 When the effect of the crane heeling moment is checked, the vertical center of gravity of the loading condition shall be calculated with load on crane hooks. When the static heeling angle exceeds 5°, the heeling lever is to be drawn in the GZ diagram for the critical loading

condition(s). Cranes are not to be used at sea, unless it can be demonstrated that the residual stability is sufficient.

004 Information on operational limitations on use of cranes, if any, is to be included in the stability booklet. This could include limitations on allowable load on hooks for certain conditions of loading. The maximum heeling moment calculated according to 802 shall be stated in the stability booklet.

(j) Forces from fishing gear

001 When special arrangement of the fishing gear (e.g. trawls or purse seines) result in significant forces on the vessel with impact on the stability, this is to be considered in the stability calculations.

D. Openings and Closing Appliances

(a) Coaming and sill height, closing appliances, freeing ports

001 Coaming and sill heights, closing appliances, freeing port areas, air pipes, ventilators, sanitary discharges etc. shall be in accordance with the requirements in *DNV's Rules for Classification of Ships* Pt.3 Ch.3 Sec.6, except as otherwise specified in this subsection.

002 The height above deck of sills in those doorways, in companionways, erections and machinery casings which give direct access to parts of the deck exposed to the weather and sea shall be at least 600 mm (23.6 in) on the freeboard deck and at least 300 mm (11.8 in) on the superstructure deck subject to special consideration, where operating experience has shown justification, these heights, except in the doorways giving direct access to machinery spaces, may be reduced to not less than 380 mm (14.9in) and 150 mm (5.9 in), respectively.

003 Weathertight doors leading to spaces below freeboard deck and to enclosed superstructure included as buoyant in the stability calculations, are to be positioned as close to the vessel's centerline as possible. Weathertight doors are to have a standard equivalent to ISO 6042. Spraytight doors of a standard equivalent to ISO may be accepted as weathertight doors on vessels with service restriction R3 and in general for doors in bulkheads in enclosed superstructure.

004 The height above deck of hatchway coamings shall be at least 600 mm (inches) on exposed parts of the freeboard deck and at least 300 mm (inches) on the superstructure deck.

005 Where operating experience has shown justification, and subject to special consideration, the height of the hatchway coamings may be reduced, or the coamings omitted entirely, provided that the safety of the vessel is not thereby impaired. In this case, the hatchway openings shall be kept as small as practicable and the covers be permanently attached by hinges or equivalent means and be capable of being rapidly closed and battened down, or by equally effective arrangements.

006 Flush deck hatches used for catch of fish should normally be led to a tank or a watertight fish bin. The closing arrangement of the hatches are to be operated from deck.

007 Hatch covers are to be weather- or watertight, with gaskets and necessary securing devices. For hatch covers of more than 4 m^2, small hatch covers shall be installed as close to the vessel's centerline as possible for use during operation. Such hatch covers are to have securing devices also at the hinged side. Hinged hatch covers are to be securable in open position.

008 Coaming height and sill height for hatches and doors on working deck in enclosed superstructure and deckhouses where water are used in the working process are not to be less than 100 mm (3.94 in).

009 In vessels of less than 45 m (147.6 ft.) in length, closing appliances need not be fitted to ventilators the coamings of which extend to more than 3.4 m (11.15 ft.) above the freeboard deck or more than 1.7 m (5.58 ft.) above the superstructure deck.

010 Below the freeboard deck and in enclosed superstructure on freeboard deck, side scuttles with hinged deadlights are to be used.

011 Side-scuttles and windows may be accepted without deadlights in side and aft bulkheads of deckhouses located on or above the freeboard deck if satisfied that the safety of the vessel will not be impaired.

012 Side-scuttles and windows prone to be damaged by fishing gear shall be suitably protected.

013 Side scuttles in ship sides, including outboard side of enclosed superstructure and deckhouses at ship sides, are not to be closer to the loaded waterline than 500 mm (1.64 in) . Such side scuttles shall be equipped with hinged deadlights. Side scuttles closer to the loaded waterline than 1000 mm (39.37inches) shall not be possible to open.

014 The freeing port area on each side of net bins and other short wells on deck with length less than 5 m (16.40 ft.) , may be calculated using the following formula:

$$A = 0.175\, l$$

l = length of well

In short wells of less than 3 meters, the freeing port area may be specially considered. Covers of freeing ports are to be non-closeable and hinged in upper edge.

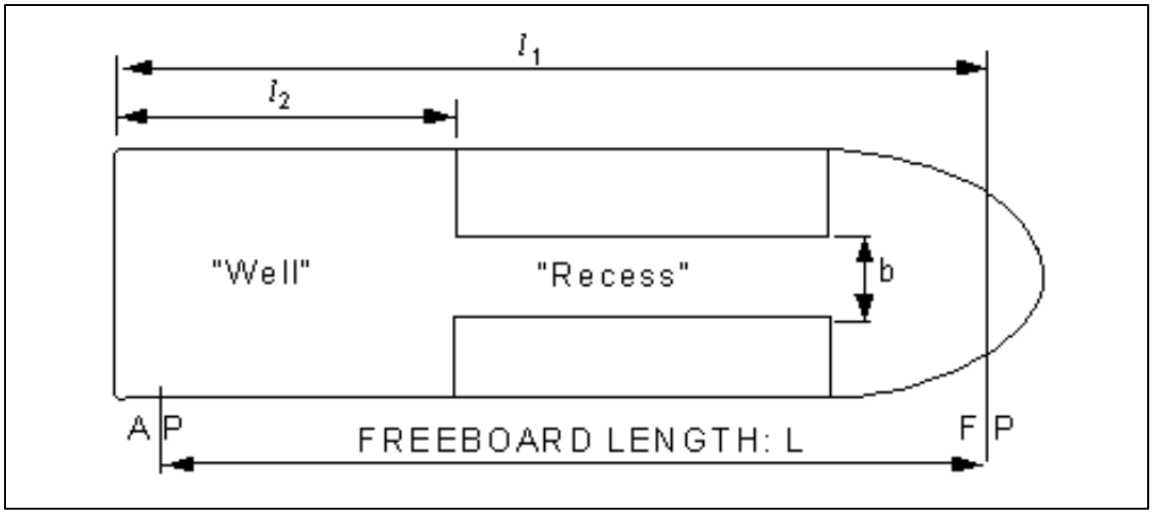


Figure 1.0 Parameters used for calculation of freeing port area

015 For non-watertight fish bins, a drainage system is required in order to prevent flooding of the working deck area.

016 Ordinary freeing ports in high bulwarks (more than 1 meter or 3.28 ft. in height), or in sides of open superstructure, are not considered as sufficient for drainage of exposed freeboard deck (may be accepted for vessel with service notation RE). Open superstructure such as open forecastle, separate walls at side or other similar constructions are therefore not acceptable, unless the stability requirements of Sec.A 100 (all) for water on deck are complied with, or if sufficient drainage is provided according to 017.

017 For vessels where the sea may enter over the stern and flood the deck into a superstructure which is open in aft end, the freeing port area on each side is not to be less than required by the following formulas:

$$A_{Well} = \left((0.07 l_2) + \frac{0.004(h - 1.2) l_2}{0.1}\right) y_1 y_2 \quad (m^2)$$

Where the length of the bulwark in the well is 20 meters or less

$$A_{Well} = \left((0.7 + 0.035 l_2) + \frac{0.004(h - 1.2) l_2}{0.1}\right) y_1 y_2 \quad (m^2)$$

$$A_{Recess} = \left[(0.07 l_1) \frac{b}{l_1} \left(1 - \left(\frac{l_2}{l_1}\right)^2\right)\right] y_1 y_2 \quad (m^2)$$

l_1 need in no case be taken as greater than 0.7 L.

y1 = 0.5 for superstructure deck
= 1.0 for freeboard deck

y2 = 1.5 for no shear
= 1.0 for suitable shear applied

h = average height of bulwark aft of the open superstructure.

Other parameters are defined by Fig. 1.0 above.

018 Freeing ports over 300 mm (inches) in depth shall be fitted with bars spaced not more than 230 mm (inches) nor less than 150 mm (inches) apart or provided with other suitable protective arrangements. Freeing port covers, if fitted, shall be of approved construction. If devices are considered necessary for locking freeing port covers during fishing operations they shall be easily operable from a readily accessible position.

019 Pound-boards and means for stowage of the fishing gear shall be arranged so that the effectiveness of freeing ports will not be impaired. Pound-boards shall be so constructed that they can be locked in position when in use and shall not hamper the discharge of shipped water.

020 In vessels intended to operate in areas subject to icing, covers and protective arrangements for freeing ports shall be capable of being easily removed to restrict ice accretion. The size of openings and means provided for removal of these protective arrangements are to be considered.

E. Weathertight Integrity

(a) General

001 Small openings for wire chain, scuppers etc., will be considered as closed if submerged at angle of heel larger than 30º.

002 Openings to spaces below freeboard deck, or to other spaces included as buoyancy in stability calculations, shall be fitted with weathertight closing appliances.

003 Closing appliances shall be built with same strength as the surrounding structure and be arranged to provide safety against sea impact.

004 Closing appliances shall as a minimum include gasket and two closing devices in addition to hinges.

(b) Doors

001 Doors shall be possible to operate from either side of the bulkhead.

002 The sill height of door openings to spaces below freeboard deck shall be at least 380 mm (inches) . For doors located at least 380 mm (inches) above freeboard deck, a reduced height of sill may be accepted, but normally not less than minimum 150 mm (inches).

003 Arrangement for removable washboard replacing a sill may be accepted based on special consideration.

(c) Port and ramps

001 Port and ramps in freeboard above weathertight deck may be accepted. Water- tightness shall be arranged with gasket and hinges/clamps with spacing not exceeding 300 mm (inches) .

002 The arrangement for safety of operation, stop arrangement and any indicators etc. shall be submitted for approval.
003 The lower edge of openings shall not be less than 200 mm (inches) above deepest waterline.

(d) Ventilation

001 Ventilation openings shall be arranged to avoid flooding of the vessel and normally have minimum height 600 mm (inches) above freeboard deck.
002 Ventilation openings shall normally not be immersed at heel angle smaller than 50º.

(e) Air pipes

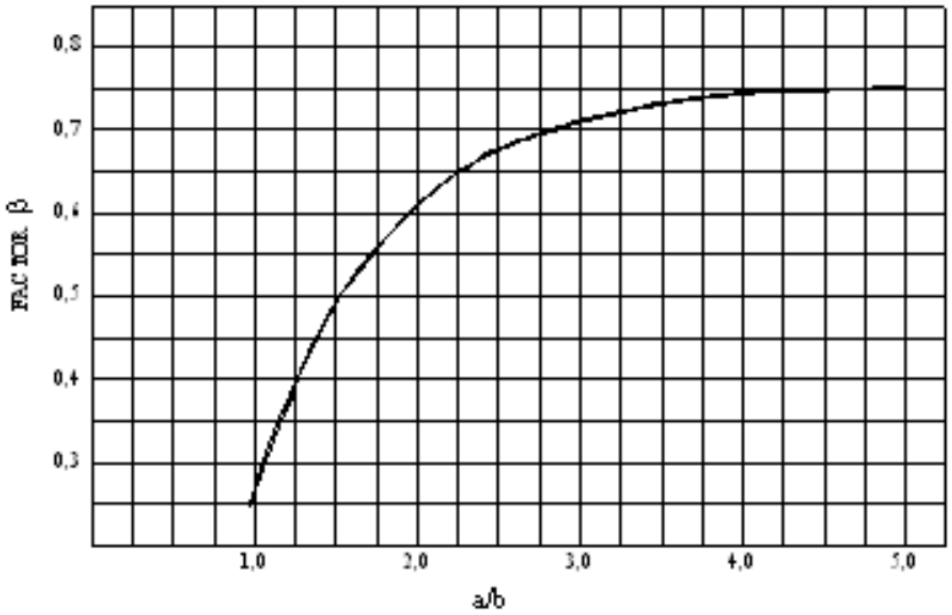
001 Air pipes are defined as openings for ventilation normally not exceeding an area equivalent to a diameter of 50 mm (inches) .
002 Air pipes shall be arranged with non-return valve or goose necks to prevent water ingress.
003 The height of air pipes shall normally not be smaller than 600 mm (inches) above the freeboard deck.
004 Air pipes shall be protected from damage from work on deck.

(f) Windows

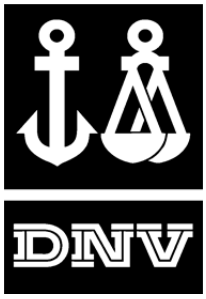
001 Windows in accommodation spaces may be fabricated from thermally or chemically toughened glass or polycarbonate. Windows shall not fracture in fragments that can easily cause human injury.
002 Windows shall be fitted in rigid frames and secured from being pressed in. A rubber profile is acceptable if the window cannot be pressed in and the glass thickness is increased by 20%.
003 The minimum thickness of windows shall be calculated according to the following formula:

$$t = \frac{b}{K}\sqrt{\beta P}$$

P = design pressure at the location of the window
β = according to the figure below
a = the larger dimension of the window opening
b = the smaller dimension of the window opening
K = 190 for glass
= 160 for polycarbonate.



004 For windows placed above positions exposed to sea-load the thickness may be reduced by 25%.
005 Horizontal windows in positions exposed to impact from operation are subject to special consideration.



STANDARD FOR CERTIFICATION
No. 1USFV

Interim Rules v5.0

Chapter III – Materials and Manufacturing

Chapter III - Materials and Manufacturing

Section 1 - General Requirements

A. Steel

001 Structural steel materials shall be weldable and meet the specifications for ASTM A36 Steel Plate:

Chemical Requirements for A36/A36M Steel[1]

Product	Shapes[A]	Plates[B]		Bars[B]	
Thickness, in. [mm]	All	To 3/4 [20] incl	Over 3/4 to 1 1/2 [20 to 40]	To 3/4 [20] incl	Over 3/4 to 1 1/2 [20 to 40]
Carbon, max, %	0.26	0.25	0.25	0.26	0.27
Manganese, %	...	...	0.50-1.20	...	0.60-0.90
Phosphorus, max, %	0.04	0.04	0.04	0.04	0.04
Sulfur, max, %	0.05	0.05	0.05	0.05	0.05
Silicon, %	0.40 max	0.40 max	0.40 max	0.40 max	0.40 max
Copper, min, % when copper steel is specified	0.2	0.2	0.2	0.2	0.2

[A] Manganese content of 0.85–1.35 % and silicon content of 0.15–0.40 % is required for shapes with flange thickness over 3 in. [75 mm].

[B] For each reduction of 0.01 percentage point below the specified carbon maximum, an increase of 0.06 percentage point manganese above the specified maximum will be permitted, up to the maximum of 1.35 %.

[1] Source: *ASTM Designation A35/A36M-08, Standard Certification for Carbon Structural Steel*

Tensile: 58 KSI minimum
Yield: 36 KSI minimum
Elongation: 18% minimum in 8”
21% minimum in 2” (for plate 24” and wider)

002 Structural steel material shall be delivered with a works certificate

003 Each lot shall be marked with the manufacturers name, type designation, approval certificate reference, batch number and date of manufacture

004 Products lacking the marking specified in 003 above, shall be subject to a product control testing verified by a recognized institution.

