MSC Guidelines for Review of Ventilation System Plans

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Purpose:

This Plan Review Guideline (PRG) explains the requirements for seeking plan approval of ventilation systems from the Marine Safety Center (MSC) for most vessel types. The MSC will review the required plans for compliance and issue an approval letter. All submittals must include ventilation system details consisting of ducting materials, fire damper locations and bulkhead penetrations.

References:

a. 46 CFR Subchapter D, Subpart 32.55 – Ventilation
b. 46 CFR Subchapter H, Subpart 72.15 – Ventilation
c. 46 CFR Subchapter I, Subpart 92. 15 – Ventilation
d. 46 CFR Subchapter I-A, Subpart 108.181 – Ventilation
e. 46 CFR Subchapter K, Part 116, Subpart F – Ventilation
f. 46 CFR Subchapter L, Subpart 127.250 – Ventilation for enclosed spaces, and 127.260 Ventilation for accommodation spaces
g. 46 CFR Subchapter O, Subpart 153.310 – Cargo Handling Space Ventilation
h. 46 CFR Subchapter R, Subpart 167
i. 46 CFR Subchapter T, Part 177, Subpart F – Ventilation
j. 46 CFR Subchapter U, Subpart 190.15 – Ventilation
k. Navigation and Vessel Inspection Circular (NVIC) 9-97, Change – 1, Guide to Structural Fire Protection, Sections 2.14 – Fire Dampers, 3.7 – Ventilation Systems
l. Consolidated text of the International Convention for the Safety of Life at Sea (SOLAS) 2009, Chapter II-2, Part C, Regulation 9.7.4
m. International Code of Safety for High-Speed Craft, (HSC), 2000

Contact Information:

If you have any questions or comments concerning this document, please contact the Marine Safety Center by e-mail or phone, referring to Procedure Number: **GEN-04.**

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Applicability

This PRG is applicable to vessels constructed under 46 CFR Subchapters D, H, I, I-A, K, L, O, R, T, U and international regulations contained in SOLAS 74, as amended.

SOLAS as an Alternative to CFR Requirements:

Domestic vessels can apply sections of SOLAS as an acceptable equivalent to the requirements of the CFR. See NVIC 9-97 CH-1, Section 3.7 for the complete list of SOLAS regulations that must be complied with in order to be considered as an equivalent arrangement.

Definitions:

Duct – includes trunks, plenums, and any other type of ventilation piping, chamber or duct work used to move air. [72.05-50(a)]

Jumper Duct – a short piece of ventilation ducting penetrating a bulkhead, with or without a damper at the bulkhead, and unconnected at one or both ends to a ventilation system.

Natural Ventilation – refers to a system where air is supplied and removed by natural means without the use of fans or other powered ventilators. This can be used to describe both ducted and non-ducted systems.

Non-ducted ventilation – refers to a system where air is moved through common spaces, such as corridors, without the benefit of a dedicated, contiguous duct. This definition includes all jumper ducts, air transfer grills, openings (e.g. windows), and any section of ducting not physically connected to a ventilation system.

General:

All enclosed or partially enclosed spaces within a vessel must be adequately ventilated in a manner suitable for the purpose of the space. [72.15-15, 92.15-10, 108.181, 116.600, 127.250]

Natural Ventilation:

MSC will not "Approve" the installation of a natural ventilation system. This type of system must be deemed adequate and approved by the OCMI. MSC will "Examine" non-powered/mechanical ventilation systems and defer approval to the cognizant OCMI. [72.15-20(b); 92.15-15(b); 116.600(c)]

Duct Construction:

SOLAS Certificated vessels: Ducts must be constructed of steel or other equivalent material. (II-2/9.7.1.1)

SOLAS further restricts combustible ducting sections to a maximum cross sectional area of 0.02 m^2. [II-2/9.7.1.1]

US Flag (domestic only): Ducts must be constructed of steel or other non-combustible material.

