

MSC Guidelines for the Review of Vapor Control Systems

Procedure Number: C1-46

Revision Date: March 30, 2012



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Purpose: To outline procedures for review of vapor control system (VCS) piping plans and pressure drop calculations, and for generating a VCS List of Cargoes.

References:

- a. 46 Code of Federal Regulations (CFR) Part 39
- b. 33 CFR Part 154, Subpart E (Facility Vapor Control Systems)

Contact Information: If you have any questions or comments concerning this document, please contact the Marine Safety Center (MSC) by email or phone. Please refer to the Procedure Number C1-46.

Email: MSC@uscg.mil

Phone: 202-475-3401

Website: <http://homeport.uscg.mil/msc>

Responsibilities: Using applicable portions of references (a) and (b), the submitter shall provide sufficient documentation and plans to indicate compliance with the applicable requirements. The submission shall be made electronically to the above email address or, if paper, in triplicate to the MSC's address found on the above website. To facilitate plan review and project management, all plans and information specified in these guidelines should be submitted as one complete package through a single point of contact for the project.

General Guidance: Regulating vapor control systems commenced 23 July 1990. The Environmental Protection Agency (EPA) mandated that states satisfy the volatile organic compound emission requirements in the Clean Air Act. In response to the EPA's mandates, many states required tank vessel owners to cease releasing certain volatile organic compound vapors, such as gasoline, into the air. The Coast Guard does not require the vessel owner to use a vapor control system. **But**, if a vapor control system is installed, the Coast Guard does regulate how the system is

MSC Guidelines for the Review of Vapor Control Systems

Procedure Number: C1-46

Revision Date: March 30, 2012

designed and operated via 46 CFR Part 39 to protect vessel personnel and the environment from the ramifications from explosion and/or over-pressurization.

As described in 46 CFR Part 39, the vapor control system regulations apply to any vessel (foreign and U.S. flagged) operating in the navigable waters of the U.S. while collecting crude oil, gasoline blends or benzene vapors emitted from a vessel's cargo tanks.

In addition, a tank vessel capturing vapors of flammable and combustible liquid cargoes other than crude oil, gasoline blends or benzene must follow the Marine Safety Center's "*Guidelines for Determining the Maximum Liquid Transfer Rate for a Tank Vessel Transferring a Flammable or Combustible Cargo Using a Vapor Collection System.*" This document is referred to as the "**Guidelines**" in the remainder of this plan review guideline.

- A submittal must include all of the necessary plans and supporting documents including:
 - VCP Piping Plans
 - Pressure Drop Calculations
 - Completed VCS Form/PRIS, available on the Homeport website
 - High Velocity P/V Valve Specifications (Pressure Drop vs. Flow Diagram)
 - Alarm Height Calculations
 - Application for Inspection (if not already on file at MSC)
 - Tank Group Characteristic Loading Form (TGCLF) for Subchapter O vessels, available on the Homeport website
 - Verification of the Maximum Allowable Working Pressure (MAWP) (either by MSC or ABS approval letter)

 - If the vessel plans are being reviewed by a Classification Society under NVIC 10-82, refer to the NVIC 10-82 section below.
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MSC Guidelines for the Review of Vapor Control Systems

Procedure Number: C1-46

Revision Date: March 30, 2012

VCS Piping Plans:

- Each vessel installing a VCS for the first time or modifying its VCS will need its VCS Piping Plans approved. The piping plans must demonstrate compliance with the following requirements:
 - A list of materials that includes the components used to construct the VCS piping system such as piping, flanges, valves, and other miscellaneous fittings. Piping components are required to satisfy the material and design specifications in 46 CFR Table 56.60-1 (A) & (B).
 - According to 46 CFR 56.60-20(a), heat sensitive materials cannot be used for flammable or combustible fluids. We use the requirements of 46 CFR 56.60-60(d)(1) as a guide and do not approve the installation of nonferrous materials having a melting point of 1700°F or less, such as copper or bronze.
 - P/V valves and spill valve approval information. P/V valves must be CG approved per 46 CFR 162.017 and have a valid approval certificate. Spill valves must meet the American Society of Testing and Materials (ASTM) standard F1271.
 - General System Configurations, including:
 - Whether incompatible vapors can be separated per 46 CFR 39.20-1(a)(2).
 - The piping will be permanently installed and the vapor connection is located as close as practical to the cargo loading manifold per 46 CFR 39.20-1(a)(1). Cargoes carried under 46 CFR Table 151.05 or 46 CFR 153 Table 1 may have vapor connections near the tank instead of near the loading manifold per 46 CFR 39.20-1(a)(3).
 - A method for eliminating liquid condensate by use of either low point drains or by sloping the pipe back towards the tank per 46 CFR 39.20-1(a)(4).
 - The piping is electrically bonded to the hull and electrically continuous per 46 CFR 39.20-1(a)(5).