>>>>>>>>>>>>>>>>>> Guidance Note <<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<<
In general, no credit is given for construction of vessels with steels exceeding the properties of A36. For other approved steels see: *DNV’s Rules for Ships Part 2 Chapter 2 “Metallic Materials,”* and coordinate with DNV’s local Approval Center.
>>>>>>>>>>>>>>>>>> End of Guidance Note <<<<<<<<<<<<<<<<<<<<<<<<

B. Aluminum

001 Chemical Composition of DNV recommended Aluminum alloys

Table A1 Chemical composition limits [1] for wrought aluminium alloys

Grade	*Si*	*Fe*	*Cu*	*Mn*	*Mg*	*Cr*	*Zn*	*Ti*	*Other elements [2]*	
									Each	*Total*
NV-5052	0.25	0.40	0.10	0.10	2.2 to 2.8	0.15 to 0.35	0.10	-	0.0	0.15
NV-5059	0.45	0.50	0.25	0.6 to 1.2	5.0 to 6.0	0.25	0.40 to 0.9	0.20	0.05 [5]	0.15 [5]
NV-5083	0.40	0.40	0.10	0.40 to 1.0	4.0 to 4.9	0.05 to 0.25	0.25	0.15	0.05	0.15
NV-5086	0.40	0.50	0.10	0.20 to 0.7	3.5 to 4.5	0.05 to 0.25	0.25	0.15	0.05	0.15
NV-5154A	0.50	0.50	0.10	0.50	3.1 to 3.9	0.25	0.20	0.20	0.05	0.15
NV-5383	0.25	0.25	0.20	0.7 to 1.0	4.0 to 5.2	0.25	0.40	0.15	0.05 [4]	0.15 [4]
NV-5454	0.25	0.40	0.10	0.50 to 1.0	2.4 to 3.0	0.05 to 0.20	0.25	0.20	0.05	0.15
NV-5456	0.25	0.40	0.10	0.50 to 1.0	4.7 to 5.5	0.05 to 0.20	0.25	0.20	0.05	0.15
NV-5754	0.40	0.40	0.10	0.50 [3]	2.6 to 3.6	0.30 [3]	0.20	0.15	0.05	0.15
NV-6005A	0.50 to 0.9	0.35	0.30	0.50 [6]	0.40 to 0.7	0.30 [6]	0.20	0.10	0.05	0.15
NV-6060	0.30 to 0.6	0.10 to 0.30	0.10	0.10	0.35 to 0.6	0.05	0.15	0.10	0.05	0.15
NV-6061	0.40 to 0.8	0.7	0.15 to 0.40	0.15	0.8 to 1.2	0.04 to 0.35	0.25	0.15	0.05	0.15
NV-6063	0.20 to 0.6	0.35	0.10	0.10	0.45 to 0.9	0.10	0.10	0.10	0.05	0.15
NV-6082	0.7 to 1.3	0.50	0.10	0.40 to 1.0	0.6 to 1.2	0.25	0.20	0.10	0.05	0.15

1) Composition in percentage mass by mass maximum unless shown as a range or as a minimum.
2) Includes Ni, Ga, V and listed elements for which no specific limit is shown. Regular analysis need not be made.
3) Mn + Cr: 0.10-0.60.
4) Zr: maximum 0.20. The total for other elements does not include Zirconium.
5) Zr: 0.05-0.25. The total for other elements does not include Zirconium.
6) Mn + Cr: 0.12-0.50.

002 For mechanical properties of rolled and extruded aluminum, see *DNV's Rules for Ships Part 2 Chapter 2 Section 9, "Aluminium Alloys"*

C. Other Materials

For materials please reference DNV's *Standards for Certification 2.21 - Craft*

Section 2 - Metallic Materials, Machining, Welding and Joints

A. Steel Materials

(a) General

001 Steel material shall be stored in a way that corrosion is avoided

(b) Welding

001 Welding of construction parts shall be done by or supervised by a welder with approved certificate for the actual or similar material and method of welding.
002 Welding procedures shall be approved on site.
003 Welding electrodes shall be stored in a dry and clean place.
004 Gas-shielded welding shall be performed indoors.
005 Horizontal welding shall be used as far as possible
006 The seams shall be cleaned and free from damaging paint, rust and dirt before welding.
007 Shop primer used shall be of a type that is possible to weld without leaving any damaging effect to the strength of the welding.
008 Welds shall have a minimum throat thickness according to the following table:

Plate thickness (mm) (inches)	Throat thickness, a (mm) (inches)
< 4 (0.04)	2.0 (0.078)

4 – 6.5 (0.04 – 0.255)	2.5 (0.098)
6.4 – 8 (0.251- 0.314)	3.0 (0.118)
> 8 (0.314)	0.45 (0.018) x thickness of thinnest plate

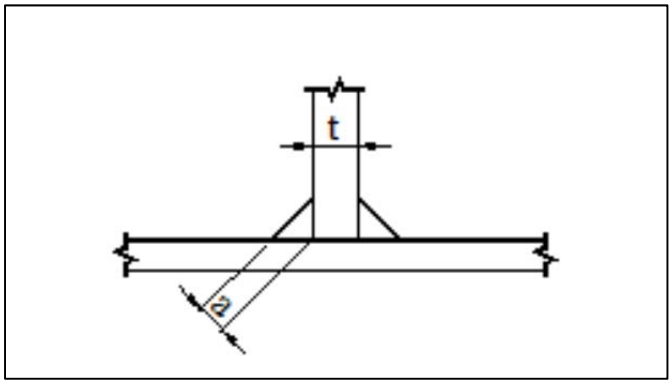


Figure 4 - Throat thickness, a

009 The following items shall be welded with double side continuous fillet welding:

Continuous welding	Brackets for beams and other means of support
	Transverse frames below waterline and floors
	Foundations for engine(s), propulsion and equipment
	Keel and stem

010 For intermittent welding, the weld length and spacing shall be according to the following table:

Thickness of plate: t (mm) (inches)	Weld length: l (mm) (inches)	Spacing: e (mm) (inches)
3 – 4.5 (0.118-0.177)	50 (1.97)	100 (3.93)
5 – 6.5 (0.19-0.255)	65 (2.56)	130 (5.12)
7 – 8.5 (0.27-0.335)	75 (2.95)	150 (5.91)
9 – 10.5 (0.35-0.41)	100 (3.93)	200 (7.87)

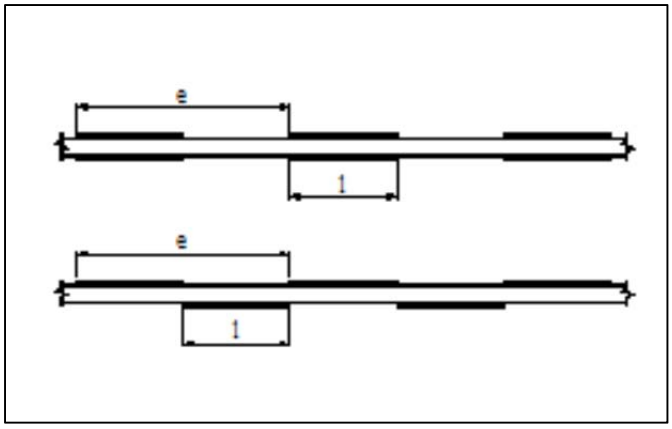


Figure 5 - Intermittent welding

B. Welding of Aluminum

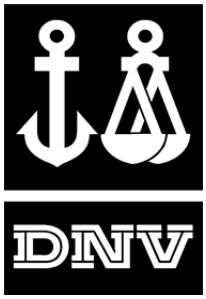
001 Welding of construction parts shall be done by or supervised by a welder with approved certificate for the actual or similar material and method of welding.

001 Welding procedures for aluminum can be referenced in Rules for Classification of Ships, Part 2 chapter 3 Section J, “Welding Procedures for Aluminum.”

C. Welding of Dissimilar Metals

001 Welding of construction parts shall be done by a certified welder or supervised by a welder with approved certificate for the actual or similar material and method of welding.

002 For welding of dissimilar metals, builder shall reference an industry standard procedure and document material and weld process used.



STANDARD FOR CERTIFICATION
No. 1USFV

Interim Rules v5.0

Chapter IV – Structures

Chapter IV – Structures

Section 1 - Design Principles

A. Validity

001 This Chapter applies to F/Vs with displacement hulls with overall lengths from 50 to 150 feet with speeds not exceeding 15 knots.

002 For vessels designs falling outside 001 above, please refer *to DNV's Standards for Certification 2.21 Craft, or DNV's Rules for Ships*.

003 Structural arrangements not covered by this rule, or for unusual structural arrangement please *DNV's Rules for Ships*

B. Documentation

(a) Plans and particulars

001 The following plans shall be submitted for approval:

- midship section including main particulars and maximum speed V
- profile and decks
- longitudinal and transversal stiffening members
- shell expansion and framing including openings
- watertight bulkheads and transom including openings and their closing appliances
- tank structure
- engine room structures including foundation for heavy machinery components
- aft peak structures
- forepeak structures
- superstructures and deckhouses including openings with sill heights and their closing appliances
- hatchways, hatch covers and ports including securing and tightening appliances
- propeller shaft brackets with their attachments to the hull
- appendages with their attachments to the hull
- rudder and rudder stock with details of bearings and seals
- arrangement and particulars of anchoring and mooring equipment.
- Additional documentation may be required.

<<<<Guidance note>>>>>>

Identical or similar structures in various positions are recommended covered by the same plan.

<<<<e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e>>>>>

001 The following plans shall be submitted for information:

- general arrangement
- tank arrangements
- capacity plan
- body plan
- arrangement of cathodic protection.

002 Additional documentation required are listed in the appropriate sections.

(b) Strength calculations

001 Strength calculations shall normally be submitted for reference to demonstrating that stresses are within required limits.

Section 2 - Design Loads

A. General - Application

001 The design loads in this chapter shall only be applied in association with the strength formulas given in this chapter.

(a) Local reinforcements

001 Structure with local loads from cargo, fenders, deck-gears, foundations etc., shall be reinforced for the actual loads.

(b) Draught for scantlings

001 For fishing vessels for which the draught is not limited by any freeboard mark, or other operational limit regarding the maximum draft, the molded depth D instead of draught T is to be used when calculating the scantlings of strength members.

(c) Reductions for service restrictions

001 For vessels with service restriction R0-RE, the dynamic load factors k_{sea}, k_{tk}, k_d may be reduced by percentage as follows:

Service restriction	k_{sea} reduction
R0	No reduction
R1	10%
R2	20%
R3	30%
R4	40%
RE	50%

B. Design loads – General Considerations for Fishing Vessels

(a) Longitudinal strength

The maximum longitudinal bending moment for vessel operating entirely in displacement mode shall not be taken less than: $M = 0.016 \cdot L_{WL}^3 \cdot B_{WL}$ (kNm)

001 In no case shall the maximum longitudinal bending moment be taken less than 100 kNm.
002 The maximum longitudinal bending moment shall be applied to the central 25% of L with a linear reduction to zero at the fore and aft end of the vessel.
003 For vessels with service restriction R0-RE, the M value may be reduced by percentage as follows:

Service restriction	k_{sea} reduction

R0	No reduction
R1	3%
R2	6%
R3	9%
R4	12%
RE	15%

(b) Sea pressure on hull bottom and side

001 Design sea pressure P_{sea} should be calculated as below. The pressures correspond to scantlings draught equal to vessel depth.

P_{sea} $= (10 + k_{sea}) D$ (kN/m^2) at baseline (z = 0)
$= k_{sea} D$ (kN/m^2) at deck line
= linear interpolation based on z-coordinate between baseline an deck line
= minimum 5 (kN/m^2)

where:
D = vessel depth in meters measured at midship
k_{sea} = dynamic factor for sea pressures, for vessels without service restrictions k_{sea} shall be calculated as below
k_{sea} = bottom, at baseline (z=0)
3.5 D – at A.P
2.0 D – between 0.2-0.7L
5.0 D – at F.P
= side, at deck line (z=D at midships)
4.5 D – at A.P
3.0 D – between 0.2-0.7L
6.0 D – at F.P
= linear interpolation of k_{sea} values between A.P and 0.2L, and 0.7L and F.P.

(c) Design loads on decks and superstructures

001 The design sea pressure acting on decks shall not be taken less than:

$Pd = k_d \cdot L + 4.5$ (kN/m2)
Where:
k_d = 0.2 for exposed main weather deck and superstructure deck forward of 0.25 L from FP
= 0.1 for exposed superstructure decks elsewhere.

002 The design load for accommodation decks and decks intended for cargo shall be taken as:

$P_{dc} = (10+k_{dc}) H$

where:
k_{dc} = 5 within 0.2L from F.P.
= 3 elsewhere
H = deck cargo in t/m2
= 0.35 t/m2 for accommodation decks

003 The design sea pressure on superstructures and deck houses shall not be taken less than given in the table below:

Position	p (kN/m2)
Front bulkhead	0.3 L + 6
Sides and aft bulkhead	0.15 L + 3
Deck house roof, 1st tier	0.1 L + 3
Deck house roof, elsewhere	0.1 L + 1.5

(d) Design loads for bulkheads and tanks

001 The design load for watertight bulkheads shall not be taken less than:

$$P_{bh} = 10\ h_b \quad (kN/m2)$$

h_b = distance from load point to top of bulkhead

002 The design load for tanks for oil, freshwater, water ballast, etc. shall not be taken less than a maximum of:

$pt = (10 + k_t) \bullet hs$
where:
k_t = 5.0 in forward area within 0.2 L from the forward perpendicular (FP)
= 3.0 elsewhere
$pt = 7 \bullet h_p$ (kN/m2)
= 15 (kN/m2)
hs = vertical distance in meters from the load point to the top of tank or hatchway, excluding smaller hatchways
hp = distance from load point to top of air pipe or filling pipe whichever is the greater.

(e) Design loads for deck equipment

001 Design loads of deck equipment shall not be taken less than:
1.2 SWL for equipment intended for harbor use only
1.5 SWL for equipment intended for offshore use
where:
SWL is Safe Working Load

002 Higher design loads may be requested by DNV on case-by-case basis.

Section 3 - Structural Design; and Steel Vessels

A. Structural arrangement

(a) Structural design in general

001 The ship arrangement shall take into account:

- continuity of longitudinal strength, including horizontal shear area to carry a strength deck along
- transverse bulkheads or strong webs
- web/pillar rings in engine room

- superstructures and deckhouses
- direct support
- transitions
- deck equipment support
- multi-deck pillars in line, as practicable
- external attachments, inboard connections.

002 Brackets are to extend to the nearest stiffener, or local plating reinforcement shall be provided at the toe of the bracket.
003 Generally, connections of outfitting details to the hull shall be such that stress-concentrations are minimized and welding to high stressed parts is avoided as far as possible.
004 Connections shall be designed with smooth transitions and proper alignment with the hull structure elements. Terminations shall be supported.
005 Knuckles shall be supported.

