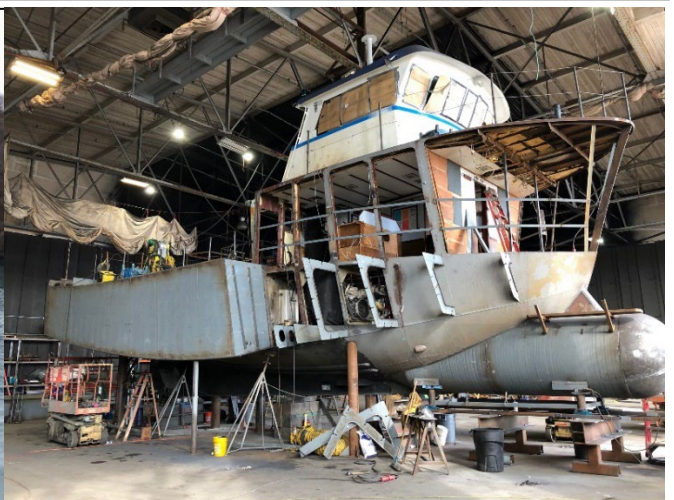
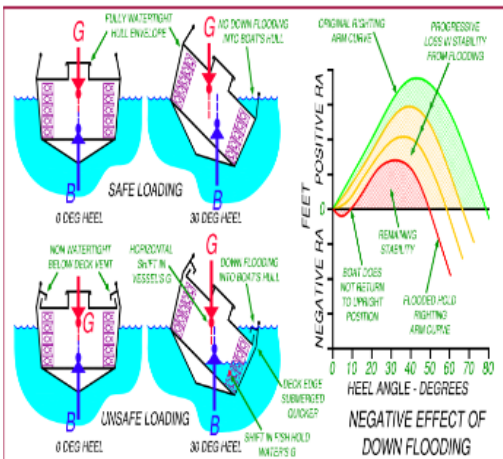


CFVS Examiner's Stability Reference Guide



Developed by Marine Safety Unit Portland
 Fishing Vessel Safety
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 503-240-9337 FVSPortland@uscg.mil

Updated September 2022

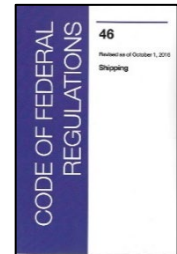
CFVS EXAMINER'S STABILITY REFERENCE GUIDE

This guide has been developed as a tool to assist Commercial Fishing Vessel Safety Examiners in evaluating a vessel's compliance with 46 CFR 28 Subpart E (Stability). It may be used in conjunction with a stability checklist during a dockside examination.

This tool is a collection of information from Coast Guard policies, Marine Safety Information Bulletins, stability training providers, naval architects and Federal regulations. It is not all encompassing and examiners should further consult those appropriate sources and references.

REFERENCES:

- 46 CFR 28, Subpart E—Stability
- 46 CFR 170, Subchapter S—Subdivision and Stability
- 46 CFR 42; 46 USC 5102—Load Lines
- NVIC 5-86, Enclosure 1, Chapter 1, Stability
- NVIC 3-89, Guidelines for the Presentation of Stability Information for Operating Personnel
- MSC Guidelines for Commercial Fishing Vessel Stability PR H2-20
- MSC Technical Note MTN 04-95, Ch-2 Lightship Change Determination
- MSC Major Conversion Determinations PR GEN-06
- ASTM F1321-92, Standard Guide for Conducting a Stability Test
- Marine Safety Alert 11-17 Remain Upright by Fully Understanding Vessel Stability
- Findings of Concern 006-19 Impacts of Modifications, Alterations and Weight Creep on Stability
- Marine Safety Information Bulletin 01-21 Improving Fishing Vessel Stability
- Marine Safety Alert 03-21 Related to Blocked Freeing Ports
- A Best Practices Guide to Vessel Stability, 2nd Edition, U.S. Coast Guard
- A Skipper's Guide to Fishing Vessel Stability & Modifications, Jensen Maritime Consultants/NPFVOA
- Voluntary Safety Initiative-Good Marine Practice (VSI-GMP) Examination Guide
- Freeing Port Calculator Tool, CG-ENG-2/MSU Portland



Corrections, changes or suggestions to this guide may be directed to Mr. Michael Rudolph Michael.G.Rudolph@uscg.mil or 503-240-9337.

