

MSC Guidelines for Review of Vapor Control Systems

Procedure Number: C1-46

Revision Date: 01/08/2018

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Purpose: The purpose of this document is to provide guidance and information regarding the submission of vapor control system (VCS) piping plans and pressure drop calculations, and for generating a VCS List of Cargoes.

References:

- a. 46 CFR Part 39
- b. 33 CFR Part 154, Subpart E (Facility Vapor Control Systems)
- c. Marine Safety Bulletin 11-14, dated July 18, 2014

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

Email: MSC@uscg.mil

Phone: 202-795-6731

Website: <http://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Prevention-Policy-CG-5P/Commercial-Regulations-standards-CG-5PS/Marine-Safety-Center-MSC/>

Responsibilities: Using applicable portions of references (a) through (c), 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:

- If the vessel is new and not a sister vessel, has the Application for Inspection been submitted? In general, plan review may not occur until a copy of the Application is received.
- Does the submission clearly state what is desired from MSC?

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- ❑ Does the submission include all necessary information to demonstrate compliance with the applicable requirements? At a minimum, submissions should include the following:
 - VCS Piping Plans
 - Pressure Drop Calculations
 - Alarm Height & Overfill Protection Calculations
 - Completed VCS Form/PRIS, available on the MSC's website
 - Manufacturer's High Velocity P/V Valve Specifications (Pressure Drop vs. Flow Diagram)
 - Application for Inspection (if not already on file at MSC)
 - Tank Group Characteristic Loading Form (TGCLF) for Subchapter O vessels seeking Cargo Authority Attachment, available on the Homeport website
 - Verification of the Maximum Allowable Working Pressure (MAWP) (either by MSC or ABS approval letter)

 - ❑ Are all plans requiring Coast Guard review and/or approval submitted in triplicate (if submittal is in hard copy)?

 - ❑ Are there any special/unusual requests or a time critical element involved?
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General Review Guidance:

- ❑ If a vapor control system (VCS) is installed on a vessel, the VCS must be designed and operated in accordance with 46 CFR Part 39 to protect vessel personnel and the environment from explosion and/or over-pressurization while operating in the navigable waters of the United States.

 - ❑ Each vessel installing a VCS for the first time or modifying an existing VCS will need its VCS Piping Plans approved. In general, reference (a) outlines the guidance for construction on VCS.

 - ❑ The plans and/or calculations should provide evidence that the VCS meets the following requirements:
 - Fixed piping and manifold location: 46 CFR 39.2001(a)
 - Isolation of incompatible vapors, if applicable: 46 CFR 39.2001(b)
 - Electrical continuity: 46 CFR 39.2001(c)
 - Condensate elimination: 46 CFR 39.2001(d)
 - Isolation valve: 46 CFR 39.2001(g)
 - Markings: 46 CFR 39.2001(h)(1) and (2)
 - Hoses: 46 CFR 39.2001(i)
 - Connection flange: 46 CFR 39.2001(j)
 - Overpressure and vacuum protection: 46 CFR 39.2011
 - Operating requirements: 46 CFR 39.3001
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- Each VCS Plan must have a Bill of Materials:
 - 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).
 - In accordance with 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.
 - 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.

- Vapor overpressure and vacuum protection:
 - P/V valves must be CG approved, per 46 CFR 162.017, and have a valid approval certificate for use in Vapor Control Systems.
 - Spill valves must meet the American Society of Testing and Materials (ASTM) standard F1271. Documentation from the manufacturer attesting compliance with the standard is satisfactory. **A vessel that intends to carry toxic cargoes cannot have spill valves as the primary means of overfill protection.**
 - A liquid pressure-vacuum breaker may be used for vapor overpressure and vacuum protection, but the owner must seek approval from Commandant (CG-ENG-5) for this arrangement, in accordance with 46 CFR 2011(c).

- Tankships must have a pressure sensing-device and associated alarms meeting the requirements of 46 CFR 39.2013. The Coast Guard accepts high and low pressure sensors located in individual cargo tanks, in lieu of the main vapor collection line. 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.
 - For tank barges, a Pressure-Vacuum indicating device: 46 CFR 39.2015.
 - The VCS system must not interfere with the cargo tank venting system, per 46 CFR 30.2001(f). When isolation valves are installed, each tank must have a means to bypass the isolation valves, as required by 46 CFR 32.55-25(b). If the vessel has a VCS and additional pressure-vacuum (P/V) relief valves are installed on individual tanks, they 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.

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- Cargo gauging: 46 CFR 39.2003.
 - Liquid overfill protection system: The vessel must meet 46 CFR 39.2007 for a tankship, or 39.2009 for a tank barge. 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 46 CFR 39.2007(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 protection systems, per 46 CFR 39.2009:
 - High Level/ Tank Overfill Alarm
 - Intrinsically Safe Overfill Control System
 - Spill Valve
 - Rupture Disc
 - Tankships with an Inert Gas System must have a means to isolate the inert gas supply from the VCS, as required by 46 CFR 39.2001(e) and SOLAS 74 II-2/62.10.8.
 - Cargoes carried under 46 CFR, Part 151 or Part 153, may use flexible hoses no longer than three meters (9.84 ft) for interconnection between fixed piping to preserve cargo segregation. These flexible hoses must meet the requirements of 46 CFR 39.2001(a)(2) and the hose requirements of 46 CFR 39.2001(i).
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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.
 - A tank vessel capturing vapors of flammable and combustible liquid cargoes thru a VCS must calculate the vapor growth rate factor in accordance with 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*," hereafter referred to as the "**Guidelines**." The Guidelines provide details for calculating the pressure drops in the VCS. Submitters are recommended to follow the Guidelines for their VCS Pressure Drop Calculations. The Guidelines are available on MSC's website. Select the "Tank Vessel/Offshore Division" tab and download "VCS Guidelines" from the Helpful Documents list.
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Overfill Calculations:

- ❑ For tankships, the submission must include calculations for the set point of the high level and overfill alarms prescribed in 46 CFR 39.2007. The high level alarm set point must be set at 95 percent liquid-full, but must activate before the overfill alarm. The overfill alarm must activate with enough time to allow the person in charge of the cargo transfer operation to stop the operation before the tank overflows.
- ❑ For tank barges, the submission must include calculations for the set point of the overfill protection system prescribed in 46 CFR 39.2009(a)(2). At the calculated set point, the overfill protection system must actuate an alarm and automatically shut down the system at the facility overfill control panel 60 seconds prior to the tank being 100 percent liquid-full.

Tandem Loading Requests:

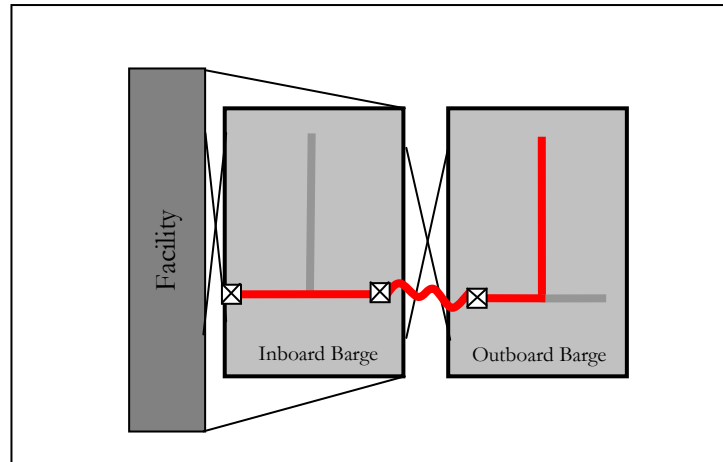


Figure 1: The Total Equivalent Length of VCS Piping and Fittings in Conjunction with a Dual Loading Request

- ❑ MSC will review the calculations required by 46 CFR 39.5001(e) to ensure the system complies with the material, overfill, and cargo tank over pressurization requirements of 46 CFR 39. In accordance with the procedural changes outlined in reference (c), tandem loading no longer requires final approval by Commandant (CG-ENG-5), but may be approved by the local Officer in Charge of Marine Inspections and may be subject to additional operational requirements.
- ❑ Dual loading requests must include calculations with the largest participating barge moored inboard to demonstrate 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. As shown in Figure (1), the total equivalent length includes the longitudinal VCS header of the outboard barge, transverse VCS header

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of both barges, no more than 25 feet of hose between the barges, and all associated valves and fittings. The dual loading calculations must account for the increased flow rate in the applicable portion of the inboard barge's transverse VCS header.

- ❑ If the inboard barge is fitted with a “dummy” vapor header, the inboard barge must meet the additional requirements of 46 CFR 39.5005.
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Lightering Operations With Vapor Balancing:

- ❑ Each vessel that uses vapor balancing while conducting a lightering or topping-off operation must have an approved VCS. The vessel must also meet the technical and operational requirements found in 46 CFR 39.4000.
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Vapor Processing Units (VPU):

- ❑ A VPU is defined in 33 CFR 154.2001 as the components of a vapor control system that recover, destroy, or disperse vapor collected from a vessel. VPU's are generally a type of scrubber or device installed aboard a tank vessel to process cargo vapors before releasing into the atmosphere.
 - ❑ VPUs must meet the requirements of 33 CFR 154, Subpart P and 46 CFR Subpart D, F, and J.
 - ❑ Because of their size and weight, VPUs also require 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 the MSC.
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Plan Review Conducted by ABS under NVIC 10-82:

- ❑ NVIC 10-82 authorizes the American Bureau of Shipping (ABS) to conduct plan review on behalf of the Coast Guard for certain systems. In the case of vapor control systems, ABS may approve systems on vessels which only carry flammable/combustible cargoes (subchapter D), but may not approve systems which are designed for the carriage of hazardous materials (subchapter O).
 - ❑ In order to generate a Cargo Authority Attachment which satisfies the requirements of 33 CFR 154.2150, the submitter must provide the following information for subchapter D vessels:
 - Approval letter from ABS.
 - VCS Piping Plans bearing the ABS approval stamp.
 - Pressure Drop Calculations bearing the ABS approval stamp.
 - Verification of the MAWP (either by MSC or ABS approval letter, or by submission of plans and calculations).
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- Once the above information is received and reviewed, MSC will generate a VCS list of cargoes and a Cargo Authority Attachment (CAA), in accordance with the ABS approval. Since the MSC did not perform plan review, a VCS Plan Review Information Sheet will not be generated.
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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 guidance 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.