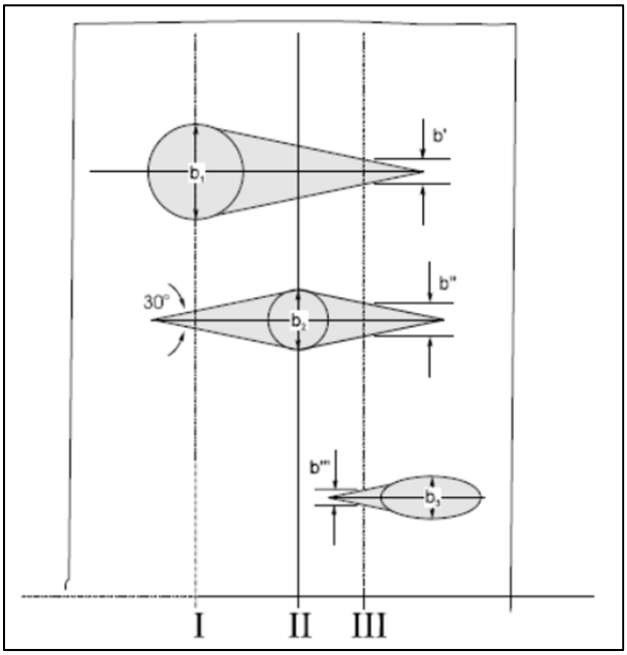
(b) Longitudinal strength

001 The section modulus amidships Z of hull girder shall not be less than:

$$Z = 11.4\ M\ (cm^3)$$

along the central 25% of the length of the hull girder. Outside the central part, the section modulus may be reduced linearly to zero at the fore and aft end of the vessel.
002 The section modulus lower than required by 001, but not less than Z = 5.7 M, may be accepted after special consideration. Strength of the upper deck, bottom, and upper/lower parts of longitudinal bulkheads and ship side shall then be designed per DNV Ship Rules Pt.3 Ch.2.
003 The effective sectional area of continuous longitudinal strength members is in general the net area after deduction of openings. Superstructures which do not form a strength deck are not to be included in the net section. This applies also to deckhouses and bulwarks. The effect of openings is assumed to have longitudinal extensions as shown by the shaded areas in the figure below i.e. inside tangents at an angle of 30° to each other. Example for transverse section III:

$$B_{III} = b' + b'' + b'''$$



(c) Bottom structures

001 The bottom structure shall comply with the requirements given in Parts C through F below.
002 The local strength of the keel shall be sufficient to withstand loads in connection with docking attachment of external ballast keel, etc.
003 Bottom structures may be longitudinally or transversely stiffened.
004 The longitudinals shall preferably be continuous through transverse members. If they are to be cut at transverse members, i.e. watertight bulkheads, continuous brackets connecting the ends of the longitudinal shall be fitted or welds shall be dimensioned accordingly.
005 Longitudinal stiffeners shall be supported by bulkheads and web frames.
006 Web frames are to be continuous around the cross section i.e. floors side webs and deck beams are to be connected. Intermediate floors may be used.
007 In the engine room plate floors shall be fitted at every frame. Alternatively the bottom structure shall be arranged with sufficient stiffness to effectively support the main engine(s) and minimize vibration, following engine manufactures specifications.
008 In way of thrust bearings, additional strengthening shall be provided.
009 Longitudinal girders shall be carried continuously through bulkheads or effectively supported at the ends.
010 A center girder shall be fitted for docking purpose if the external keel or bottom shape does not give sufficient strength and stiffness.
011 Openings shall not be located at ends of girders without due consideration being taken to shear strength.
012 Under the main engine, girders extending from the bottom to the top plate of the engine seating shall be fitted.
013 Engine holding down bolts shall be arranged as near as practicable to floors and longitudinal girders.
014 In way of thrust bearing and below pillars additional strengthening shall be provided.
015 Manholes shall be cut in the inner bottom, floors and longitudinal girders to provide access to all parts of the double bottom. The vertical extension of lightening holes shall not exceed one half of the girder height. The edges of the manholes shall be smooth. Manholes in the inner bottom plating shall have reinforcement rings. Manholes shall not be cut in the floors or girders in way of pillars.

(d) Side structures

001 The scantlings of side structures shall comply with the requirements given in Parts C through F below.
002 The vessel's sides may be longitudinally or vertically stiffened.
003 The longitudinals at deck and bottom should be continuous through transverse members. If they are to be cut at transverse members, i.e. watertight bulkheads, continuous brackets connecting the ends of the longitudinal shall be fitted or welds shall be dimensioned accordingly
004 Vertical side frames should be connected to floors and deck beams with well-rounded transitions or brackets.

(e) Deck structure

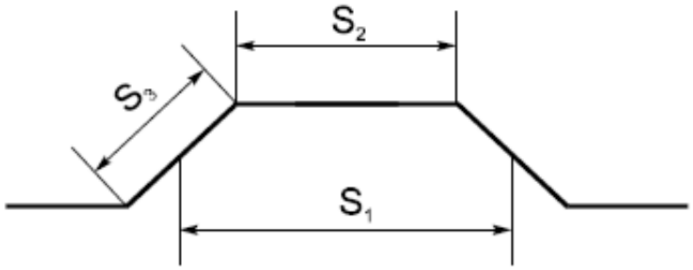
001 The scantlings of deck structures shall comply with the requirements given in Parts C through F below.
002 Decks may be longitudinally or transversely stiffened.
003 Longitudinal should be continuous through transverse members. If they are to be cut at transverse members, i.e. watertight bulkheads, end connections and continuity shall be ensured.

004 The plate thickness shall be such that the necessary transverse buckling strength is achieved, or transverse buckling stiffeners may have to be fitted intercostals.
005 The thickness of bulwark plates shall not be less than required for side plating in a superstructure in the same position.
006 A strong section shall be continuously welded to the upper edge of the bulwark.
007 Bulwark stays shall be able to withstand design sea pressures as for superstructure side wall. The stays should be in line with transverse beams or local transverse stiffening. The deck beam shall be continuously welded to the deck in way of the stay. Bulwarks on forecastle decks shall have stays fitted at every frame
008 Stays of increased strength shall be fitted at ends of bulwark openings. Openings in bulwarks shall not be situated near the ends of superstructures.
009 Where bulwarks on exposed decks form wells, ample provision shall be made to freeing the decks for water.

(f) Bulkhead structure.

001 The scantlings of bulkhead structures shall comply with the requirements given in Parts C through F below.
002 Number and location of transverse watertight bulkheads shall be in accordance with the reference to Stability Chapter II, Sec. 1B.
003 Bulkheads shall have sufficient strength to withstand loads imposed by the supported decks, girders, and stiffeners.
004 Watertight bulkhead stiffeners and girders shall have end connections
005 Longitudinal and transverse bulkheads may be corrugated.
006 For corrugated bulkheads the following definition of spacing applies (see figure below):

s = s1 for section modulus calculations
= 1.05 s2 or 1.05 s3 for plate thickness calculations.



(g) Superstructures and deckhouses

001 The scantlings of superstructures and deckhouses shall comply with the requirements of Parts C through F below.
002 In superstructures and deckhouses, the front bulkhead shall be in line with a transverse bulkhead in the hull below or be supported by a combination of girders and pillars. The after end bulkhead shall be effectively supported. As far as practicable, exposed sides and internal longitudinal and transverse bulkheads shall be located above girders and frames in the hull structure and shall be in line in the various tiers of accommodation. Where such structural arrangement in line is not possible, there shall be other effective support.
003 Sufficient transverse strength shall be provided by means of transverse bulkheads or girder structures.
004 At the break of superstructures, which have no set-in from the ship's side, the side plating shall extend beyond the ends of the superstructure, and shall be gradually reduced in

height down to the deck or bulwark. The transition shall be smooth and without local discontinuities. A substantial stiffener shall be fitted at the upper edge of plating. The plating shall be additionally stiffened.

005 In long deckhouses, openings in the sides shall have well rounded corners. Horizontal stiffeners shall be fitted at the upper and lower edge of large openings for windows.

006 Openings for doors in the sides shall be substantially stiffened along the edges. The connection area between deckhouse corners and deck plating shall be increased locally.

007 Deck girders shall be fitted below long deckhouses in line with deckhouse sides.

008 Deck beams under front and aft ends of deckhouses shall not be scalloped for a distance of 0.5 m (1.64 feet) from each side of the deckhouse corners.

B. Plating

(a) General

001 In this section the general requirements for the local strength of laterally loaded plates in steel are given.

(b) Plate thickness

001 Plate thicknesses shall be not less than the largest value found from the following formulas t_1 and t_2:

$t_1 = f_{pl}\ s\ \sqrt{P}$ (mm)
f_{pl} shall be taken as:
= 1.25 in general
= 1.45 for longitudinal bulkheads, weather deck, and bottom within 0.3-0.7 L
$t_2 = t_0 + k\ L$ (mm)

t_0 and k shall be taken from the table below:

Structure	t_0	k
Keel plate	7.0	0.05
Hull bottom	5.0	0.04
InBot in general	5.0	0.03
InBot w/o celling	6.0	0.03
InBot w/celling	5.0	0.03
Sea chest boundaries	6.0	0.05
Centre bottom girder	6.0	0.04
Bottom girders and floors	6.0	0.02
Hull side	5.0	0.04
Side and deck girders	5.0	0.01
Transom	5.0	0.04
Exposed deck (unshathered)	5.5	0.02
Exposed deck (shathered)	5.0	0.02
Longitudinal bulkheads	5.0	0.03
Collision bulkhead	5.0	0.02
Other bulkheads	5.0	0.01

Transverse frames	5.0	0.01
Stiffeners in general	5.0	0.01
Superstructure decks, front and sides, lowermost tier	5.0	0.02
Superstructure decks, front and sides, higher tiers	4.0	0.02

C. Frames, Girders and Stiffeners

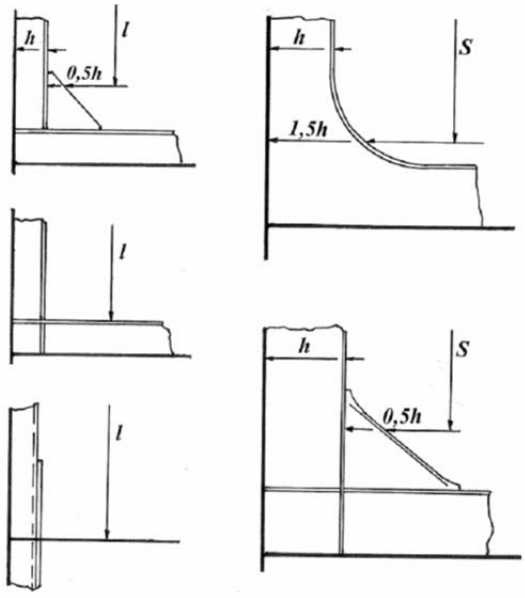
(a) General

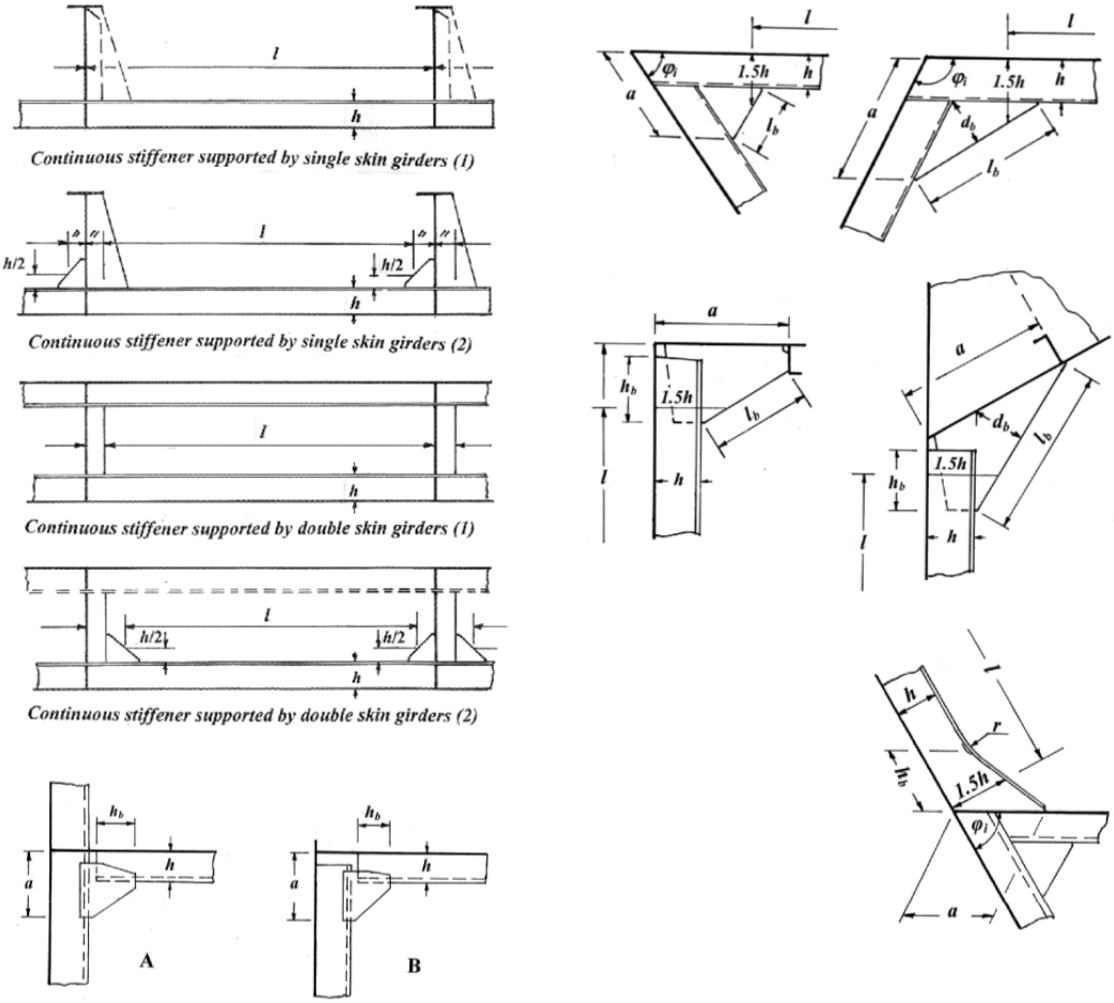
001 In this section the general requirements for the strength of laterally loaded frames, beams and other stiffeners in steel and constructions are given.

002 In addition to requirements in this section, webs and flanges of the stiffening members shall satisfy requirements to plating given in B.

(b) Definition of span for stiffeners and girders

001 The effective span of a stiffener (l) or girder (S) depends on the design of the end connections in relation to adjacent structures. Unless otherwise stated the span points at each end of the member, between which the span is measured, is in general to be determined as shown in below figures. When the adjacent structure is ineffective in support of the bracket, or when the end bracket does not comply with requirements in this section and is fitted for stiffening of supporting structures, the span point shall be defined by the intersection of the line defined by the stiffener face plate and the end support structure.





(c) Section modulus

001 The requirement to section modulus given below apply to stiffeners and simple girders. Complex girder system (grillages and ring frames) may need to be designed with direct calculation.

002 The section modulus of stiffening members is not case to be less than 15 cm^3

003 The section modulus of stiffening members shall not to be less than:

$$Z = f_{stf}\ l^2\ s\ P \quad (cm^3)$$

f_{stf} shall be taken from the table below
b = load breadth in meters (feet)
l = stiffener span in meters (feet).
P = design pressure taken at the midspan of the member kPa

The f-values are normally to be taken as follows for the various structural members:

f_{stf}	
Item	f_{stf}
Continuous longitudinals	0.52
Transverse stiffeners in deck and bottom, both ends fixed	0.63
Other transverse members, both ends fixed	0.52
Other transverse members, one end fixed	0.63
Other transverse members, both ends simply supported	0.78
Vertical members, both ends fixed	0.63
Vertical members, lower end fixed	0.83
Vertical members, both ends simply supported	1.00

004 For definition of "simply supported end" and "fixed end" requirement in (e) and (f) below.

005 The requirements in 002 and 003 are to be regarded as the requirement about an axis parallel to the plating. As an approximation the requirement to standard section modulus for stiffeners at an oblique angle with the plating may be obtained if the formula in 003 is multiplied by the factor:

$$\frac{1}{\cos\alpha}$$

α = angle between the stiffener web plane and plane perpendicular to the plating.
For angles α < 15º corrections are normally not necessary.