DETERMINING AND DOCUMENTING APPLICABILITY

It is critical for Examiners to inquire about vessel modifications, changes to equipment and other factors to properly determine applicability. Relying on keel laid date alone is not adequate. Asking questions related to the history of the vessel, changes to dimensions (sponsoring/lengthening), installation of new equipment such as cranes, changes in fishing methods not previously done, etc.

Documenting this information on the Exam form (CG-5587) and including this in MISLE helps record the history of the vessel.



SUGGESTED MISLE ENTRIES

Fishing Vessel Activity:

Narrative Entry example related to stability compliance:

Vessel stability instructions provided by I.M Smart from Naval Architect Firm (Seattle, WA) dated October 2019. Last incline test September 2019. The operator B.A. Cap'n, attended stability training March 2022, AMSEA.

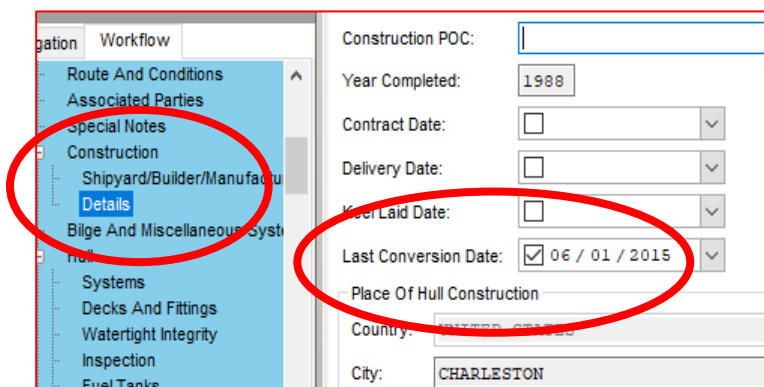
Special Note examples related to vessel modifications:

Vessel's relevant modifications and change in service history includes: 1990--The vessel's hull was sponsored; 2006--a processing factory was added and operated as fish processor enrolled in the ACSA program; 2017--disenrolled from ACSA program and change in service to a Fish Tender where the factory equipment has been partially removed and is no longer in service.

MSC determined the 2015 modifications constitute a major conversion. In 2015 vessel was sponsored and lengthened to increase its hold capacity. The sponsoring added 5.5' wide outboard extensions to the hull to increase the vessel's beam to 35'-0". The hull was also lengthened in the bow and stern to an overall length of 90.0/Reg Len. 82.3'.

Vessel Profile Entry for Major Conversions/Modifications:

Under Construction, Details, make an entry in Last Conversion Date for the effective date of the major conversion.