Exception (domestic only): Short sections of low flame spread combustible ducting may be used at the termination of a duct (typically between a rigid sheet metal duct

and a ceiling mounted diffuser). Total length of the combustible duct must not exceed 2m and must not be located within 600 mm of a penetration of any A or B-class division including continuous B-class ceiling assemblies. [NVIC 9-97 CH-1, Section 3.7]

Fire Dampers:

Dampers must be constructed per 46 CFR 72.05-50; 116.610; or be listed for 1 ½ hours by UL.

US Flag vessels (domestic only): Automatic fire dampers are only required at MVZ boundaries.

SOLAS: AUTOMATIC fire dampers are required at all penetrations of A-class divisions if the cross sectional area is 0.075m^2 or more unless the requirements of Regulation II-2/9.7.3.1.2 are met.

Systems Penetrating MVZ Boundaries:

No duct may serve spaces in more than one main vertical zone;

Penetrations of main vertical zones must be minimized.
[116.610, 72.05-50(d)]

US Flag (D, H, I, IA, K, L, O, U - Non-SOLAS) A ventilation duct penetrating a main vertical zone bulkhead must:

- be constructed of 11 gauge (0.1196" or 3mm) steel or thicker,
- be fitted with an fire damper adjacent to the MVZ bulkhead, on passenger vessels this damper must be AUTOMATIC,
- meet the same requirements relative to the passage of smoke and flame as the MVZ boundary,
- be fitted with insulation of the same type and thickness as the boundary penetrated for a distance of at least 305 mm (12 inches) on the insulated side of the boundary (fire damper blades need not be insulated)

SOLAS requires AUTOMATIC fire dampers if cross sectional area is 0.075m^2 or more, unless the requirements of Regulation II-2/9.7.3.1.2 are met.

Systems Penetrating Non-MVZ Fire Control Boundaries:

A ventilation duct penetrating an **A-Class** fire control boundary must:

- meet the same requirements relative to the passage of smoke and flame as the fire control boundary penetrated;
- be of at least 11 gauge steel; and

- be fitted with insulation of the same type and thickness as the boundary penetrated for a distance of at least 305 millimeters (12 inches) on the insulated side of the boundary. (fire damper blades need not be insulated);
- be equipped with either an automatic or manual fire damper if the duct opens into a space formed by that boundary.

Note: A steel duct that penetrates an A-Class fire control boundary other than a main vertical zone bulkhead, and does not open within the space formed by the boundary need not be fitted with a fire damper provided the duct is at least 11 gauge throughout that space AND there is at least one fire damper located between the fan room and the space served by the ventilation system. Additionally, SOLAS requires the intermediate space to be enclosed by A-class divisions (II-2/9.7.3.1.2). SOLAS also requires AUTOMATIC fire dampers if cross sectional area is 0.075m^2 or more unless the requirements of Regulation II-2/9.7.3.1.2 are met.

A ventilation duct penetrating a **B-Class** fire control boundary must:

- meet the same requirements relative to the passage of smoke and flame as the fire control boundary penetrated;
- be of at least 22 gauge (0.0299 inches or 0.8 mm) steel, or provided with a fire damper at each penetration of a B-class boundary; and
- be fitted with insulation of the same type and thickness as the boundary penetrated for a distance of at least 300 millimeters (12 inches) on the insulated side of the boundary.

Ducts serving cargo spaces, machinery spaces, or vehicles spaces which pass through accommodation spaces must be fitted with automatic fire dampers adjacent to the point of entry into the accommodation spaces. Vertical ducts must meet the applicable bulkhead requirements for a distance of 6 feet above the damper.

Non-ducted Ventilation Systems:

NOTE: The only acceptable use of non-ducted ventilation is the use of non-ducted corridor air returns in stateroom and cabin areas where the fan room is separated from the corridor by B-class bulkheads.

Non-ducted Construction:

In some designs, air flow is accomplished by passing through compartments or concealed spaces without the use of a dedicated ducting system. When air handling is accomplished using non-ducted construction, the assumption that air handling systems have some inherent fire protection integrity is no longer valid. In this case, a penetration for air flow will provide substantially less resistance to the movement of smoke and flame. Given this situation, non-ducted construction may be permitted on a case-by-case basis only after review by the Marine Safety Center.