006 When several stiffeners are equal, the section modulus requirement may be taken as the average requirement for each individual member in the group. However, the requirement for the group is not to be taken less than 90% of the largest individual requirement.

007 Effective plate flange of stiffeners may normally be taken equal to the stiffener spacing.

008 Effective plate flange for girders is given in (g).

009 The thickness of web and flange is not to be less than:

for flats:

t_{web} = 1/20 x flat depth.

for other sections:

t_{web} = 1/70 x web depth, provided net shear area > 0.075 lsp

t_{flange} = 1/12 x flange width from web.

(d) Girder webs

001 The web thickness of the girder at ends is given by:

$$t_{web} = k\ A\ P / h_{eff}\ (cm^2)$$

k = 0.06 at ends for continuous horizontal girders and upper end of vertical girders

= 0.08 at end for lower end of vertical girders

= 0.03 at midspan of the girder

= intermediate values to be obtained by linear interpolation

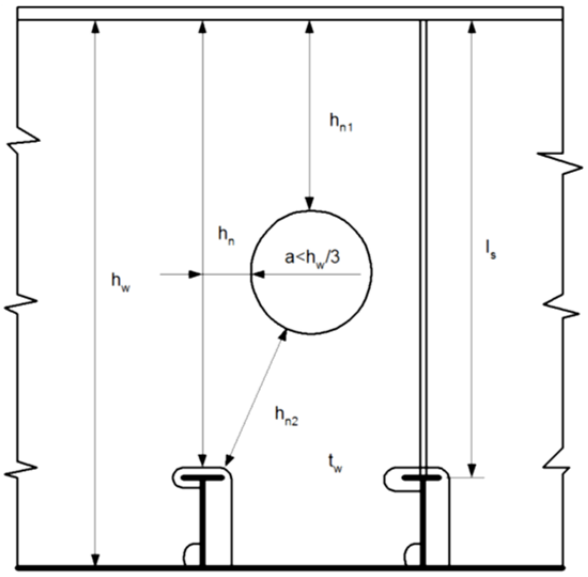
A = load area supported by the girder (m^2)

h_{eff} = effective girder height in m

P = design pressure of the girder, taken in the middle of the load area A

002 The above requirements apply when the web plate is perpendicular to the ship's side. For oblique angles the requirement is to be increased by the factor 1/cos α, where α is the angle between the web plate of the girder and the perpendicular to the ship's side.

003 Effective height of the girder web shall be taken after deduction of openings, as illustrated on figure below.



(e) End connections of stiffeners

001 Continuous stiffeners are regarded as "fixed ends". Continuous stiffener means its web and flange are carried through the member supporting the stiffener.

002 Stiffeners fitted with end bracket in compliance with 003-006, or bracketless connection according to 007, may be regarded as "fixed ends".

003 Arm length of the bracket should not be less than:

004 $$a = c\sqrt{\frac{Z}{t}} \qquad \text{(mm)}$$

c = 70 for brackets with flange or edge stiffener

= 75 for brackets without flange or edge stiffener

Z = required section modulus in cm^3 of stiffener

t = thickness of bracket in mm

005 The arm length, a, shall in no case be taken less than (1 + 1/ sinα) h, where α represents the angle between the stiffeners connected by the bracket, and h the depth of the lowest of the connected stiffeners. In addition the height of the bracket, hb, see figures in (b), shall not be less than h.

006 Brackets shall be arranged with flange or edge stiffener if free lengths exceed 50 (tb - tk) except when the depth of the bracket defined as the distance from the root to the edge is less than 22 (tb - tk).

007 The connection between stiffener and bracket shall be so designed that the effective section modulus is not reduced to a value less than required for the stiffener.

008 Bracketless end connections may be applied for longitudinals and other stiffeners running continuously through girders (web frames, transverses, stringer, bulkheads, etc.), provided

sufficient connection area is arranged for. Both web and flange of the stiffener should be effectively supported by backing structure.

009 Stiffeners with sniped ends may be allowed in compartments and tanks where dynamic loads are small and where vibrations are considered to be of small importance, provided the thickness of plating supported by the stiffener is not less than:

$$t = 1.25\sqrt{(l - 0.5s)sP} \text{ (mm)}$$

l = stiffener span in m

s = stiffener spacing in m

P = pressure on stiffener in kN/m^2.

010 Stiffeners with sniped ends shall be regarded as "simply supported".

(f) End connections of girders

001 Girders should be arranged with end connections according to requirement in this section, hence may be evaluated as with "fixed ends".

002 Girder arranged with end connection

003 Bracketless connections may be applied provided adequate support of the adjoining free flanges is arranged for.

004 The thickness of brackets on girders shall not be less than that of the girder web plate.

005 The arm length including depth of girder web may normally be taken as:

$$a = 63\sqrt{\frac{Z}{t}}$$

Z = Rule section modulus in cm^3 of the strength member to which the bracket is connected

t = thickness of bracket in mm

006 Flanges on girder brackets are normally to have a cross-sectional area not less than:

$A = l\,t$ (cm^2)

l = length of free edge of brackets in m

t = thickness of brackets in mm.

007 Bracketless connection of girder may be accepted under special consideration.

(g) Effective flange of girders

001 The section modulus of the girder is to be taken in accordance with particulars as given in the following.

002 The effective plate flange area is defined as the cross-sectional area of plating within the effective flange width. Continuous stiffeners within the effective flange may be included. The effective flange width be is determined by the following formula:

$b_e = C\,b$

C = as given in below table

Values of C								
a/b	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*≥7*

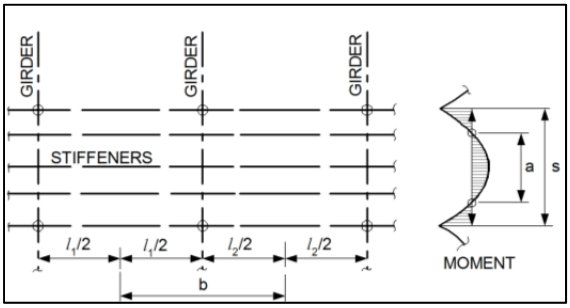
C (r ≥ 6)	0.00	0.38	0.67	0.84	0.93	0.97	0.99	1.00
C (r = 5)	0.00	0.33	0.58	0.73	0.84	0.89	0.92	0.93
C (r = 4)	0.00	0.27	0.49	0.63	0.74	0.81	0.85	0.87
C (r ≤ 3)	0.00	0.22	0.40	0.52	0.65	0.73	0.78	0.80

a = distance between points of zero bending moments, see figure below.
= S for simply supported girders
= 0.6 S for girders fixed at both ends

S = span of girder

b = plate flange width taken as the sum of half spans of adjacent stiffeners, see Fig.8

r = number of stiffeners along girder span.



(h) Stiffening of girders

001 In general girders are to be provided with tripping brackets and web stiffeners to obtain adequate lateral and web panel stability. The requirements given below are providing for an acceptable standard. The stiffening system may, however, be modified based on direct stress analysis and stability calculations according to accepted methods.

002 The web plate of girders are to be stiffened where:

$h_w > 75\ t_w$ (mm)

t_w = web thickness in mm, t_k not included

with stiffeners of maximum spacing:

$s = 60\ t_w$ (mm)

within 20% of the span from each end of the girder and where high shear stresses.

Elsewhere stiffeners are required where:

$h_w > 90\ t_w$ (mm)

with stiffeners of maximum spacing:

$s = 90\ t_w$ (mm)

003 Stiffening around openings is normally not required if the thickness of the girder web is more than 1.5 times the requirement in (d) Girder Webs. Otherwise will be specially considered.

004 The spacing S_T of tripping brackets (if required) is normally not to exceed the values given in table below valid for girders with symmetrical face plates. For others the spacing will be specially considered.

Spacing between tripping brackets	
Girder type	S_T (m)
Transverse girders Vertical girders Longitudinal girders outside 0.5 L amidships	0.02 b_f 1) maximum 6
b_f = flange breadth in mm S = distance between transverse girders in m. 1) For girders in tanks and machinery spaces S_T is not to exceed 0.014 b_f. 1) If the web of a strength member forms an angle with the perpendicular to the ship's side of more than 10°, S_T is not to exceed 0.007 b_f.	

005 Tripping brackets on girders are to be stiffened by a flange or stiffener along the free edge if the length of the edge exceeds:

$$0.06\ t_t \quad (m)$$

t_t = thickness in mm of tripping bracket, t_k not included.

006 Hatch end beams supporting hatch side coamings are to have tripping brackets located in the center line and between the hatch side coaming and the ship's side.

007 The thickness of tripping brackets shall not be less than:

$$t = 5 + 0.15\ L \quad (mm)$$

A. Pillars

(a) General

001 In this section the general requirements to steel pillars supporting structure or equipment are given.

002 Where practicable, deck pillars are to be located in line with pillars above or below. Otherwise beams or girders in deck in way will have to be reinforced.

003 Bulkhead supporting decks may act as pillars and strength need to be verified.

(b) Scantlings

001 Solid steel pillars shall have dimensions according to the table below.

Table E1 Solid steel pillars				
Load (kN)	Pillar length (m) (feet)			
	2.0	2.5	3.0	3.5
	Diameter (mm)			
30	50	53	56	59
40	53	56	60	64
60	56	60	65	69
80	59	64	69	73
100	62	68	73	78
130	65	71	77	82
160	68	75	81	86
200	71	78	84	90
240	74	81	88	94

290	77	84	91	98
340	80	88	95	102
400	83	91	99	106

Tubular pillars shall have dimensions according to the table below, based on the scantlings of solid pillars:

Table E2 Tubular steel pillars				
Diameter of equiv. solid pillar (mm)	Pillar length (m) (feet)			
	2.0	2.5	3.0	3.5
50	70x6.0	70x6.0	70x6.0	
55	70x6.0	70x6.0	70x6.0	
60	80x6.5	75x6.0	75x6.0	75x6.0
65	90x6.5	80x6.5	80x6.5	80x6.0
70	100x7.0	90x6.5	90x6.5	89x6.5
75	115x7.0	110x6.5	110x6.5	100x6.5
80	130x7.5	120x7.0	115x7.0	105x6.5
85	145x8.0	130x7.5	125x7.0	115x7.0
90	160x8.5	145x8.0	135x7.5	125x7.0

B. Aluminum

001 Aluminium alloy for marine use may be applied in superstructures, deckhouses, hatch covers, hatch beams and other local items.

002 In weld zones of rolled or extruded products (heat affected zones) the mechanical properties given for extruded products may in general be used as basis for the scantling requirements.

003 Note that for the alloy NV-A1MgSil the most unfavorable properties corresponding to -T4 condition are to be used.

004 Welding consumables giving a deposit weld metal with mechanical properties not less than those specified for the weld zones of the parent material are to be chosen

005 For aluminum structures earthing to steel hull is to be in accordance with DNV Ship Rules Pt.4 Ch.8.

C. Special requirements

(a) Bar keel

001 The scantlings of the bar keel are not to be less than:

depth: 100 + 1.5 L (mm)
thickness: 10 + 0.6 L (mm)

(b) Bar stem

001 If bar stem is fitted the scantlings are not to be less than:

width: 90 + 1.2 L
thickness: 12 + 0.48 L.

(c) Shaft tunnels

001 In ships with engine room situated amidships, a watertight shaft tunnel is to be arranged. Openings in the forward end of shaft tunnels are to be fitted with watertight sliding doors capable of being operated from a position above the load waterline.

002 The thickness of curved top plating may be taken as 90% of the requirement to plane plating with the same stiffener spacing.

003 If ceiling is not fitted on top plating under dry cargo hatchway openings, the thickness to be increased by 2 mm.

004 The shaft tunnel may be omitted in ships with service area notations **R2, R3, R4** and **RE** provided the shafting is otherwise effectively protected. Bearings and stuffing boxes shall be accessible.

(d) Strengthening against slamming

001 Vessels with minimum draught at F.P less than 0.05L, and bottom with a rise of floor less than 15 degrees, shall satisfy requirements below.

002 The minimum draught shall be given as vessel's operational limitation.

003 The flat part of the bottom forward may have to be strengthened against slamming. The slamming pressure forward of 0.25 L from F.P. may be taken as:

$$p_{sl} = 240\sqrt{L}\left(1 - \frac{20d_b}{L}\right) \quad (kN/m^2)$$

d_b = design ballast draught in m at F.P.

004 Aft of 0.25 L the slamming pressure may be reduced linearly to zero at 0.45 L from F.P.

005 For ships with service restriction notations the strengthening will be specially considered.

006 The thickness of the bottom plating is not to be less than:

$$t = 0.9s\sqrt{p_{sl}} + t_k \quad (mm)$$

007 Above the strengthened area the thickness is to be gradually reduced to the ordinary requirement at side.

008 The section modulus of longitudinals or transverse stiffeners supporting the bottom plating defined in 303 and 304 is not to be less than:

$$Z = 0.2\, l^2\, s\, p_{sl} \quad (cm^3).$$

009 If the minimum draught at FP is less than 0.025 L, the following additional floors and longitudinal girders will be required in the slamming area:

Alternative 1: Floors at every frame. Additional side girders.
Alternative 2: Floors at every second frame, side girders at maximum spacing 1.5 m.

010 For draught 0.025L and above, the floor and girder arrangement will be specially considered, especially with respect to shear areas of the webs.

(e) Strengthening against bow impact

001 For vessels with high speed, well rounded bow lines and/or large flare, special strengthening of the bow region is to be considered, see DNV *Rules of Classification of Ships* Pt.3 Ch.1 Sec.7 E100.

Section 4 – Additional Requirements for Fishing Vessels

A. Cargo Holds for Fish in Bulk

(a) General - Classification

001 The requirements in this Section are mandatory for vessels that intend to carry fish in bulk. The **notation S** will be added to the class notation assigned in accordance with the following sections.

(b) Assumptions

001 The rules in this section are based on the assumptions that:

- During loading in vessels having one longitudinal bulkhead, the level of cargo at any time will be approximately the same on both sides of the bulkhead
- Cargo not carried in tanks, is drained before loading
- Cargo holds fully loaded with fish treated with preserving agent, are checked regarding swelling.

B. Bulkhead Arrangement and Strength

(c) Location of bulkheads

001 Longitudinal bulkheads are normally to be arranged as follows:

B ≤6 m (19.68 ft) : One center line
B > 6 m (19.68 ft) : Two bulkheads
B = internal ship breadth measured between shell or ceiling.

002 Longitudinal bulkheads are to be positioned symmetrically about the ship's center line.
003 Transverse bulkheads in cargo holds are normally not to be spaced more than 0.15 L apart. The spacing need not be taken less than 9 m (feet) and is not to exceed 12 m (feet) .

(d) Design load conditions

001 If there is one longitudinal center line bulkhead a loading condition as defined in C. (b) 001 is assumed.
002 If there are two or more longitudinal bulkheads, these are to be designed for one-sided loading.
003 Transverse bulkheads are to be designed for one-sided loading.

(e) Longitudinal bulkheads with vertical wooden boards

001 In hatch openings in which vertical wooden boards are used, a steel stiffener is to be fitted at each side of the bulkhead top, and if necessary also half way up the bulkhead.
002 The section modulus of the longitudinal stiffeners in accordance with 003 is given on the assumption that stiffeners on each side of the bulkhead are connected to each other at 1/4 and 1/2 span. For area of connection, see (f) 009. If the stiffeners are not connected to each other, the section modulus according to 003 (below) is doubled.
003 The section modulus of each steel stiffener is to be at least:

$$Z = \frac{s+3}{6f_1} k\, h^2\, l^2 \qquad (cm^3)$$

k = 1.2 for one longitudinal bulkhead
k = 1.6 for two or more longitudinal bulkheads
h = height of bulkhead in m
l = distance between supports of steel stiffeners in m
s = greatest transverse distance between bulkheads or between bulkhead and ceiling at side in m.