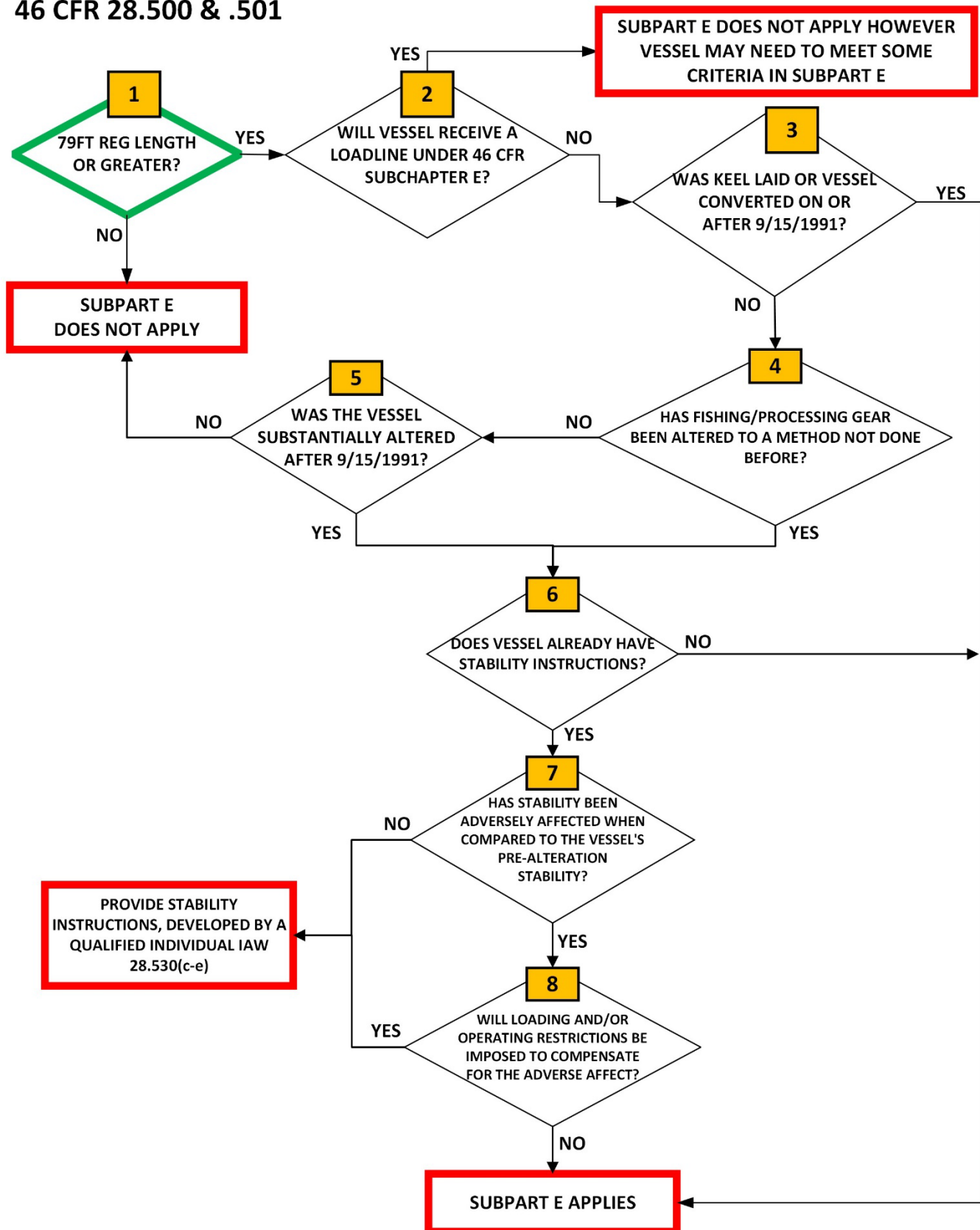


Construction POC:	
Year Completed:	1988
Contract Date:	<input type="checkbox"/>
Delivery Date:	<input type="checkbox"/>
Keel Laid Date:	<input type="checkbox"/>
Last Conversion Date:	<input checked="" type="checkbox"/> 06 / 01 / 2015
Place Of Hull Construction	
Country:	UNITED STATES
City:	CHARLESTON

SUBPART E APPLICABILITY FLOWCHART

46 CFR 28.500 & .501

Updated Sep 2022-MGR



APPLICABILITY

46 CFR 28.500 *Numbers correlate to applicability flowchart

Vessels (1) 79 feet or more in length NOT required to be issued a (2) Load Line **and**:

- (3) Has its **keel laid** or is at a similar stage of construction or undergoes a **major conversion** started on or after September 15, 1991;

Example: Major Conversions are determined by MSC and could be when a vessel changes service (former inspected vessel) or significant changes to the vessel.



Fish Tender GULF RANGER former inspected OSV

- (4) Undergoes **alterations to the fishing or processing equipment** for the purpose of catching, landing, or processing fish in a manner **different** than has previously been accomplished on the vessel; or

Example: Vessel originally designed to fish with pots and it later adds trawling gear.

- (5) Has been **substantially altered** on or after September 15, 1991.

Examples: Changes to vessel's dimensions, underwater shape, downflooding angle, buoyant volume, or changes to lightship VCG, LCG (see below for metrics) or 5% increase in projected lateral area.



