

MSC Guidelines for Review of Gas Carrier Structures

Procedure Number: T1-32

Revision Date: 01/21/00

References

- a. 46 CFR Subchapter D
- b. 46 CFR Subchapter I
- c. 46 CFR Subchapter O
- d. 46 CFR Subchapter S
- e. ABS Rules for Building and Classing Steel Barges, 1991
- f. ABS Rules for Building and Classing Steel Vessels for Service on Rivers and Intracoastal Waterways, 1995
- g. Navigation and Vessel Inspection Circular (NVIC) No. 1-98, Loading Considerations for Existing Inland Tank Barges
- h. Ship Structure Committee (SSC) report SSC-205, "Structural Design Review of Longitudinal, Cylindrical, Liquid-filled Independent Cargo Tank Barges", 1970
- i. Coast Guard Publication CG-478, "Liquefied Natural Gas, Views & Practices, Policy and Safety", 2/1/76
- j. IGC Code, International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk
- k. ABS rules for Building and Classing Vessels Intended to Carry Liquefied Gases and Chemical Cargoes in Bulk
- l. International Convention for the Safety of Life at Sea, 1974, and its Protocol of 1978 (SOLAS), as amended

Disclaimer

These guidelines were developed by the Marine Safety Center staff as an aid in the preparation and review of vessel plans and submissions. They were developed to supplement existing guidance. They are not intended to substitute or replace laws, regulations, or other official Coast Guard policy documents. The responsibility to demonstrate compliance with all applicable laws and regulations still rests with the plan submitter. The Coast Guard and the U. S. Department of Transportation expressly disclaim liability resulting from the use of this document.

Contact Information

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General Review Guidance

- If the vessel is new and not a sister vessel, has the Application for Inspection been submitted? In general, no plan review will occur until receipt of a copy of the Application.
- Is it clearly stated what is desired from the MSC? Are all plans requiring Coast Guard review and/or approval submitted in triplicate? Are there any special or unusual requests involved?
- Is the vessel being reviewed by ABS under NVIC 10-82? If **Yes**, the MSC will not normally review the structural plans. These plans may be reviewed by the MSC under ABS oversight procedures.
- Is the vessel being classed by ABS? If **Yes**, the submitter should provide the MSC with a copy of the ABS approval letter and approved drawings. Per references (a) (b) and (c), the USCG considers ABS structural review for class as acceptable for demonstrating compliance with US regulations.
- The majority of gas carrier reviews involve unmanned tank barges and independent pressure vessel barges regulated under a dual Subchapter O/D certification, for domestic routes only. Determine applicability of regulations per 46 CFR 151.01-10, as follows:
 - For **unmanned** barges only, if cargo is listed in 46 CFR Table 151.05 and **has** flammability or combustibility characteristics as indicated by a fire protection requirement in the table, then Subchapters O and D apply.
 - For **unmanned** barges only, if cargo is listed in 46 CFR Table 151.05 and **does not have** flammability or combustibility characteristics as indicated by a fire protection requirement in the table, then Subchapters O and D or O and I apply. The option for applying D or I, in addition to O, should be indicated by the owner on the Application for Inspection.
 - Per 46 CFR 151.01-10(e), **manned** barges which carry a cargo listed in Table 151.05 will be considered individually by Commandant for applicable regulations and design requirements.
- If the vessel is a self-propelled tankship, consult 46 CFR, Subchapter O, Parts 153 and 154. Ensure compliance with references (j), (k), and (l), as applicable for international routes.

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- Per 46 CFR 38.05-1 and 46 CFR 151.15-3(d), a minimum of hull type II is required for gas barges. A type I hull may be required depending on appropriate hazard of cargo.
- Determine anticipated cargoes and consult 46 CFR 151.50 for cargoes which require special structural design requirements under this section (e.g. 151.50-12 requires design of at least 75 psi and no welding to the tank, among other requirements, for ethylene oxide)
- Evaluate compliance with ABS structural rules for the primary hull structure (references (e) and (f)), as follows:
 - For vessels, over 190 m (623 feet), receiving a loadline, only.
 - Calculate the vessel definitions: Part 3, Section 1.
 - Verify the information in Introduction: Part 5, Section 2A.1.
 - Calculate the scantlings for the bottom shell: Part 5, Section 2A.4.3.2.
 - Calculate and check long. and trans. bulkheads: Part 5, Section 2A.4.5.
 - Verify the scantlings of main supporting members: Part 5, Section 2A.4.5.5.
 - Verify buckling and ultimate strength calcs.: Part 5, Section 2A.5.2.2.
 - For vessels, under 190 m (623 feet), receiving a loadline, only.
 - Calculate the vessel definitions: Part 3, Section 1.
 - Validate the gen. information: Part 5, Section 2 Part B.1-15.
 - Verify shell plating scantlings: Part 5, Section 2B.19.
 - Calculate and check bulkhead plating: Part 5, Section 2B.23.
 - Calculate the scantlings for bottom structure: Part 5, Section 2B.26.
 - Verify the scantlings of supporting members: Part 5, Section 2B.27.
 - Verify the scantlings of frames, beams, and bulkhead stiffeners: Part 5, Section 2B.29.
 - For unclassified, non-loadlined vessels over 190 m (623 feet)
 - Calculate the vessel definitions: Section 1.
 - Validate the information in Introduction: Part 5, Section 2A.1.
 - Calculate and check the design considerations: Part 5, Section 2A.2.
 - Calculate and check load criteria calcs.: Part 5, Section 2A.3
 - Calculate the scantlings for bottom structure: Part 5, Section 2A.4.3.
 - Calculate and check side shell and deck plating: Part 5, Section 2A.4.4.
 - Calculate and check long. and trans. bulkheads: Part 5, Section 2A.4.5.1.