The designer has the burden of proving such a design does not degrade the integrity of the barriers or egress routes. The following arrangements may be considerations for making such a proposal:

- Non-ducted construction should be used only for exhaust of adjacent, low risk accommodation spaces, corridors and low risk service spaces. The air flow may not pass through any compartments of greater fire risk.
- The HVAC system must be designed to fully exhaust the air returned from the accommodation areas unless duct smoke detectors are installed in the air handler common return and supply ducts (downstream of the filters) and arranged to stop all HVAC fans upon detection of smoke.
- Un-ducted penetration of interior A-class or C-class smoke tight barriers is prohibited.
- Penetration of B-class barriers is prohibited above one half the height of the barrier; consistent with the requirements for louvers.
- Penetrations of C-class barriers need no special consideration.

Stairs:

Vent ducts serving stairway enclosures shall serve no other spaces. [72.05-50(f); 116.610(h)]

Galleys:

Exhaust Ducts from Galley Ranges [SOLAS II-2 Reg 9.7.5]

- Must meet the construction requirements of II-2/9.7.2.1.2.1 and 9.7.2.1.2.2
- Must be fitted with a grease trap or grease removal system;
- Must be provided with a fire damper located at the lower end of the duct (at the junction between the duct and the hood) which is automatically and remotely controlled. A remotely operated damper must also be fitted in the upper end of the duct;
- A fixed means for extinguishing a fire within the duct must be provided; and
- Remote controls for securing the exhaust and supply fans, operating the fire dampers and operating the duct fire extinguishing system and must be provided. The controls shall be located at the galley entrance.

Modular Buildings:

Modular buildings may be used on a host vessels for sleeping quarters, galleys, sanitary facilities, laundry rooms, dive or other equipment rooms, mudlogger's cabins, workshops, control offices, etc. There are currently no regulations available for these buildings, which generally have their own stand-alone attached ventilation units. Plan review for Ventilation, Structural Fire Protection, Structures, Stability, etc. are carried out using the criteria of meeting or exceeding the host vessel standards.

Machinery, Cargo, and Vehicle Spaces:

All enclosed spaces shall be suitably vented or ventilated. [72.15-15, 92.15-10, 108.181, 127.250]

- Means shall be provided for securing ventilation systems serving machinery and cargo spaces, from outside of the space.
- Provisions must be provided for securing ventilation blowers or openings for spaces protected by a fixed gas fire suppression system. [95.15-35; 108.455]
- Machinery spaces protected by fixed gas fire suppression systems must be provided with the means for AUTOMATIC securing of powered ventilation to the space prior to release of extinguishing agent into the protected space
- Ducts serving cargo spaces, machinery spaces, or vehicles spaces which pass through accommodation spaces must be fitted with automatic fire dampers adjacent to the point of entry into the accommodation spaces. Vertical ducts must meet the applicable bulkhead requirements for a distance of 6 feet above the damper.

Vessels Using Fuel Having Flashpoint of Greater Than 110°:

Subchapter T [182.465] and Subchapter K [118.465] vessels for spaces containing diesel powered machinery.

Vessels < 65 feet in length, carrying not more than 12 passengers, may comply with ABYC H-32 in lieu of the following requirements:

Enclosed spaces

- Air cooled engines installed below decks must be fitted with supply ducts leading from the weather decks.
- Spaces containing diesel machinery must be provided with at least two ducts to provide natural or powered ventilation.

Duct Requirements

- The total inlet area and outlet area of each duct shall not be less than one square inch per foot of vessel beam; additional area is required when the ducts provide engine air supply.
- Ducts must be of rigid permanent construction and made of same material as hull or of non-combustible materials.
- Supply ducts shall be provided with inlet cowls or scoops having an area not less than twice the required duct area.
- The duct openings shall not be located near sources of vapor or exhaust air.
- Provisions shall be provided for securing ventilation blowers or openings for spaces protected by a fixed gas fire suppression system

Vessels Using Fuel Having Flashpoint of 110°F or Lower:

Subchapter H, I or U vessels with spaces containing fuel tanks or machinery powered by fuel having flashpoint ≤110° F. [72.15-10, 92.15-5, 190.15-5]

Subchapter K vessels MUST have specific case-by-case approval from Commandant (CG-5213) to have spaces containing fuel tanks or machinery powered by fuel having flashpoint ≤110° F. [119.405]