Former Gulf Shrimper has their stern squared off to better suit trawling in the North Pacific

APPLICABILITY—SUBSTANTIAL ALTERATIONS

46 CFR 28.501 *Numbers correlate to applicability flowchart

Additional criteria to determine which level of stability compliance is required based on the effect of the alterations:

(6) If the vessel already has stability instructions developed by a qualified individual and (7) the alterations don't adversely affect the vessel's stability then minor updates can be done to the stability instructions. If the vessel doesn't have stability instructions then it will need to meet all of Subpart E.

(8) If the alterations **adversely affect** the vessel's stability and loading and/or operating restrictions are needed to compensate for the effects then the existing stability instructions can be updated with the new information. Otherwise, it will need to meet all of Subpart E.

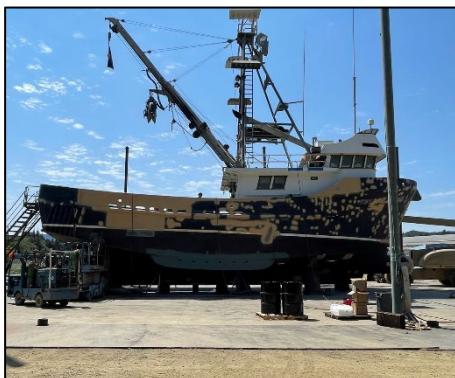
"Adversely affect" is defined as:

- Alterations that result in an increase of the vessel's lightweight **vertical center of gravity by more than 2 inches**,
- Change in the vessel's **lightweight displacement of more than 3%**, or
- A shift of the **longitudinal center of gravity of more than 1%** of the vessel's length.

A qualified individual must also consider the net effects on stability of any:

- Reduction of the **downflooding angle**;
- Increase in the **maximum heeling moment** caused by fishing gear or weight lifted over the side due to changes in lifting arrangement or capacity;
- Reduction in **freeing port area**;
- Increase in **free surface effects**, including increased free surface effects due to water on deck associated with any increase in length or height of bulwarks;
- Increase in **projected wind area**;
- Decrease in the angle of **maximum righting arm**;
- Decrease in the area under the **righting arm curve**; and
- Increase in the **surface area on which ice** can reasonably be expected to accumulate.

It is **HIGHLY LIKELY** that a vessel 79 feet or greater has been substantially altered or undergone a major conversion since September 15, 1991. A better way to look at applicability is to consider **ALL vessels 79 feet or greater needing to meet stability** and exempt only those vessels that haven't undergone a major conversion or meet substantial alteration definition since 9/15/1991.



STABILITY INSTRUCTIONS

46 CFR 28.530; NVIC 5-86, Enclosure 1 (Stability); NVIC 3-89

Note the date of the stability information and last stability test in the MISLE Fishing Vessel Exam Activity.

- Vessel must have a **stability book or stability information** on board developed by a naval architect or other qualified individual.
- Depending on the vessel, the **criteria used to evaluate adequate stability** could come from 46 CFR 28, 46 CFR 170, Load Line or NVIC 5-86 (IMO Res. A.168(ES.IV)-Torremolinos).
- Provides master with **loading constraints and operating restrictions.**
- Drafted in a **format understood by the master**, which may include:
 - Simple loading instructions;
 - Loading diagram with instructions;
 - Stability booklet with sample calculations; or
 - Any other appropriate format for providing stability instructions.
- Must reflect the vessel's **current construction and operation**, which may include:
 - Lightweight data;
 - General arrangement plans showing watertight compartments, closures, vents, downflooding angles and allowable weights (verify accuracy during vessel walkthrough);
 - Capacity plan or tank sounding tables showing centers of gravity and free surface effects;
 - Amount and location of any fixed ballast;
 - Use of trawl cranes or lifting devices; and
 - Guidance on the use of roll limitation devices (stabilizers).