The minimum section modulus is 40 cm3.

004 When steel stiffeners are fitted at both the top and half height of the bulkhead, the section modulus of the steel stiffeners is decided as follows:

Upper stiffeners:

$$Z = \frac{0.4 h^2 l^2}{f_1} \quad (cm^3)$$

Middle stiffener:

$$Z = \frac{s+3}{6 f_1} k\, h^2 l^2 \quad (cm^3)$$

k = 1.6 for one longitudinal bulkhead
k = 2.2 for two or more longitudinal bulkheads.

Remaining symbols as given in (c) 002

005 When there is one longitudinal bulkhead, the wooden board thickness is to be at least:

Without steel stiffener at mid-height:

$$t = 31\, h \quad (mm)$$

With steel stiffener at mid-height and at bulkhead top:

$$t = 10\, h + 35 \quad (mm), \text{ min. } 63 \text{ mm}$$

h = bulkhead height in m.

006 When there are two or more longitudinal bulkheads, the thickness of wooden boards is to be at least:

$$t = 22 l \sqrt{h} \quad (mm), \quad \text{min } 76 \text{ mm}$$

l = greatest span between supports in m
h = bulkhead height in m.

007 In hatch openings a channel section or similar is to be fitted over the top of the bulkhead to prevent the boards from floating away from the bulkhead. If the channel section is supported by the hatchway beams, these are to be secured to the hatch coamings.

008 The depth of guides for vertical boards is to be at least 100 mm (inches) below the deck and at the bottom. The minimum thickness of the section or plate which forms the guide is to be 10 mm (inches) . The clearance in the longitudinal direction of the boards is to be as small as possible

009 Guide bars are to have a continuous weld connection to the deck and bottom structure, see 004. In way of hatches the bottom guides are to be stiffened with tripping brackets maximum 2 frame spaces apart. Guide bars bedded in concrete are to be fastened to the ship's bottom structure. If this is not feasible, the guide bars are to be securely fastened in the concrete.

(f) Longitudinal bulkheads with horizontal wooden boards

001 The distance between vertical uprights, or permanent transverse bulkheads and uprights is normally not to be greater than 2.0 m (6.56 ft) and is in no case to exceed 2.25 m(6.56 ft).

002 If there is one longitudinal bulkhead, the section modulus of uprights is to be at least:

$$Z = \frac{0.5(s+3)h^3 b}{f_1} \ (cm^3), \ \text{min. } 40\ cm^3$$

h = free span of upright in m
b = distance between uprights in m
s = greatest transverse distance between bulkheads or between bulkhead and ceiling at side in meters

003 If there are two or more longitudinal bulkheads, the section modulus of uprights is to be at least:

$$Z = \frac{5.0\ h^3 b}{f_1} \ (cm^3), \ \text{min. } 40\ cm^3$$

h = free span of upright in m
b = distance between uprights in m

004 The uprights are to be secured at top and bottom so that the reaction forces are distributed to adjacent structures.
005 If openings are cut in the uprights for the entering of the upper boards, the boards in the opening are to be locked in position to prevent their slipping out of the guide.
006 Permanent pillars for hatch end beams or transverses which also serve as guides for shifting boards or removable bulkheads in steel ships are to have extra stiffening with brackets at the top. For scantlings of pillars, see (d) 002 and 003.
007 The wooden board thickness is to be at least:

$$t = k\, l \sqrt{h} \qquad (mm)$$

k = 20 for one longitudinal bulkhead
k = 24 for two or more longitudinal bulkheads
h = bulkhead height in m
l = distance between uprights in m.

Minimum board thickness is 76 mm (2.99 in.) for bulkhead heights over 1.9 m (6.23 ft.) and 63 mm (2.48 in.) for lower heights.

008 Supporting guides for wooden boards in stiffeners or uprights are to be at least 75 mm (inches) deep and made of plates or sections of at least 10 mm (inches) thickness. If the sections do not comply with the requirements to groove depth or breadth for bulkhead boards, a flat bar (or similar) is to be welded to the flange of the section and the breadth may be adjusted by inserting a lining into the groove.
009 Bulkheads are to extend to the deck. Between beams, the spaces above bulkheads are to be packed with filling pieces such as steel plates which are to run down the side of the uppermost board and be fastened to this.

(g) Transverse bulkheads with vertical wooden boards

001 When horizontal steel stiffeners are fitted at half height of the bulkhead, the section modulus of the steel stiffener is to be at least:

$$Z = \frac{2.6\ h^2 l^2}{f_1} \ (cm^3), \ \text{min. } 40\ cm^3$$

h = bulkhead height in m
l = distance between supports in m.

002 In exceptional cases the horizontal stiffener may be fitted on the hold side. A 100 x 12 mm (inches) flat bar is then to be fitted on the other side of the bulkhead. The bar is bolted to the horizontal stiffener with bolts spaced not more than 200 mm (inches) . The sectional area of the bolts at bottom of threads is not to be less than:

$$A = 1.2\ h^2\ b \quad (cm^2)$$

h = bulkhead height in m
b = bolt spacing in m.
Minimum bolt diameter 16 mm (0.63 in.).

003 The horizontal stiffener is fastened to frames etc. with bolts of which at least 2 on each side are to be through bolts. The total sectional area of the bolts at bottom of threads at each end is not to be less than:

$$A = 0.6\ h\ l \quad (cm2)$$

h = bulkhead height in m
l = span of stiffeners in m.
Minimum bolt diameter 16 mm(0.63 in.). .

004 The wooden board thickness is to be at least:

$$t = 25 l \sqrt{h} \quad (mm)$$

t = greatest span between supports in m
h = bulkhead height in m.
Minimum board thickness in 76 mm (2.99 in.) and 63 mm (2.48 in.), respectively, when the bulkhead height is, more or less than 1.8 m (5.91 ft.).

005 For details, see (d) 004 -006, (d) 008 and 009

(h) Transverse bulkheads with horizontal wooden boards

001 The section modulus of uprights is to be at least:

$$Z = \frac{5.3\ h^3 b}{f_1}\ (cm^3),\ \text{min. } 40\ cm^3$$

h = free span of upright in m
b = distance between uprights in m.

002 The board thickness is to be at least:

$$t = 27 l \sqrt{h} \quad (mm)$$

h = bulkhead height in m
l = distance between uprights in m, maximum 2.0 m.
Minimum board thickness in 76 mm (2.99 in.) and 63 mm (2.48 in.), respectively, when the bulkhead height is, more or less than 1.8 m (5.91 ft.).

003 For details, see (d) 004 -006, (d) 008 and 009.

004 Area of attachment (bolts, etc.). The area of attachment at the lower end of removable uprights is to be at least:

$$A = 0.9\ h2\ b \quad (cm2)$$

h = bulkhead height in m
b = distance between uprights in m.
Minimum bolt diameter 16 mm.

005 Sectional area at bottom of threads per bolt for bolted bulkheads is to be determined according to the formula in (d) 004 when:

b = bolt spacing in m.
Minimum bolt diameter 16 mm (0.63 in.).

006 The area of attachment at the top for single deck vessels can be 60% of the area stipulated in (d) 004 and 005.
007 All welds for the securing of bulkheads and uprights are to be of the double continuous type.
008 If a U-shaped collar is fitted around beams and keelson and secured with horizontal through bolts, the area of these bolts can be 60% of the area stipulated in (d) 004 and 005.
009 The total area of attachment between horizontal stiffeners mentioned in 301, is to be at least:

$$A = 1.05\ h2\ l \quad (cm2)$$

h = bulkhead height in m
l = distance in m between support of stiffeners.

(i) Permanent steel bulkheads

001 The section modulus of stiffeners on permanent longitudinal or transverse bulkheads is to be at least:

$$Z = \frac{k l^2 sh}{f_1} \ (cm^3), \text{ min. } 15\ cm^3$$

k = 3.75 for one longitudinal bulkhead
k = 4.5 for transverse bulkheads
k = 4.5 for 2 or more longitudinal bulkheads
l = stiffener span in m
s = stiffener spacing in m
h = height in meters from midpoint of stiffener span to top of bulkhead or hatch coaming.

002 The stiffener's moment of inertia is to be at least:

$$I = 2.2\ Z\ \sqrt[3]{Z} \quad (cm^4)$$

Z = as given in (g) 001, with f1=1.0.

003 Permanent pillars which are welded to permanent bulkheads and also serve as guides for removable bulkheads in way of hatches are to have scantlings as given in (g) 001 and 002, when s = breadth of load surface in m. Remaining symbols as under (g) 001.
004 The plate thickness in permanent steel bulkheads is to be as given in (h) 002.
005 Corrugated bulkheads will be accepted provided their strength is equivalent to that of plane bulkheads.
006 Stiffeners are to be fitted with brackets at both ends. The brackets are not to terminate on unstiffened plating or over a scallop

007 When the corrugations are deep, care is to be taken, particularly at the bottom, that the corners of the corrugations do not end on unstiffened plating

008 The various structural parts are to be connected by welding in accordance with the requirements for watertight bulkheads.

(j) Removable bulkheads of steel or aluminum

001 Removable steel or aluminum bulkheads which are used in connection with hatches are to be double plated with the stiffeners placed horizontally. Internal surfaces of steel bulkheads are to be covered by a corrosion-resistant coating.

002 The plate thickness in removable bulkheads is to be at least:

Steel:

$$t = \frac{3.4s}{\sqrt{f_1}}\sqrt{h} + 1.5 \quad \text{(mm), min. 6 mm}$$

Aluminum:

$$t = 4.7s\sqrt{h} + 1.5 \quad \text{(mm), min. 6 mm}$$

s = stiffener spacing in m
h = height in m from upper edge of bulkhead to lower edge of plating.

The section modulus of horizontal stiffeners is not to be less than:
Steel:

$$Z = \frac{7.0 l^2 sh}{f_1} \quad (cm^3)$$

Aluminum:

$$Z = 13.5\, l\, 2\, s\, h \quad (cm3)$$

l, s and h = as given in (g) 001.

003 For aluminum materials with a guaranteed 0.1% tensile proof stress ($\sigma_{0.1}$) which exceeds 12.5 kp/mm^2, the requirement to Z can be reduced in direct proportion. If however, the material's guaranteed $\sigma_{0.2}$ value is greater than 70% of the guaranteed ultimate tensile strength, the lower value is to be used as a basis for scantlings.

004 The moment of inertia of stiffeners is not to be less than:

$$I = k Z \sqrt[3]{Z} \qquad (cm^4)$$

k = 2.2 for steel
= 5.75 for aluminum
Z = as given in 803 for steel, with f1 = 1.0.

005 When welding aluminum, attention should be paid to the reduced strength of the material in the weld area, and the weld should, where practicable, be positioned in less stressed areas.

006 Guides for removable bulkheads are to have brackets at 1 m spacing. The depth of the support at the sides of removable bulkheads is to be at least equal to the bulkhead thickness, and not less than 65 mm (2.55 in.). The minimum thickness of sections or plates which form the guides is 10 mm (.39 in.).

007 In order to prevent galvanic corrosion, insulation is to be fitted at connections or contact surfaces between steel and aluminum.

008 If necessary, removable bulkheads are to be equipped with a securing arrangement for preventing the bulkhead from floating.

009 Slot welding is carried out against a 50 x 8 mm steel flat bar or equivalent.

010 Removable aluminum bulkheads are presumed constructed of a sea-water resistant alloy.

(k) Corrugated aluminum sections

001 Corrugated aluminum shifting boards may be used instead of horizontal wooden boards. The maximum length between supports is not to be greater than:

$$l = \frac{k}{h}\left(\frac{I_A\, h\sqrt{h}}{b}\right)^{\frac{1}{3}} \quad (m)$$

k = 0.6 for one longitudinal bulkhead
k = 0.5 for 2 or more longitudinal bulkheads
k = 0.4 for transverse bulkheads
h = bulkhead height in m
b = board breadth in m
I_A = moment of inertia of board in cm4.

002 In order to prevent galvanic corrosion, insulation is to be fitted at connections or contact surfaces between steel and aluminum.
003 The corrugated boards are to be made of seawater resistant aluminum.
004 For details the same rules apply as for bulkheads with horizontal wooden boards.

(l) Pillars

001 Pillars acting as supports for deck loadings are to be permanently connected at top or bottom. If the connections are arranged with bolts these bolts are to be secured by welding.
002 Pillars acting as supports for shifting boards only may have ordinary bolt connections.

(m) Bulwarks

001 The thickness of bulwark plating is not to be less than 80% of Rule thickness of side shell plating, and minimum 6 mm.
002 Bulwark stays are to be fitted at every 2nd frame.

C. Fishing Vessel Additional Notations

(a) Stern Trawler - Additional requirements

001 Vessels built for stern trawling may be given the additional class notation Stern Trawler provided the additional requirements in (b) 001-009 of this paragraph are also complied with.
002 The thickness of bottom and side shell plating up to a height 2 m above loaded waterline is not to be less than

$$t = \frac{4 + 0.04L}{\sqrt{f_1}} + 2 \quad (mm)$$

t need not be taken more than 10 mm.=

003 The thickness of side shell plating above the limit given in 002 is not to be less than given *"Rules for Classification of Ships – Newbuildings Pt.3 Ch.6."*
004 For frame spacings exceeding the rule values given in Sec.1 the plate thickness is to be increased in direct proportion.
005 The thickness of bottom plating is also to comply with the requirements to buckling strength as given in DNV's *Rules for Classification of Ships Pt.3 Ch.1 Sec.14 or Pt.3 Ch.2 Sec.13*.
006 The thickness of trawl ramp and adjacent side plating, stern and side plating abaft the point where the trawling boards are normally taken on board, is not to be less than:

$$t = \frac{5 + 0.12L}{\sqrt{f_1}} + 2 \quad \text{(mm), min. 12 mm}$$

007 Between gallows the bulwark plating is to have the same thickness as the side shell plating, and bulwark stays are to be fitted at every frame.

008 Where bulwarks, sheer strake, side shell and transom plating are particularly exposed to blows and chafing, steel rubbing pieces are to be fitted, consisting of minimum 75x37 mm half-round bars or equivalent.

009 The section modulus of stiffeners in the trawl ramp is not to be less than

$$Z = \frac{15 l^2 s}{f_1} \quad (cm^3)$$

(b) Fish RSW Tanks

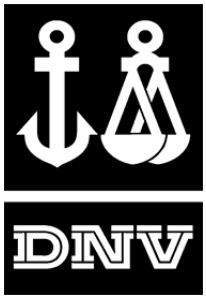
001 Fishing Vessels meeting 002 through 005 below may be given the additional notations RSW

002 Refrigerated Sea Water (RSW) tanks for transportation of fish are to be designed for relevant pressure heads in accordance with the rules.

003 Where an internal skin is fitted and welded continuously to every other frame/stiffener and slot-welded to the rest, and the gap between skin and hull structure is filled with insulation of an approved type an effective flange, b = 40 t (where t = skin thickness, minimum 5 mm) may be included, when calculating the section modulus of strength members. The skin plate is to be made continuous with good end connections and should not be terminated abruptly.

004 The insulation material is to have good adhesion to steel and suitable strength characteristics (e.g. polyurethane foam, density of 45 kg/m3). The steel surface is to be corrosion protected before it is insulated.

005 Corrugated bulkheads are to be supported along both bulkhead flanges in the bottom structure with sufficient connections to crossing members. Carlings are to be fitted in way of corners in corrugations and ends of unstiffened plate panels.