Subchapter T vessels with spaces containing gasoline tanks or machinery powered by gasoline. [182.460] Note: Vessels < 65 feet in length, carrying not more than 12 passengers, may comply with ABYC H-2 or 33 CFR 183 in lieu of the following requirements:

Enclosed spaces (H, I, and T):

- Must be provided with at least two natural ventilation supply ducts located at one end of the space; ducts shall extend to lowest part of the bilges.
- Must be provided with at least two exhaust ventilation ducts located at the end of the space opposite the supply ducts; the ducts shall extend to lowest part of the bilges. The ducts must be led to one or more powered blowers.
- All ducts must be 22 gauge (0.0299" or 0.75mm) or thicker non-ferrous or galvanized ferrous metal.

Partially-enclosed spaces (T only, see 182.460(a)(2)):

- At least one duct must be installed at the forward part of the space and one duct installed at the after part of the space. The ducts shall be provided with cowls or scoops.

Blower Requirements

- The blowers shall have the capacity to provide the air exchanges required by Table 182.460(b) or Table 72.15-10(b), as applicable.
- An exhaust blower motor shall not be located in the exhaust duct.
- Blower blades must be non-sparking.
- Must be provided with automatic shutdowns if the space serviced by the blowers is provided with a fixed gas fire suppression system.
- Blower switches must be interlocked with the starting switch and ignition switch such that the blowers are energized prior to the engine starting.

Duct Requirements

- Duct area shall be sufficient to limit air velocity to 2,000 feet/minute
- Ducts must be of rigid permanent construction and made of same material as hull or of non-combustible materials.

- Supply ducts shall be provided with inlet cowls or scoops having an area not less than twice the required duct area.
- The duct openings shall not be located near sources of vapor or exhaust air.

Enclosed Classified Locations:

The ventilation systems shall be arranged to maintain a differential pressure between an enclosed classified location, as defined by 46CFR108.170, and each adjacent non-classified location as to prevent the discharge of gasses into the non-classified space. [108.185]

Vehicle Spaces:

Spaces "specially suitable for vehicles" which are located below decks shall be provided with continuous pressure-positive ventilation at each level that the vehicles are carried. The quantity of air provided shall not be less than 1 cubic foot per square foot of deck area. [72.15-15, 92.15-10]

SOLAS Vessels Capacity of ventilation systems for vehicle, ro-ro and special category spaces [II-2/ 20.3.1]

- All passenger vessel "special category spaces" and enclosed ro-ro spaces on vessels carrying more than 36 passengers: 10 air changes per hour
- Cargo vessels and enclosed ro-ro spaces on vessels carrying not more than 36 passengers: 6 air changes per hour

Tank Vessels:

Ventilation of Tank Vessel machinery and pump rooms [32.55-1, 32.60-20]

- Compartments containing machinery where sources of vapor ignition are present shall be provided with means to remove vapors from the floor level or bilges.
- Pump rooms for Grades A, B and C cargoes shall be equipped with exhaust ventilation having capacity to complete an air exchange of the pump room and associated trunks up to the deck at which access to the weather is provided in not more than 3 minutes.
    - Pump room ventilations units shall not be capable of producing a source of vapor ignition.
    - Power ventilation outlets shall terminate more than 6 feet from any opening to the interior part of the vessel which contains a source of vapor ignition. The outlets shall be located to prevent recirculation of contaminated air through the pump room.

- Pump rooms for Grade D and E cargoes shall be fitted with at least two ducts extending to the weather deck; at least one of the ducts shall extend to the pump room floor level. Power ventilation may be used but is not required.

Ventilation of pump rooms [SOLAS II-2/4.5.4]

- Cargo pump rooms shall be provided with mechanical exhaust ventilation led to a safe location on the open deck. A minimum air exchange of 20 per hour based on the gross volume of the space shall be provided. The fans must be non-sparking type.

Plans:

Ventilation system details consisting of ducting material, fire damper locations, and bulkhead penetrations should be included in the submittal package, as applicable

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 Marine Safety Center, who is responsible for implementing this guidance.