EXAM CHECKLIST: *Use Supplemental Checklist #2—Stability as a Job Aid*

- If vessel operates with pots, verify the pot weights used in the stability calculations reflect the actual pots used. *Icing conditions may limit the number of pots allowed on board.*
- Ask about any modifications, changes, alterations to vessel since last incline/stability test.
- Master has adequate information and is familiar with the contents.
- Instructions include (righting energy in compliance with):
 - Free surface effect,
 - Intact stability using lifting gear,
 - Icing (operations north of 42° N (OR/CA border) between November 15 and April 15)
**verify owner/operator/engineer are aware of ice accumulation thicknesses used in the calculations,*
 - Water on deck,
 - Intact righting energy, and
 - Severe wind and roll

WHEN TO UPDATE STABILITY INSTRUCTIONS

46 CFR 28.501 & .530; MSC Technical Note MTN 04-95, Ch-2 Lightship Change Determination
Voluntary Safety Initiative-Good Marine Practice (VSI-GMP) Examination Guide

For vessels that have stability instructions, it may become necessary to update them since they do not accurately reflect the same vessel as before. Changes to vessel characteristics, installation or removal of equipment and changes to a vessel's weight are a few examples.

Apart from the obvious thresholds identified in definitions of major conversion or substantial alterations that would trigger an update to stability, the following guidelines are offered:

WEIGHT CHANGES

Most vessels appreciably gain weight over time. Owners should keep a record of weight changes. This includes a tally of weights added, removed and relocated. MSC Technical Note MTN 04-95, Ch-2 provides helpful guidance when a deadweight survey, full stability test or a simple weight-moment calculation is needed when updating stability.

If the aggregate (total) weight of the cumulative changes is between 2-10% of the vessel's lightship weight, then a deadweight survey might be all that is needed to determine the new lightship weight and longitudinal center of gravity (LCG). However, if the deadweight survey reveals that the vessel's lightship weight has increased more than 3% or the LCG has moved more than 1% of the vessel's length, then a new full stability test is required.

For aggregate (total) weight of the cumulative changes is more than 10% of the vessel's lightship weight, then a new full stability test is required.

STABILITY REVIEW

The Voluntary Safety Initiative-Good Marine Practice (VSI-GMP) recommends a review of a vessel's stability is performed every 5 years by a naval architect. This is already a requirement for vessels enrolled in the Alternate Compliance Safety Agreement (ACSA) Program and many owners are surprised to learn the significant changes to a vessel's weight in just 5 years.

FREEING PORTS

46 CFR 28.555

- Vessels with bulwarks must be fitted with adequate freeing ports to allow rapid removal of water.
- Covers are permitted provided the area required is not diminished and covers are fitted so water will readily flow outboard.



USE OF FREEING PORT CALCULATOR TOOL

CG-ENG-2 (Load line division) and MSU Portland developed an excel spreadsheet that will calculate a vessel's required freeing port surface area given some parameters. This tool can be downloaded from www.FishSafeWest.info.

Measurements needed to use the tool include:

_____	Overall Length of Vessel	_____	Length of Bulwark (total)
_____	Average Height of Bulwark <i>*Total Area of bulwark divided by bulwark length</i>	_____	Area of Freeing Ports (side)
Y or N	Does the deck have sheer (rises towards the bow and stern)?		
Y or N	Does the vessel operate on protected waters?		

The freeing port criteria in 46 CFR 28.555 is more conservative than that required of a vessel with a load line.

Troubles add up aboard the Destination

A Coast Guard analysis – based on computer modeling – found the Destination failed to meet federal stability standards.

Incorrect crab-pot weights?
Some 200 steel-framed pots were assumed to be stacked on the Destination as it left port a final time. A stability report to guide loading allowed that number of pots, based on the calculation that each weighed 700 pounds with gear. After the boat sank, the only pot recovered from the sea bottom weighed 840 pounds.

Typical crab pot

Bulbous bow

Water onboard
Water drains out

Undersized freeing ports
Holes cut on each side of the Destination allowed water that washed onboard to drain back out. The surface area of these holes was less than half what federal regulation required.

No record of recent stability report
An incline test performed with weights is used to assess a boat's stability. In 2013, the vessel was modified with a bulbous bow to improve fuel efficiency. The Destination's incline test was done 20 years earlier. A new test could have uncovered changes affecting stability. There are no records the test was done.