STANDARD FOR CERTIFICATION
No. 1USFV

Interim Rules v5.0

Chapter V– Machinery and Systems

Chapter V - Machinery and Systems

A. Documentation

(a) Documentation Required – Piping Drawings

001 Bilge, Sea chests, and Ballast
002 Fuel and lube oil
003 Exhaust piping
004 Cooling water
005 Raw and potable water
006 Sanitary water black/grey
007 Overboard discharges
008 Hydraulic systems
009 Compressed/Control Air
010 Oily water separator
011 Fire main
012 Refrigeration
013 Ventilation

(b) Documentation Required – Electrical

001 One line AC and DC
002 Load Analysis – AC and DC
003 Distribution Ac and DC
004 Lighting main and emergency
005 Interior communication
006 General Alarm and fire detection
007 Switchboards (main and emergency)
008 Alarm and monitoring
009 Propulsion Control
010 Steering control
011 Motor control
012 Emergency shutdowns

(c) Documentation Required – Specifications and Bill of Materials

001 All relative manufacturers data

a. Specifications
b. Certifications
c. USCG approvals
d. Type Approvals
e. Any other industry accepted standard documentations

B. Certification

(a) Machinery

001 Class usually employs a process of on-site certification of machinery and components (the CMC process) or type approval for key machinery and components used in the shipbuilding process.
002 For F/Vs Classed under this Rule, machinery and components shall meet industry accepted standards with supporting documentation per A.(c) above.
003 New technologies or machinery and components heretofore unused in the industry shall be certified and approved by DNV.

C. Propulsion and auxiliary engines

(a) Engines

001 Engines shall be of recognized type adapted for maritime use. Engines with a power exceeding 2 500 kW shall be Type Approved by DNV or another recognized organization. Individual DNV approved product certificates are not required. Engine documentation shall meet the requirements in Section A (c) above

002 Inboard diesel engine(s) shall normally be used for main propulsion. Natural gas fired engines can be considered as an alternative (DNV Rules for Certification High Speed, Light Craft, and Naval Surface Craft Part 6 Chapter 13).

(b) Engine room

001 The engine room shall not be used for other purposes. The normal service points of the engine shall be readily accessible. Rotating parts shall be shielded to prevent personal injury.

002 Windows, scuttles or similar in engine room shall have the same fire rating as surrounding structure.

003 The engine room shall be equipped with artificial lighting.

004 Ventilation of the engine room for the engine's air consumption and cooling shall be arranged according to the engine manufacture's specifications. The engine room/space shall have ventilation to the outside. The total cross sectional area of intake ventilation openings and ducts shall not be smaller than 7 cm2 (inches)/kW(HP?) or the engine manufacturer's specifications.

005 Ventilation openings shall be equipped with fire closing appliances that can be operated from outside the engine room and secured in open and closed position.

(c) Engine controls

001 Engines shall be possible to monitor from the helm position. The following indicators or alarms shall be visible/audible:

- speed of revolutions (may be omitted for auxiliary engines)
- lubrication oil pressure
- cooling water temperature
- alarm for loss of exhaust cooling

The instrumentation shall be equipped with adjustable lighting.

(d) Exhaust

001 Each engine shall have a separate exhaust system or a system installed in accordance with the engine manufacturer's recommendations.

002 Exhaust lines shall be accessible for inspection.

003 Exhaust line with a surface temperature exceeding 80ºC (176°F)shall be equipped with protection against touching. Exhaust piping shall not be arranged in such a way that other materials or structures reach temperatures above 65ºC (149°F).

004 Materials in seawater cooled exhaust systems shall be corrosion resistant. Special attention shall be given to avoid galvanic corrosion.

005 Seawater cooled exhaust systems shall be equipped with alarm at the steering position for loss of seawater cooling or for high temperature in the exhaust pipe.

006 Exhaust outlets shall be at least 100 mm (0.32 in.) above loaded water line or the exhaust line shall consist of a metallic pipe brought at least 100 mm above loaded water line.

007 At one location the lower inside surface of the exhaust pipe shall be at least 350 mm (1.14 in.) above loaded water line. From this location the pipe shall fall continuously to the exhaust outlet.

008 Flexible rubber and plastic hoses for wet-exhaust system shall be a class B hose according to ISO 13363:2004 or equivalent.

Section 2 - Driven units

A. Shafting

001 The diameter of steel shafting shall be in accordance with the engine manufacturer's recommendation, but not smaller than:

$$d = 90 \cdot \left(\frac{P}{RPM}\right)^{1/3} \cdot \left(\frac{600}{Rm + 160}\right)^{1/3}$$

P = maximum continuous power of driving engine (kW)(HP)
RPM = shaft revolutions pr. minute
Rm = tensile strength (MPa).

002 Shafting shall be supplied by recognized manufacturers. The dimensions of shafting fabricated from materials other than steel are subject to special consideration.

B. Shaft brackets and stern tubes

003 Shaft bearings shall be sufficiently lubricated.
004 One-armed shaft brackets shall have a section modulus W at the vessel's bottom not smaller than:

$$W = \frac{l \cdot d^2}{112 \cdot Rm} \quad (cm^3)$$

d = shaft diameter (mm) (in.)
l = length of bearing (mm) (inches)
Rm = tensile strength (MPa)

.

At the bearing the section modulus shall not be smaller than 0.6 W.

C. Gears and Propellers

Gears and propellers shall be supplied by industry recognized manufacturers. The equipment shall be reviewed by DNV in the bill of materials as meeting typical industry standards.

Section 3 - Steering

A. Definitions

The following definitions apply in this section:
K = steering force on tiller at point of actuation (N)
F = steering force on rudder (N)
A = rudder area (m2) (inches2)
V = maximum vessel speed (knots)
Sa = length of tiller from rudder stock center to point of actuation (mm) (inches)
Sb = distance from pressure center of rudder to lower rudder bearing for spade rudders, to upper bearing for balance rudder (mm) (inches)

Sv = distance from rudder pressure center to axis of rotation, not to be taken smaller than 40% of the chord length aft of the leading edge for plate rudders, not to be taken smaller than 30% of the chord length aft of the leading edge for profile rudders (mm) (inches)
P = maximum engine power output (kW) (HP)
M = combined bending moment and torque on rudder stock (Nmm) (???)
d = diameter of rudder stock (for solid stock) (mm) (inches)
σ0.2 = yield stress of rudder stock or other item, as applicable (MPa).

B. Arrangements

(a) General

001 The steering arrangement shall ensure reliable maneuvering of the vessel at the maximum engine power for which the vessel is certified. The steering system shall be protected.
002 It shall be possible to steer the vessel by means of an emergency arrangement also when the normal means of actuating the rudder/waterjet has failed.
003 Rudder stops shall be fitted.

C. Forces on steering system

(a) Rudder steering

001 The steering force K with rudder shall not be taken smaller than:

$$K = F \cdot \frac{S_v}{S_a} \quad (\mathrm{N})$$

with F not taken smaller than:

$$F = 110 \cdot A \cdot V^2 \quad (N)$$

The means of actuating the rudder shall have a capacity corresponding to not less than 2 times the maximum torque on the rudder stock.

D. Rudder stock

(a) General

001 The combined bending moment and torque, M, on the rudder stock shall not be taken smaller than:

for balance rudders

$$M = \left(\frac{F \cdot S_b}{4} + \frac{F}{2} \cdot \left(S_b + 2 \cdot S_v^2 \right)^{1/2} \right) \quad (Nmm)$$

for spade rudders

$$M = \left(\frac{F \cdot S_b}{2} + \frac{F}{2} \cdot \left(S_b + 2 \cdot S_v^2 \right)^{1/2} \right) \quad (Nmm)$$

002 The diameter d of the rudder stock shall not be smaller than:

$$d = \left(\frac{M}{\sigma_{0.2}}\right)^{1/3}$$

for solid stocks.

Hollow stocks shall satisfy the following criteria:

$$d = \left(d_0^4 - d_i^4\right)^{1/3}$$

do = outer diameter of stock
di = inner diameter of stock.

003 The length of the bearings shall normally not be smaller than d. The nominal contact pressure on the bearing (stock diameter x length of bearing) shall normally not exceed:

- 7.0 (MPa) for steel against steel
- 4.5 (MPa) for steel against white metal
- 5.5 (MPa) for steel against synthetic materials, water lubricated

.

004 The diameter of pintles shall not be smaller than

$$0.6 \cdot d + 5 \text{ mm. (inches)}$$

005 Fillets shall be carried out with radii such that undue stress concentrations are avoided.
006 The diameter of bolts, db, in flanged couplings shall not be smaller than:

$$d_b = 0.65 \cdot \frac{PCD}{2 \cdot \sqrt{n}} \quad (mm)$$

n = number of bolts, shall not be smaller than 4
PCD = pitch circle diameter, shall not be smaller than 2 · d

The thickness of the flanges and there width outside the bolt holes shall not be smaller than db.

007 The packing box of the rudder stock housing shall normally not be placed lower than 100 mm (0.32 in.) above the deepest waterline. If placed below a grease filled packing box with at least two seals shall be fitted.

E. Rudder

001 Rudders can be fabricated from steel, or aluminum.
002 The plate thickness t in plate rudders shall not be smaller than:

$$t = 3 + 0.125\ d \text{ (mm) (inches)}$$

003 The plate thickness of profile rudders shall not be smaller than:
004 t = 4 (mm) (0.013 in.)
005 The section modulus W of the rudder at any horizontal section through the rudder shall not be smaller than given by:

$$W = \frac{M_{bend}}{\sigma_{all}}$$

Mbend = bending moment at the cross section due to maximum rudder lift force
σall = allowable bending stress
σall shall not be taken larger than:

- 50% of specified minimum yield strength for steel.
- 50% of minimum yield strength in welded condition for aluminum

006 The total effective shear area A web of vertical webs in any horizontal cross section shall not be smaller than given by:

$$A_{web} = \frac{S}{\tau_{all}}$$

S = maximum lift force of the part of the rudder below the cross section
τ_{all} = allowable shear stress
τ_{all} shall not be taken larger than:

- 29% of specified minimum yield strength for steel.
- 29% of minimum yield strength in welded condition for aluminum

F. Steering system

(a) Hydraulic steering system with or without external source of power

001 The capacity of the steering system shall be documented.
002 The complete installation shall be tested for leaks.
003 The satisfactory function of the steering system shall be verified by practical operational test at sea trial.
004 Hand operated hydraulic steering systems shall be CE-marked according to Council Directive 94/25/EC or equivalent and installed according to the manufacturers recommendations.

(b) Steering wheel

001 Steering wheels shall be CE-marked according to Council Directive 94/25/EC or equivalent. For not CE-marked steering wheels the requirements below apply.
002 For open steering positions a steering wheel fabricated from plastic materials without structural metal frame shall not show any major decrease in strength after ageing in xenon light corresponding to 4 years of natural ageing. This requirement may be deleted for black wheels.

Section 4 - Piping Systems and Tanks

A. General

001 The material(s) used in piping systems shall be suitable for the carried liquid and external environment to which it is exposed. Corrosion and variation in temperature shall be considered. Different materials shall not be combined such that there is a possibility for galvanic corrosion.
002 All components in the installation shall have sufficient strength and be so mounted that the system including its foundations will withstand the accelerations and vibrations to which it may be exposed as well as the design pressure. They shall be protected against mechanical damage. Expansion loops or equivalent arrangement shall be provided to allow expansion/contraction of pipes.
003 Flexible hoses used in fuel system, seawater cooling system, bilge system and other systems where a failure of the connection will lead to flooding shall be fitted with two stainless steel hose clamps or pressed on end couplings.
004 Pipes or hoses shall not be installed over switchboard or electrical distribution panels.

B. Bilge System

(a) Arrangement

001 The bilge system shall normally consist of rigid pipes fabricated from steel, Metallic materials shall be used in the engine room. The bilge system shall be permanently installed. If flexible hoses are used attention shall be given collapse due to suction.

002 The bilge system shall be able to empty all compartments except tanks.

003 Separate suction lines shall be fitted to each watertight compartment and be equipped with a valve between the main bilge line and the individual suction line. The valve shall be possible to operate from above floors. Emptying by use of the bilge system of small compartments may not be required based on special consideration.

004 One bilge pump driven directly by the engine or by electric motor shall be installed. The bilge pump shall have a capacity Q not smaller than:

Table B1 Bilge pump capacity	
Loa (m)	Capacity (l/minute)
<8	60
8-10	80
10-12	120
12-15	180
15 – 24	250

The bilge pump shall be possible to operate from the steering position. For vessel with L larger than 6 m minimum two pumps shall be fitted, each with at least 50% of the capacity given above.

005 Alternative to the arrangement using one bilge pump, separate bilge pumps may be installed for one or more compartments. Pumps shall be possible to operate from the steering position.

(b) Alarm

001 Engine, fish hold, cargo spaces and all other compartments (with exception of tanks) shall be fitted with bilge alarm.

C. Fuel system

(a) Arrangement

001 Fuel strainers, filters and water separators shall be easily accessible and possible to replace, drain and clean with engine in operation.

002 Fuel tanks shall not be located above the engine.

003 Fuel tanks may be integral or separate. Separate tanks shall be mounted such that air can circulate freely around the tank and such that they can be readily inspected or movable for inspection.

(b) Fuel tanks

001 Fuel tanks shall be fabricated from steel, or aluminum. Tanks in engine room shall be fabricated from steel or aluminum.

002 The design pressure p of fuel tanks shall be taken as the larger of:

$$p = 25 \cdot hs \text{ (kN/m2), and}$$
$$p = 6.6 \cdot hp \text{ (kN/m2), and}$$

hs = height of tank (m)
hp = height from bottom of tank to top of filling and air pipe (m)

.

003 The plate thicknesses (mm) shall not be smaller than:

Carbon steel:	2.0 (mm) (inches)
Stainless steel:	2.0 (mm) (inches)
Aluminum:	2.0 (mm) (inches)

004 Fuel tanks shall have an inspection hatch. For removable tanks an inspection hatch is not required.
005 Wash bulkheads shall allow adequate circulation of the fuel along the top and bottom of the tank.
006 Each tank shall have separate filling pipe and air vent. The air vent shall be mounted in a way to prevent water from entering the tank. The filling pipe shall have an internal diameter of at least 38 mm. The vent pipe shall have an internal diameter of at least 16 mm (0.053 in.). If the filling pipe has a screw coupling or similar device for the filling line, the internal cross sectional area of the vent pipe shall not be smaller than 125% of the internal cross sectional area of the filling pipe.
007 The amount of fuel in the tank arrangement shall be possible to verify at any given time, e.g. by fitting a level gauge to each tank. External sight glass shall have a self-closing valves.

(c) Fuel piping

001 Fuel lines may consist of metal pipes or flexible hoses, or a combination thereof. Fuel lines shall not pass over engine(s) or be arranged such that a leakage can occur on to sources of ignition (e.g. hot surfaces).
002 The engine shall be connected to the fuel line by a short flexible hose.
003 Flexible hoses shall satisfy the requirements of ISO 7840 or equivalent Small vessel fire resistant fuel hoses type A1 or A2 or equivalent, and be marked in accordance with this standard.
004 Shutoff valves, installed so as to close against the fuel flow, must be fitted in the fuel supply lines, one at the tank connection and one at the engine end of the fuel line to stop fuel flow when servicing accessories. The shutoff valve at the tank must be manually operable from outside the compartment in which the valve is located, preferably from an accessible position on the weather deck. If the handle to the shutoff valve at the tank is located inside the machinery space, it must be located so that the operator does not have to reach more than 300 millimeters (12 inches) into the machinery space and the valve handle must be shielded from flames by the same material the hull is constructed of, or some noncombustible material. Electric solenoid valves must not be used, unless used in addition to the manual valve. At least two hose clamps fabricated from stainless steel shall be used at each connection on flexible hoses. Spigots shall be sufficiently long to accept the hose clips and have grooves or a bead.
005 Flexible hoses for pressurized system(s) shall be fitted with pressed on end fittings.