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- Validate corrugated bulkhead scantling, as applicable: Part 5, Section 2A.4.5.4.
- Verify the scantlings of main supporting members: Part 5, Section 2A.4.5.5.
- Calculate/verify total strength assessment: Part 5, Section 2A.5.
- For unclassified, non-loadlined vessels under 190 m (623 feet)
 - Calculate the vessel definitions: Section 1.
 - Validate the introduction information: Part 5, Section 2B.1-.15.
 - Calculate/check hull-girder strength: Part 5, Section 2B.17.
 - Calculate and check the shell plating: Part 5, Section 2B.19.
 - Calculate and check deck plating: Part 5, Section 2B.21.
 - Calculate and check bulkhead plating: Part 5, Section 2B.23.
 - Calculate the scantlings for bottom structure: Part 5, Section 2B.26.
 - Verify the scantlings of supporting members: Part 5, Section 2B.27.
 - Verify the scantlings of frames, beams, and bulkhead stiffeners: Part 5, Section 2B.29.
- Verify that a structural review of the hull and tanks is complete, including stress analyses as indicated by the attached matrix for structural requirements. In particular note the following:
 - Pinnacle grounding stresses in accordance with 46 CFR 32.63-20 and 151.10-20(b)(2)(ii). Note that pressure tanks supported by three or more saddles interact with the hull and may share some of the hull bending moment. This shared hull bending moment also results in added tank bending moment and must always be considered in the tank design, per 46 CFR 32.63-25(a) and (c).
 - LBS and oceans routes require dynamic loading analysis per 46 CFR 38.05-2(d) and 151.10-20(b)(3)(iii). Hog, sag and stillwater bending also required for oceans routes in accordance with 151.10-20(b)(3). See reference (j) for more details. As further stated in 46 CFR 38.05-10, each tank shall be so supported as to prevent the concentration of excessive loads on the supporting portions of the shell or head, and cargo tank resonance and tank vessel vibrations must be considered in the design of foundations and stays.
 - Collision chocks and saddle designs per 46 CFR 38.05-2(e) and 32.63-25, include the following:

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- Saddle and hold-downs must be designed so that barge deflections and the resulting induced tank loads from pinnacle grounding or dynamic loading do not result in tank failure
 - Collision protection requires collision chocks, typically a length of plate fastened to the tank longitudinally, which will dissipate the energy of a collision. For these chocks, the design loads are specified as a factor times the cargo plus tank weight. Since no standard is given, the standard listed in 151.15-3(d)(1)(ii) is acceptable. As shown in 151.15-3(d)(1)(ii), the stress limits shall be greater than yield and ultimate tensile strength such that the energy is dissipated by the chocks.
 - Aluminum materials are unacceptable for hatch covers and ullage openings.
 - Evaluate welding schedule details. If welding schedule plan is not provided, the MSC may either request copies from submitter or specify welding compliance issues in comments on the return correspondence letter. No strength welding shall be employed in the attachment of supports, lugs, etc., to tanks that require and have been stress relieved.
 - Verify the barge's compressive deck stresses and collapse strength, according to the guidance of reference (g). This will be of particular interest if the L/D ratio exceeds 16 for oceans service or 20 for inland service.
 - Under normal review procedures, the MSC will conduct independent calculations to verify submitter accuracy by evaluating saddle reactions and hull stress in grounded conditions using a computer model. Independent tanks supported by three or more saddles contribute to hull stiffness but are not an integral part of SM.
 - Under normal review procedures, the MSC will compare the hull section modulus to that developed from a computer model of the ship's hull.
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Attachment

Matrix for Structural Requirements for Type I and II Independent Pressure Tank Barges