Source: Feb. 9, 2018 Coast Guard stability analysis MARK NOWLIN / THE SEATTLE TIMES

The MBI determined the DESTINATION had inadequate freeing port size
EMMY ROSE did not comply with covers and was grossly undersized

WATERTIGHT AND WEATHERTIGHT INTEGRITY

46 CFR 28.560

Each opening in a deck or a bulkhead that is exposed to weather must be fitted with a weathertight* or a watertight* closure device. *Compliance with the coaming height requirements may influence whether a watertight or weathertight closure device is needed.

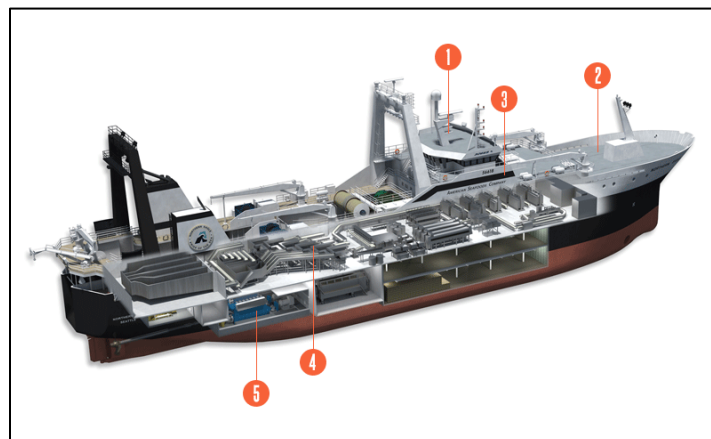
- Ensure closure is operational, checking dogs and handles
- Gasket material and seals provide adequate protection
- Operate doors and dogs for proper function

Openings include **vents for fuel/water tanks**. The use of a gooseneck vent with ball checks are considered weathertight. Another option is to close the vent with a weathertight flange. *Failure to comply with this requirement could change the point of downflooding (critical point) used in the stability analysis.*



PROCESSORS

- An opening below the weather deck used for discharging processing water or debris must be fitted with a means to ensure the opening can be closed weathertight.
- The means of closing must be operable from a location which is outside the space containing the opening. *Aleutian Enterprise casualty.*



COAMING HEIGHT

46 CFR 28.560

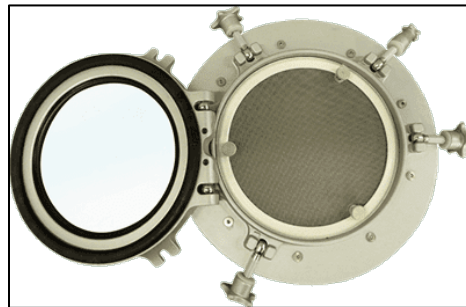
- Each opening in a deck or a bulkhead that is exposed to weather must be fitted with a watertight coaming as follows:

Condition	Height
<79 feet (holdover from old NPRM)	12"
79 feet or more	24"
Fish hold under constant attention	6"
Quick-Acting Watertight Closure	Accommodate closure height
Deck above the lowest weather deck (except on an exposed forecastle deck)	None



DEADLIGHT COVERS

- Each window and portlight located below the first deck above the lowest weather deck must be provided with an inside deadlight. Each deadlight must be efficient, hinged, and arranged so that it can be effectively closed watertight. *OCMI may accept polycarbonate (Lexan) windows without deadlight covers if they meet ABS rules for sufficient strength.*