(d) Testing

001 After installation a leakage test shall be carried out of the whole installation with a pressure equal to 20 kPa. (3.0 psi)

D. Seawater cooling systems

(a) General

001 Flexible hoses may be fitted. Flexible hoses shall be mounted in such a way that they are protected against mechanical damage. Flexible hoses shall comply with the same requirements

given for flexible hoses used in fuel systems. Flexible hoses shall be secured with at least two stainless steel hose clips or pressed-on couplings.

002 Seawater intakes shall have strainers or filters. All filters shall be fitted such that they can be cleaned while the engine is running.

E. Freshwater systems and grey water systems

(a) General

001 Fresh water tanks shall be accessible for cleaning.

002 Integral freshwater tanks shall not be located contiguous to fuel or grey water tanks.

003 Marine Sanitation Devices shall be installed in accordance with USCG and WPCA requirements.

F. Shell penetrations

(a) General

001 Penetration located lower than 200 mm (7.87 in.) above deepest waterline shall be arranged with closing valve or other equivalent means for preventing water from passing inboard. The valve shall be readily accessible for operation from a position above floor, or immediately below via easy operable and marked hatch in floor plate.

002 Penetration located less than 200 mm (7.87 in.) above deepest waterline and connected to a system with open inboard end located below lowest part of bulkhead-deck, and penetration located in a position immersed at an angle of heel of 10º, shall in addition to closing valve be arranged with non-return valve.

003 Valve shall have system name and indicator showing closed and open position.

004 Material of valve and hull flange shall be of steel, bronze or other equivalent accepted ductile material resistant to corrosion.

G. Bilge and Drainage Arrangement

(a) Arrangement - Cargo holds for fish in bulk

001 There is to be good drainage for water, oil or brine from the cargo. Trunks and gutters are to be located such that they at all times will provide good drainage from all layers of the cargo, throughout the hold.

002 In each bin there is to be drainage to bilge well through vertical drainage trunks of perforated plates, grating, etc. as specified in Table A1.

The minimum acceptable perforated circumference per trunk is 0.3 m (0.98 ft.). The perforations are to consist of 4-8 mm (0.16 – 0.31) holes or equivalent.

Table A1 Drainage Arrangement.

Area in m2 of bin below deck	*Minimum number of drainage trunks per bin*	*Total length in m of trunk perforated circumference per bin*
A < 10	2	0.8
10 ≤ A < 15	3	1.0
15 ≤ A < 20	3	1.2
20 ≤ A < 25	4	1.4
25 ≤ A < 30	4	1.6
30 ≤ A < 35	5	1.8

003 Each cargo hold is to have a bilge well at its after end. If the length of the watertight compartment exceeds 9 m, there is to be a bilge well also at the forward end.
004 Each bilge well is to have a volume not less than 0.15 m^3.(feet)
005 From each bilge well, a separate branch suction line is to be led to the engine room. The bilge distribution chest valves are to be of screw-down non-return type. All valves are to be fitted in readily accessible positions.
006 The valve chest collecting branch suction lines from cargo holds for fish in bulk are to have no connections from dry compartments. The valve chest is to be directly connected to the largest bilge pump. In addition, a connection is to be provided to another bilge pump.
007 The internal diameter of the branch suction lines is to be as required in "*Rules for Classification of Ships Pt.4 Ch.6"* for main bilge lines. Minimum diameter 50 mm (1.96 in.) .
008 Means for back-flushing bilge suctions is to be provided. The connecting of water supply for back-flushing is to be by portable means, e.g. hose.

(b) Tanks for fish in refrigerated sea water tanks (RSW-tanks)

001 The RSW-tanks are to have a pumping system for filling and emptying of seawater. The system is to have pipe dimensions complying with the requirements for ballast systems.
002 If the tanks are to be used also for carrying dry cargo, the tanks are to be arranged with bilge system. If the tanks are to be used for carrying fish in bulk, the requirements given in (a) 003 and 004 are also to be complied with.
003 Where RSW-tanks are also arranged for carrying dry cargo, blank flanging or two closeable valves in series to avoid ingress of water from RSW system to the bilge system are required.

(c) Engine room bilge water monitoring

001 Alarm for high level in bilge wells in engine room is to be installed on the bridge.

Section 5 - Electrical Systems

A. Scope

(a) General

001 The present section does not apply to electrical components on the propulsion or auxiliary engine(s). Equipment considered to represent a safety hazard may be required to be replaced or modified regardless of where it is mounted.
002 The present section does not cover personnel protection with respect to exposure to electromagnetic fields, e.g. from radar and CRT screens.

B. DC systems – Voltage ≤50 V

(a) General

001 Direct current systems which operate at nominal potential not exceeding 50 V shall comply with ISO 10 133 or equivalent and the requirements given in this section.
002 A circuit plan shall be supplied with the vessel when delivered and be available onboard. All markings shall be permanent.
003 Electrical fittings shall have IP rating(s) suitable for the exposure where they are located. Electrical equipment located in an environment with explosion hazard shall be Ex approved. Battery installations and gas installations are considered explosion hazard areas.

(b) Battery installations

001 Battery installations with a capacity exceeding 5 kWh shall be placed in compartments with ventilation to the outside of the vessel. Battery installations placed in accommodation areas shall be ventilated separately to the outside of the vessel.

002 Each battery shall be marked indicating the connected consumers and how connections between batteries shall be carried out.

003 Batteries installed inside the same watertight compartment as the propulsion engine(s) shall be mounted such that they are not short circuited when the compartment is filled with water up to the loaded water line. Alternatively, emergency batteries for supply to emergency lighting, navigation equipment and radio, may be placed above main deck.

004 For main engines with electric starter, the starter shall be possible to connect to two separate groups of batteries. One of the groups shall be assigned to starting and shall not be used to supply other consumers. The other group may be one used for consumers and which have a capacity that is sufficient to start the main engine.

(c) Distribution systems

001 For propulsion engines with a power output less than 100 kW(HP), the engine may be used as conductor when starting the engine.

002 Gas alarms, theft alarms, heating equipment and automatic bilge pumps may be connected between the battery/generator and the main switchboard, but must have separate protection with circuit breakers.

003 Cable penetrations in watertight bulkheads and decks shall be watertight.

004 The following cables shall be carried as separate, insulated single conductors:

- conductor to connect generator to batteries
- conductor to connect battery to electrical starter
- conductor to connect battery or generator to switchboard

The conductor between battery and electrical starter shall not be protected by circuit breaker. The conductor shall comply with the engine manufacturer's recommendations.

005 Interior lighting shall be distributed on at least two separate circuits.

(d) Protection

001 Circuit breakers shall not be placed in tank compartment or compartments for equipment that may generate explosive gases (e.g. battery installation, gas installations).

002 Safety equipment as e.g. radio, sound horn, search light etc. and consumers with drawing a current larger than 5 A shall be equipped with separate circuit breakers.

003 Navigation lights shall have separate circuit breakers. If the functioning of the navigation light can not be monitored from the steering position each light shall be equipped with an optical or audible alarm to the steering position indicating if the light is functioning. Malfunctioning of the system for indication shall not influence the function of the navigation light.

(e) Switchgear and control gear assemblies

001 Switchboards shall be protected against leaks and spray from sea and piping and shall be accessible for maintenance and replacement and visual inspection during operation.

002 Each group on the switchboard shall be independently available for measurement of insulation.

C. AC systems – Voltage ≤ 240 V

(a) General

001 Alternating current systems which operate at nominal voltage not exceeding 250 V shall comply with ISO 13297 or equivalent and the requirements given in this section. Such systems shall be installed as single phase systems.
002 A circuit plan shall be supplied with the vessel when delivered and be available onboard. All markings shall be permanent.
003 Electrical equipment located in an environment with explosion hazard shall be Ex approved. Battery installations and gas installations are considered explosion hazard areas.

(b) Distribution systems

001 Cable penetrations in watertight bulkheads and decks shall be watertight.
002 Interior lighting shall be distributed on at least two separate circuits, one of which must be an emergency circuit to illuminate light fixtures in the event of loss of main power. Alternately, light fixtures with internal battery backup may be utilized. If this type of light fixture is used, the internal batteries shall be inspected for functionality on the same schedule as other main battery systems.

(c) Protection

001 Circuit breakers shall not be placed in tank compartment or compartments for equipment that may generate explosive gases (e.g. battery installation, gas installations).
002 Safety equipment as e.g. radio, sound horn, search light etc. and consumers with drawing a current larger than 5 A shall be equipped with separate circuit breakers.
003 Navigation lights shall have separate circuit breakers. If the functioning of the navigation light can not be monitored from the steering position each light shall be equipped with an optical or audible alarm to the steering position indicating if the light is functioning. Malfunctioning of the system for indication shall not influence the function of the navigation light.

(d) Switchgear and control gear assemblies

001 Switchboards shall be protected against leaks and spray from sea and piping and shall be accessible for maintenance and replacement and visual inspection during operation.
002 Each group on the switchboard shall be independently available for measurement of insulation.
003 All switchboards and assemblies shall be safe against accidental touching of live conductors during normal operation.
004 Instruments, handles, push buttons or other devices that should be accessible for normal operation shall be located on the front of switchboards and control gear.
005 All other parts that might require operation shall be accessible. Doors behind which equipment requiring operation is placed shall be hinged. Hinged doors, which shall be opened for operation of equipment, shall be provided with easily operated handles or similar. There shall also be arrangements for keeping the doors in open position.
006 Main and emergency switchboards shall have handrails with an insulating surface.
007
008 The cable(s) for shore connection shall have a solid sheath resistant to oil and weathering. The socket inlet shall be protected from spray water and rain.
009 Equipment connected to the shore connection shall become earthed to the shore connection.

D. Emergency power supply

001 An alternative power supply shall be available capable of supplying the following consumers for a period of at least 3 hours:

- emergency lights in wheelhouse, accommodation and engine room (for small vessel portable flashlights may be accepted as emergency lights)
- navigation lights or Not Under Command lights
- fire detection and alarm systems
- remote control devices for fire extinguishing systems, if electrical
- navigation equipment

- communications equipment

002 The alternative power supply shall be fitted outside the engine room and above the flooded waterline with the engine room flooded.

Section 6 – Navigation, Communication and Other Systems

A. Navigation

(a) General

001 Navigation lights according to national or international regulations shall be fitted.
002 Vessels must have the navigational information on board required by : Ref. 33 CFR 88.05, 46 CFR 28.225

(b) Compass

001 Each vessel must be equipped with an operable magnetic steering compass, with a compass deviation table at the operating station. Ref. 46 CFR 28.230
002 Electronic position fixing-devices Ref.: 46 CFR 28.260

B. Communications Equipment & Operator Requirements

Ref: 46 U.S.C. 4502, 46 CFR 28.245, 46 CFR 28.375, 47 CFR Part 80

C. Pollution Prevention

001 There are many pollution prevention requirements that are applicable to all fishing vessels. Reference MARPOL Annex VI for additional guidance: Ref. 33 CFR Parts 151, 155, and 159, 40 CFR 140.3 and 140.4

D. Anchors

(a) General

001 Fishing Vessels must be equipped with "anchor(s) and chain(s), cables, or rope appropriate for the vessel and the waters of the intended voyage." SEE: 46 CFR 28.235

(b) Materials

001 Anchor heads may be cast, forged or fabricated from plate materials. Shanks and shackles may be cast or forged.

(c) Anchor Shackle

001 The diameter of the shackle leg is normally not to be less than:
002 ds = 1.4 dc and dc = required diameter of stud chain cable with tensile strength equal to the shackle material, see Table C1 or C2. For shackle material different from the steel grades NV K1, NV K2 or NV K3, linear interpolation between table values of dc will normally be accepted.

Table C2 Equipment reductions for service restriction notations (see Table C1)				
Class notation	*Bower anchors*		*Stud-link chain cables*	
	Number	*Mass change per anchor*	*Length change*	*Diameter*
R0, R1, R2, R3	Alternative 1			
	1 1	No red. – 30%	No red. No red.	No red. No red.
R0, R1, R2, R3	Alternative 2			
	2 2	– 30% – 50%	+ 60% + 60%	No red. No red.

The diameter of the shackle pin is normally not to be less than the greater of:
dp = 1.5 dc
dp = 0.7 lp

dc = as given in 301
lp = free length of pin. It is assumed that materials of the same tensile strength are used in shackle body and pin. For different materials, dp will be specially considered.

(d) Testing

001 The proof test shall be as given in Table D1, dependent on the mass of equivalent anchor, defined as follows:

- 4/3 of the total mass of H.H.P. anchors
- 2 times the total mass of S.H.H.P. anchors

Table D1 Proof test load for anchors			
Mass of anchor kg	*Proof test load kN*	*Mass of anchor kg*	*Proof test load kN*
50 55 60	23.2 25.2 27.1	550 600 650	125 132 140
65 70 75	28.9 30.7 32.4	700 750 800	149 158 166
80 90 100	33.9 36.3 39.1	850 900 950	175 182 191
120 140 160	44.3 49.1 53.3	1000 1050 1100	199 208 216
180 200 225	57.4 61.3 66.8	1150 1200 1250	224 231 239
250 275 300	70.4 74.9 79.6	1300 1350 1400	247 255 262
325 350 375	84.2 88.8 93.4	1450 1500 1600	270 278 292
400 425 450	97.9 1031 1073	1700 1800 1900	307 321 335
475 500	112 116	2000	349

E. Other systems

(a) Cooking and Heating Appliances

001 Stoves and heating units shall be securely fastened

002 Where flues are installed, they shall be insulated or shielded to avoid overheating or damage to adjacent material or to the structure of the vessel.

(b) Units using liquid fuel

003 Open-flame burners shall be fitted with a drip-pan

004 Drip-pan shall have at least 20 mm high coaming able to collect the fuel in case of leakages.

005 Where open-flame-type water heaters are installed, adequate ventilation and flue protection shall be provided

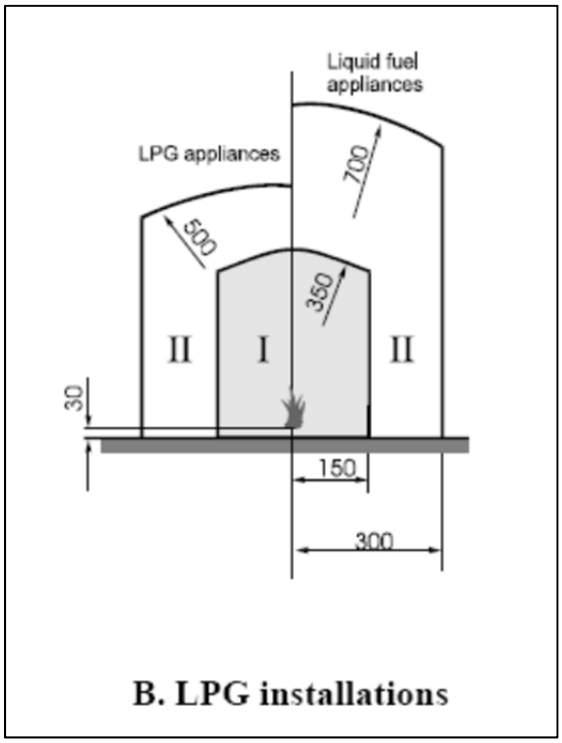
006 Where a pilot light is installed, the combustion chamber shall be room sealed, except for cockers.