MSC Guidelines for the Review of Vapor Control Systems

Procedure Number: C1-46

Revision Date: March 30, 2012

- An isolation valve with manual override provided at each point where the vessel's vapor control system may be attached to a facility VCS per 46 CFR 39.20-1(c). This requires the valve to have an indicator showing the valve status (such as a rising stem valve). The local OCMI will ensure compliance with this regulation.
- The vapor connection flange has a stud as required in 46 CFR 39.20-1(e).
- The last meter of the VCS piping before the connection flange must be marked according to 46 CFR 39.20-1(d)(1)&(2). Painted Red/Yellow/Red (.1m/.8m/.1m) and labeled with VAPOR in black letters 50mm high.
- The VCS system cannot interfere with the venting system per 46 CFR 39.20-1(b). When isolation valves are installed, each tank must have a tank breather valve or another means to bypass the isolation valves as required by 46 CFR 32.55-25(b). Installed breather valves must be set at a higher relieving pressure than the high velocity P/V valve unless it is able to relieve the full flow of vapors at the loading rate.
- Dresser couplings may be used to connect piping in the VCS systems on vessels carrying non-hazardous cargoes, listed in 46 CFR Table 30.25-1 and 33 CFR 151.47 and 151.49. If used, they must be listed in the Bill of Materials.
- Tanks with IGS must have a means to isolate the inert gas supply from the VCS as required by 46 CFR 39.20-1(a)(6) and SOLAS 74 II-2/62.10.8.
- Vessels with VCS are required to have closed gauging as defined in 46 CFR 151.15-10. The gauging must be installed prior to and during the entire transfer operation and indicate the full range of liquid in the tank per 46 CFR 39.20-3(a).
- Liquid overfill protection system meeting 46 CFR 39.20-7 & 39.20-9. The plans for the overfill alarms must be submitted to the MSC Electrical Branch for review and approval. Tankship high level and tank overfill alarms must be intrinsically safe per

MSC Guidelines for the Review of Vapor Control Systems

Procedure Number: C1-46

Revision Date: March 30, 2012

46 CFR 39.20-7(a). Spill valves and rupture discs are optional for tankships but must meet the requirements if installed. A tank barge is only required to have one of the following liquid overfill protections systems, per 46 CFR 39.20-9:

- High Level/ Tank Overfill Alarm
 - Intrinsically Safe Overfill Control System
 - Spill Valve
 - Rupture Disc
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- Tankships must have a sensor in the main vapor header of the line that has a pressure indicator located at the cargo transfer control area per 46 CFR 39.20-13(a) and has a high and low pressure alarm per 46 CFR 39.20-13(b). The Coast Guard accepts high and low pressure sensors located in individual cargo tanks in lieu of the main vapor collection line as compliant with this regulation. If this arrangement is used, there must be an individual pressure indicator and individual high and low pressure alarms located on the vessel where the cargo transfer is controlled for each sensor installed. This policy was promulgated by Commandant's Hazardous Material Standards Division (CG-5215) letter dated April 23, 1993.
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VCS Pressure Drop Calculations:

- Calculations must demonstrate that the pressure drop through the VCS created during cargo loading operations will not exceed the vessel's cargo tank maximum allowable working pressure (MAWP) during VCS operations. MSC has published guidelines on its Homeport website for industry to demonstrate compliance for these systems. The guidelines provide methods to determine compliance with the following regulations:
 - 46 CFR 39.20-11(a) (1) - VCS is capable of discharging at 1.25 times the maximum transfer rate without exceeding the MAWP or spill valve/rupture disc setting. This is the Vapor Growth Rate (VGR) mandated for Crude Oil, Gasoline, and Benzene. See Guidelines for information on how to calculate the VGR for other cargoes.
 - 46 CFR 39.20-11(a) (2) - the system will not relieve at a pressure in the tank of less than 1.0 psig.

MSC Guidelines for the Review of Vapor Control Systems

Procedure Number: C1-46

Revision Date: March 30, 2012

- 46 CFR 39.20-11(a) (3) - the system will prevent a vacuum in the cargo tanks greater than the MAWP for any tank connected to the VCS.
 - 46 CFR 39.20-11(a) (4) - the system will not relieve at a vacuum corresponding to a vacuum in the cargo tank of less than 0.5 psig.
 - 46 CFR 39.20-9(b)(2) - the set point for the overfill protection system will actuate an alarm and shutdown the system at the facility overfill control panel 60 seconds prior to the tank being 100% full.
 - 46 CFR 39.20-9(c) and (d) - spill valves must comply with ASTM F1271 and be adequately sized to prevent over pressurization. Documentation from the manufacturer attesting to compliance is satisfactory. **A vessel that intends to carry toxic cargoes cannot have spill valves as the primary means of overfill protection.**
 - 46 CFR 39.20-11(b) & (c) - each P/V valve must be CG type approved. The submission must include the CG approval number.
 - 46 CFR 39.30-1(d) - the transfer rate does not exceed 80% of the total relieving capacity of the P/V valve, or 80% of the setting of any P/V valves in the tank venting system, when relieving at the set pressure and the pressure in the system when discharging to a shore facility.
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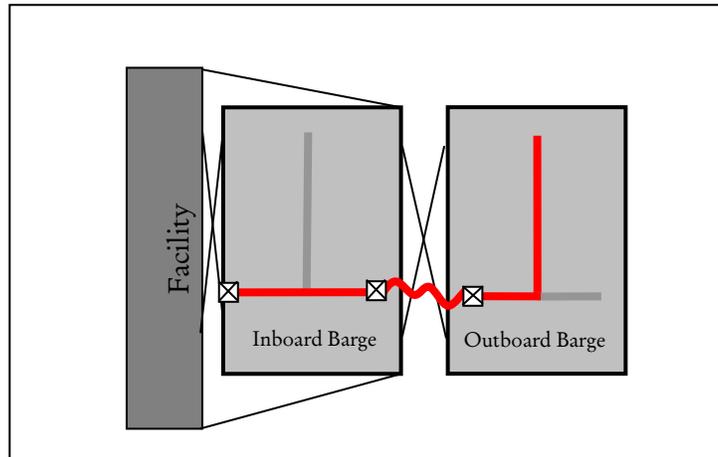
Dual Loading, Lightering, and VPUs:

- Dual Loading:
 - MSC will review the calculations to ensure the system complies with the material, overfill, and cargo tank over pressurization requirements of 46 CFR 39. Upon approval of our technical review, the submitter must send dual loading requests to COMDT (CG-5215) for final approval authority for dual loading operations.
 - Dual loading requests must include calculations with the largest participating barge moored inboard. This demonstrates the most conservative situation. Calculations must demonstrate that the total equivalent length does not create a situation where the outboard barge will over-pressurize its cargo tanks. Total equivalent length includes the longitudinal VCS header of the outboard barge, transverse VCS header of both barges, no more than 25 feet of hose between the barges, and all associated valves and fittings.

MSC Guidelines for the Review of Vapor Control Systems

Procedure Number: C1-46

Revision Date: March 30, 2012



The Total Equivalent Length of VCS Piping and Fittings in Conjunction with a Dual Loading Request

- Lightering Operations with Vapor Balancing
 - Each vessel that uses vapor balancing while conducting a lightering or topping-off operation must have an approved VCS onboard. Additionally, the vessel must meet the technical and operational requirements found in 46 CFR 39.40.
 - 46 CFR 39.40-1 requires approval from COMDT (CG-5215) for certain aspects of lightering, topping-off operations, and vapor balancing.
 - Plans and calculations must be submitted to MSC showing compliance with 46 CFR 39.10, 39.20, and 39.30 and also 39.40-3.
- Vessel Vapor Processing Unit (VPU)
 - A VPU is a type of scrubber or other device installed aboard a tank vessel to process cargo vapors before their release into the atmosphere.
 - According to 46 CFR 39.10-13, in addition to meeting the requirements of 46 CFR 39, each vessel VPU must meet the requirements of 33 CFR 154, Subpart E and 46 CFR Subpart D, F, and J.
 - Applications and exemption requests for VPUs must be submitted to COMDT (CG-5215), who will review the application for compliance.

MSC Guidelines for the Review of Vapor Control Systems

Procedure Number: C1-46

Revision Date: March 30, 2012

- Because of their size and weight, VPUs also requires review of the vessel's strength and stability. An updated general arrangement (GA) plan, intact and damage stability calculations, structural calculations, and other associated plans must be submitted to MSC.
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VCS for Plan Review Conducted by Classification Societies under NVIC 10-82:

- NVIC 10-82 authorizes certain Classification Societies to conduct plan review on the Coast Guard's behalf. In summary, Class Societies may conduct plan review for cargo systems containing oil. Therefore, for subchapter D vessels, Class Societies may be authorized to review VCS plans and calculations on behalf of the Coast Guard. However, the Coast Guard retains the authority to review plans for piping systems containing cargoes other than oil. Therefore, the MSC must review plans and calculations for Subchapter O/I or Subchapter O/D vessels, in accordance with the guidance above.
 - For Subchapter D vessels, the submitter must provide the following information:
 - 10-82 authorizations from the OCMI.
 - Application for Inspection (if not already submitted with other plans).
 - Approval letter from the Classification Society.
 - VCS Piping Plans bearing the Classification Society approval stamp.
 - Pressure Drop Calculations bearing the Classification Society approval stamp.
 - Verification of the MAWP (either by MSC or ABS approval letter or by submission of plans and calculations).
 - Once the above information is received and reviewed, MSC will generate a VCS list of cargoes and the Cargo Authority Attachment (CAA) in accordance with the Classification Society's approval. Since the MSC did not perform plan review, no VCS PRIS will be generated.
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MSC Guidelines for the Review of Vapor Control Systems

Procedure Number: C1-46

Revision Date: March 30, 2012

Disclaimer:

This guidance is not a substitute for applicable legal requirements, nor is it itself a rule. It is not intended to nor does it impose legally-binding requirements on any party. It represents the Coast Guard's current thinking on this topic and may assist industry, mariners, the general public, and the Coast Guard, as well as other federal and state regulators, in applying statutory and regulatory requirements. You can use an alternative approach for complying with these requirements if the approach satisfies the requirements of the applicable statutes and regulations. If you want to discuss an alternative, you may contact the MSC, the unit responsible for implementing this guidance.