DECKWALK COMPLIANCE CHECKS

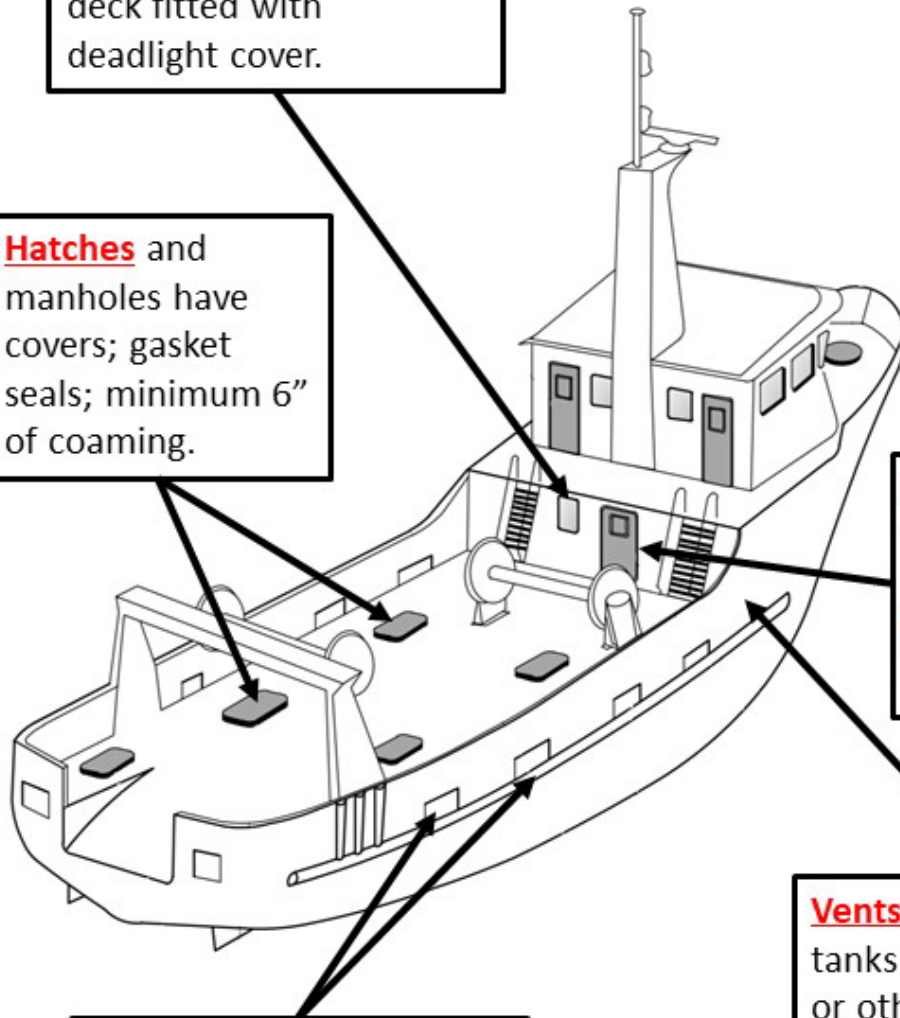
Windows on 1st level above main weather deck fitted with deadlight cover.

Hatches and manholes have covers; gasket seals; minimum 6" of coaming.

Doors have functioning dogs and gasket seals; **Coaming** height compliance.

Vents for fuel/water tanks have ball checks or other closure devices.

Adequate **Freeing Ports**, open and clear of debris. Compliance with covers.



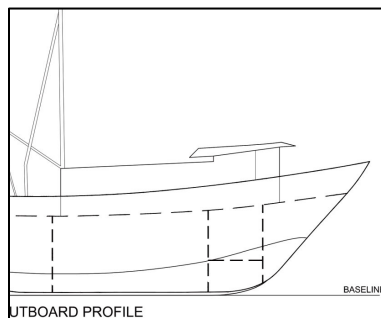
UNINTENTIONAL FLOODING

46 CFR 28.580

This section applies to new vessels built after September 15, 1991

Fitted with a **collision bulkhead** that:

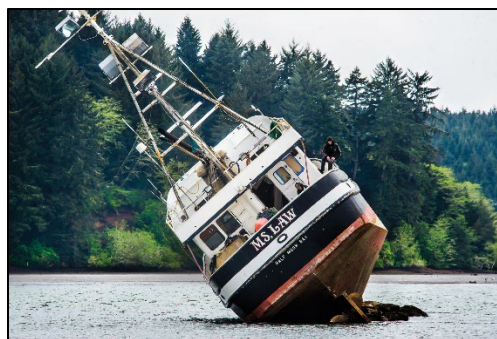
- Openings kept to a minimum; fitted with a watertight closure device
- Not fitted with a door below the bulkhead deck
- Any penetrations must be located as high and as far inboard as practical and fitted with a means to rapidly make it watertight.
- Located at least 5% of the length from the forward perpendicular.
- Not be stepped below the bulkhead deck