007 Appliances using petrol for priming, or as a fuel, shall not be installed

(c) Liquid fuel tanks for stoves and heating appliances

001 For tanks and supply lines, the applicable requirements *of "Rules for Rules for Classification of Ships Ch.5 Sec.4"* apply

002 Non-integral tanks shall be securely fastened and shall be installed outside Zone II, Figure below



B. LPG installations

003 A readily accessible shut-off valve shall be installed on the tank. If this is outside the galley, a second valve shall be fitted in the fuel line in the galley space, outside zone II, Figure below, and not behind the cooker. This requirement does not apply where the tank is located lower than the cooker/heater and there is no possibility of back siphoning

004 Fuel lines shall be equipped with a high temperature shut off device.

005 Filler openings for tanks shall be visibly identified to indicate the type of fuel to be used with the system

(d) Materials near open flame appliances

001 Materials and finishes used in the vicinity of open-flame cooking and heating devices within the ranges defined in Figure below, shall comply with the following requirements, taking into account the movement of the burner up to an angle of 20° where gimbaled stoves are fitted. The requirements do not apply to the cooker itself:

002 -Free-hanging curtains or other fabrics shall not be fitted in Zone I or II

003 Exposed materials installed in Zone I shall be glass, ceramics, aluminum, ferrous metals, or other materials with similar fireproof characteristics, or be thermally insulated

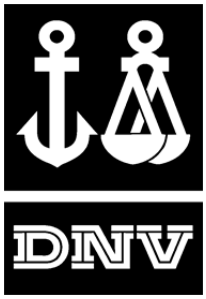
004 Exposed materials installed in Zone II shall be glass, ceramics, metals, or other materials with similar fireproof characteristics, or be thermally insulated from the supporting substrate to prevent combustion of the substrate, if the surface temperature exceeds 80ºC

(e) LPG installations

l

001 LPG systems shall be in accordance with ISO 10239 or equivalent, which covers

- working pressure of the system
- stowage of gas containers
- material and routing of LPG supply line
- installation, ventilation
- appliance and their connection
- leakage tests



STANDARD FOR CERTIFICATION
No. 1USFV

Interim Rules v5.0

Chapter VI– Fire and Safety Systems

Chapter VI - Fire and Safety Systems

Section 1 - General

A. Definitions

001 Where the government of the flag state has prescribed specific rules and regulations for fire safety measures, such rules and regulations may be considered as the basis for assignment of main class on the condition that they are deemed to provide a level of safety acceptable to the Society. Combustible insulation materials are accepted in compartments for stowage of fish provided low ignitability and low flame spread properties are documented.

002 Definitions and nomenclature in the present section follows the definitions and nomenclature in the Fire Test P Code for the vessel structure.

003 The following designations are used to classify and identify fires of different nature:

Class A: fires involving solid material, usually of organic nature
Class B: fires involving liquids or liquefiable solids
Class C: fires involving electrical equipment
Class D: fires involving combustible metals (i.e. magnesium)

(a) Definitions of Class Divisions

001 ""A" class divisions" are those divisions formed by bulkheads and decks which comply with the following criteria:

1. they are constructed of steel or other equivalent material;
2. they are suitably stiffened;
3. they are insulated with approved non-combustible materials such that the average temperature of the unexposed side will not rise more than 140ºC above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 180ºC above the original temperature, within the time listed below:

- class "A-60" 60 min
- class "A-30" 30 min
- class "A-15" 15 min
- class "A-0" 0 min

002 ""B" class divisions" are those divisions formed by bulkheads, decks, ceilings or linings which comply with the following criteria:

003 they are constructed of approved non-combustible materials and all materials used in the construction and erection of "B" class divisions are non-combustible, with the exception that combustible veneers may be permitted provided they meet other appropriate requirements of this chapter;

004 they have an insulation value such that the average temperature of the unexposed side will not rise more than 140ºC above the original temperature, nor will the temperature at any one point, including any joint, rise more than 225ºC above the original temperature, within the time listed below:

- class "B-15" 15 min
- class "B-0" 0 min

005 they are constructed as to be capable of preventing the passage of smoke and flame to the end of the one-hour standard fire test; and

006 Builder to document that structural fire protection meets "class division" requirements defined above.

(b) Application

001 Fishing vessels of less than 45 m (147.6 ft.) length (L) are to comply with the requirements in this section of the rules

002 Fishing vessels greater than 45 m (feet) length (L) and above should use these requirements as a supplement to DNV's "*Rules for Classification of Ships – Newbuildings" Part 5 Chapter 6, Section 1 G*."

(c) Fire safety in general

001 Fire safety shall be achieved by the use of passive and active means

002 Passive means is structural fire protection and control of installations and combustible materials

003 Active means is fire-fighting equipment

004 Other requirements for fire safety than listed in this section may be specified under specific service notations.

B. Structural fire protection

(a) Fire protection of bulkheads and decks

001 Boundaries of the wheelhouse and of the machinery spaces shall be A-60 class against adjacent spaces.

002 Where, in the opinion of the Society, the adjacent spaces are of negligible fire risk, the boundaries may be A-0.

003 Boundaries of escape routes shall be of B-0 class.

004 Testing is to be carried out in accordance with a recognized standard.

005 The test method chosen is to be suitable for the type of foam in question.

006 Acceptable combustible insulation is to be protected by close-fitting cladding. Acceptable cladding is steel sheet. Surface coatings are to have low flame spread properties.

(b) Engine and tank spaces

001 Arrangement and materials for structural fire protection shall be approved. The fire protection shall cover the entire boundary of the engine space above lowest waterline.

002 For small vessels (normally L < 15 m (49 ft.) other arrangements than specified in 001 may be accepted based on special consideration

003 Fuel and lubrication oil tanks located entirely or partly above the floor in the engine space shall have fire resisting division of at least B-15 rating.

004 Openings for ventilation of the engine space shall be equipped with closing appliances readily operable from the outside of the engine space.

005 Tank spaces separated from engine spaces need not follow the same requirements as given for engine spaces in 001 and 002, but shall be ventilated to the outside of the vessel

(c) Control of combustible materials

001 Acoustic insulation material used in engine spaces shall as a minimum have a non-fuel-absorbent surface towards the engine and an oxygen index of at least 21 in accordance with ISO 4589-3 or equivalent at an ambient temperature of 60°C (140 °F)

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C. Portable fire extinguishers

(a) General

001 The vessel shall be equipped with portable fire-fighting extinguishers
002 Any portable fire extinguisher shall be type approved by the Coast Guard or Underwriters Laboratories other national recognized standard.
003 The extinguisher(s) fitted shall individually or as combined be suitable for fighting ABC-fires
004 No individual extinguisher shall be rated less than B-II
005 Any individual portable carbon dioxide (CO2) extinguisher shall have a maximum capacity of 15 lbs.
Ref. 46 U.S.C. 4502, 46 CFR 25.30, 46 CFR 28.155, 46 CFR 28.160 and NVIC 13-86

(b) Location of portable fire extinguishers

001 The total number of portable fire extinguishers shall be adequate to meet the following requirements. A single extinguisher may meet more than one of the requirements
002 Readily accessible portable fire extinguisher(s) shall be located:

- within 2 m unobstructed distance from the main helm position
- within each 20 m2 of the accommodation area
- within (L/3) m from the center of any berth, measured horizontal
- within 2 m unobstructed distance from any permanent installed cocker/stove or open flame device.

003 Portable CO2 extinguishers shall only be fitted in accommodation spaces when flammable liquids are present (e.g. galley) or where energized electrical equipment is located (e.g. electric motor space, battery space, switchboard)
004 Where CO2 extinguishers are used, there shall be only one CO2 extinguisher in each hazard area. A warning notice shall be affixed near the extinguisher.
005 If the portable fire extinguisher is located where it is exposed to splashed or sprayed water, the nozzle and triggering device shall be shielded
006 The extinguisher may be stowed in a locker or other enclosed space. The locker or opening part of the space shall be labeled

(c) Fire blanket

001 If an open-flame cooker is fitted, a fire blanket, in accordance with EN 1869 or equivalent, shall be within reach and readily accessible for immediate use

D. Fire detection

(a) Engine spaces

001 The engine spaces shall be equipped with a fire detection system with both audible and visible alarm at the helm position. The detection system may be part of a fixed fire extinguishing system

E. Fixed fire extinguishing systems

(a) General

001 Engine spaces shall be protected by a fixed fire-fighting extinguishing system
002 The system shall be a manual system or a manual/automatic combined system if applicable. A manual release system shall be activated from the helm position. The release mechanism shall be protected against sea-spray and unintended release. The operation instruction shall be posted close to the release mechanism. Automatic release of the system shall be indicated by both audible and visual alarms at the helm position.
003 The extinguishing medium shall be suitable for fighting AB-fires

004 The amount of extinguishing medium and emptying time shall be adequate for the space considered such that the fire is efficiently extinguished.

005 The fixed fire extinguishing system shall be of one of the following types:

- aerosol system
- CO2 system
- gaseous agent
- high expansion foam system
- water mist systems.

006 Cylinders for the extinguishing medium shall be protected against sea-spray, mechanical damage and temperatures exceeding 50ºC. Cylinders shall not be located in accommodation areas.

007 Nozzles shall be located in a way that an even distribution of the extinguishing medium is achieved.

(b) CO2 system

001 The system shall be manually operated only. Discharge shall be indicated by both audible and visible alarm

002 The amount of extinguishing medium shall be minimum 0.6 kg/m3 net volume, but in any case not less than 2 kg in total

003 CO2 cylinders shall not be located in the engine room.

004 CO2 cylinders or fittings on distribution lines shall not be located in a way that any extinguishing medium can enter into the accommodation area in the event of leakage in the system

005 CO2 systems shall have a separate fire detection system.

(c) Gaseous agent system

001 Gaseous agent system shall be type approved according to IMO MSC/Circ. 848 or equivalent.

002 The system may either be a manual or a manual/automatic combined system

(d) Foam system

001 The system may either be a manual or a manual/automatic combined system

(e) Water mist system

001 Water mist system shall be type approved according to IMO Circ. 668/728 or equivalent.

002 The system may either be a manual or a manual/automatic combined system.

003 A water mist system shall be designed for a protection time of at least 20 minutes.

004 Water based systems requiring fresh water shall be connected to dedicated water tanks with capacity for minimum 5 minutes operation for the largest space, and automatic switch-over to sea-water supply. Alternatively manual switchover may be used if the capacity of the fresh water tank is increased to 15 minutes.

(f) Fireman's outfits and self-contained breathing apparatus

001 Ref: 46 CFR 28.205

Section 2 - Safety of Personnel

A. Safety Plan

(a) General

001 A safety plan for the vessel, shall be submitted for approval. The plan shall be delivered with the vessel.

002 The safety plan shall describe the arrangements for the following items:

- lifesaving equipment
- fire alarm and fire fighting
- emergency exits
- emergency systems (alarms, fans, valves etc.).

In addition the following may be included for information:

- emergency instruction
- first aids.

(b) Railings, Ladders, Handholds, Decks

Rails and handholds

001 All areas above and below deck intended for human occupation shall be equipped with either railings, bulwark, handholds of substantial design or other means of safe grip.

002 Decks shall normally be surrounded by railing or bulwark with minimum 750 mm (29.52 in.) height. Part of the railing may be dismountable.

003 The distance between vertical stanchions of railing shall normally not be more than 1200 mm(47.2 in.) . The vertical distance between bars in rails shall normally not exceed 230 mm (9 in.) from deck level and 330 mm (13.0) elsewhere.

(c) Deck non-slip surface

001 Non-skid surface shall be arranged on all decks and floors intended for human occupancy or work.

002 Decks shall have a toe-rail of minimum 25 mm (inches) height at the outboard edge or gunwale.

(d) Operation of Deck Gear

001 Winches, cranes and other deck-gear shall be arranged to facility safe working with respect to instruction, operation, view and shielding. Winches with open lines, lifting platforms and all types of movable deck gear, shall be shielded or arranged with automatic emergency stop activated by a person.

002 Winch barrel, and similar gears shall have protection against line end etc. hitting the person operating the winch or gear.

003 Instruction for safe operation of lifting gears, together with type notation and name of manufacturer, shall be given on a signboard on the gear at the place of operation.

004 Testing of safe work load for winches, cranes and other lifting gears shall be documented, and arrangement to avoid overload shall be fitted.

B. Guards for Exposed Hazards

001 Fishing vessels safety regulations (46 CFR 28.215) require "suitable hand covers, guards, or railings in way of machinery which can cause injury to personnel, such as gearing, chain or belt drives, and rotating shafting. This is not meant to restrict necessary access to fishing equipment such as winches, drums, or gurdies."

002 While there are no specific guidelines, the intent of the regulation is clear: Protect personnel from injury by installing guards or railings.

Examples of areas where protective guards, railings, or grating should be considered:

- *Belt drives on main engines;*
- *Auxiliary generator sets;*
- *Air compression units;*
- *Chain drives in steering systems and winches; and*
- *Propeller and winch shafting.*

The regulations also require that there must be insulation or other type protective guarding around internal combustion engine exhaust pipes

C. Escape Routes Not Blocked

001 Escape routes – from work areas or accommodation spaces – on fishing vessels shall not be obstructed. Before the vessel leaves port and during the voyage the Master should ensure that escape routes are not locked or blocked by equipment or debris.

D. First Aid Kits and Manual

See: 46 CFR 28.210

(a) First Aid and CPR Training

001 First-aid and CPR training is required by the Coast Guard

E. GENERAL ALARMS SYSTEMS

Ref: 46 CFR 28.240

001 A vessel with an accommodation space or work space that is not adjacent to (near) the operating station must be equipped with an audible general alarm system. The system must be able to be operated from the operating station, and be capable of notifying individuals in any accommodation or work space where they may normally be employed in the event of an emergency.

002 In noisy workspaces such as the engine room where it may be difficult to hear, the alarm system must include a flashing red light in the space. Each general alarm bell or flashing red light must be identified with a sign in red lettering at least one-half inch high as follows:

"ATTENTION GENERAL ALARM – WHEN ALARM SOUNDS GO TO YOUR STATION"

<<<<<< *Guidance Note* >>>>>>

The "station" is the emergency station assigned to each crewmember for specified types of emergencies: fires, flooding, abandon ship, etc. A public address (PA) system or other means of alerting persons on board may be utilized as an alternative to an alarm system provided it is as effective as a dedicated general alarm system as described above.

TESTING of the general alarm system (or alternative) is required before the vessel gets underway, and at least once each week while underway. The testing of the general alarm should be noted in the vessels log.

<<<<<< *End Guidance Note*>>>>>>>

F. PFD / Immersion Suit Requirements

Ref: 46 USC 4502, 46 CFR 25.25, 46 CFR 28.110 and NVICs, 7-91 and 1-92

(a) PFD Lights

Ref: 46 CFR 25.25
Ref: 46 CFR 28.115 and NVICs 1-87 and 1-92.

(b) Visual Distress Signals (VDS)

Ref: 46 CFR 28.145.

(c) EPIRBs - EPIRB Requirements

Ref: 46 CFR 28.145.

G. SURVIVAL CRAFT

Ref: 46 CFR 28.120 and NVICs 7-91 and 1-92, including changes 1 and 2.

H. MARKING LIFESAVING EQUIPMENT

Ref: 46 CFR 26-50, 46 CFR 28.135, and 46 CFR 28.140