Instructions include **Damage Stability** for each loaded condition (including icing). An alternative is to obtain a Load Line. *Note: Some Fishing Vessels chose to have a Load Line when built to meet this standard only to later drop their Load Line. This is easily missed.*

Buoyancy of Superstructure (if included in the buoyant volume):

- Sufficiently strong to withstand impact of waves;
- Fitted with interior access from the spaces below;
- *Each opening fitted with weathertight or watertight closures; and
- *Deadlight covers for each window and portlight.
- *Depending on buoyant volume used, this may extend to levels above the first deck above the weatherdeck.



LOAD LINE CERTIFICATE

46 USC 5102, 46 CFR 42; 46 CFR 28.580(i)

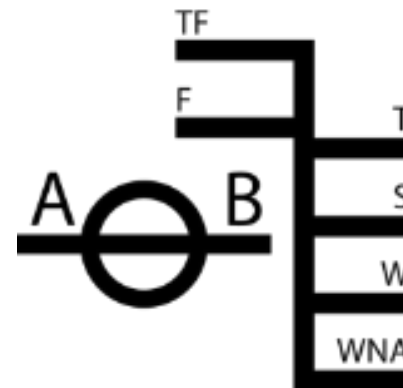
APPLICABILITY: Fishing Industry Vessels **EXCEPT**

ANY VESSEL	Less than 79 feet (load line length)
	Operates inside the Boundary Line
	Operates exclusively between Puget Sound and Southeast Alaska
	150 GT or less, keel laid before January 1, 1986, and on a domestic voyage.
FISHING VESSEL	Keel laid before July 2, 2013.
FISH PROCESSOR	Constructed as a fish processor before January 1, 1983; or
	Converted for use as a fish processor before January 1, 1983; and not on a foreign voyage.
FISH TENDER*	Constructed, under construction or under contract to be constructed as a fish tender before January 1, 1980; or
	Converted for use as a fish tender before January 1, 1983, and not on a foreign voyage or engaged in the Aleutian Trade.

**Fishing Vessels that occasionally operate as a Fish Tender (part-time tender) must still comply with Load Line requirements. However, D13 and D17 are in a period of non-enforcement for applicable part-time Fish Tenders that were operating prior to 2019. Contact either district for more information.*

LOAD LINE CERTIFICATES

- Issued by ABS or DNV classification societies.
- Valid for **5 years**.
- **Must be endorsed annually** by the issuing class society otherwise the certificate is invalid

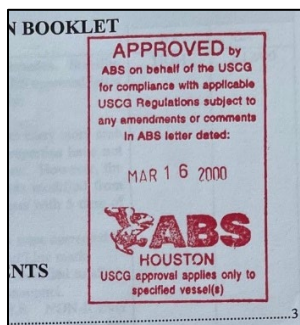


LOAD LINE MARKINGS

- Permanently and conspicuously affixed to the hull.
- Not be submerged.

ALTERNATIVE TO MEETING DAMAGE STABILITY 46 CFR 28.580(i)

Even though maintaining a load line might not be required by statute, a vessel may obtain a load line as an alternative to meeting the damage stability criteria in Subpart E.



STABILITY TRAINING

46 USC 4502(g)

The 2010 Coast Guard Authorization Act amended 46 USC 4502(g) requiring the individual in charge of a CFIV operating more than 3nm from the baseline, more than 16 POB or an Aleutian Trade Act Fish Tender to pass a training program. This program includes stability training.

While the implementing regulations have not been developed yet, having a conversation with the vessel owner, operator and engineer about attending a fishing vessel stability workshop is a good idea. Just from the CFVS Examiner mentioning available stability training and the benefits from a better understanding can help reduce the risks associated with commercial fishing.

Fishing Vessel Stability Training Organizations

NPFVOA	206-285-3383	www.npfvoa.org
AMSEA	907-747-3287	www.amsea.org

Coast Guard Fishing Vessel Intact Stability Model

Most Fishing Vessel Safety programs have access to a stability demonstration model. It is a very good visual representation of the dynamic forces affecting a vessel's stability.

