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ventilation intakes and openings to accommodations, service, control station, and other gas-safe spaces.

(c) Each ventilation system under § 154.1200 (a) and (b)(1) must change the air in that space and its adjoining trunks at least 30 times each hour.

(d) Each ventilation system for a gas-safe cargo control station in the cargo area must change the air in that space at least eight times each hour.

(e) A ventilation system must not recycle vapor from ventilation discharges.

(f) Each mechanical ventilation system must have its operational controls outside the ventilated space.

(g) No ventilation duct for a gas-dangerous space may pass through any machinery, accommodation, service, or control space, except as allowed under § 154.703.

(h) Each electric motor that drives a ventilation fan must not be within the ducts for any space that may contain flammable cargo vapors.

(i) Ventilation impellers and the housing in way of those impellers on a flammable cargo carrier must meet one of the following:

(1) The impeller, housing, or both made of non-metallic material that does not generate static electricity.

(2) The impeller and housing made of non-ferrous material.

(3) The impeller and housing made of austenitic stainless steel.

(4) The impeller and housing made of ferrous material with at least 13mm (0.512 in.) tip clearance.

(j) No ventilation fan may have any combination of fixed or rotating components made of an aluminum or magnesium alloy and ferrous fixed or rotating components.

(k) Each ventilation intake and exhaust must have a protective metal screen of not more than 13mm (0.512 in.) square mesh.

§ 154.1210 Hold space, void space, cofferdam, and spaces containing cargo piping.

(a) Each hold space, void space, cofferdam, and spaces containing cargo piping must have:

(1) A fixed mechanical ventilation system; or

(2) A fixed ducting system that has a portable blower that meets § 154.1205(i) and (j).

(b) A portable blower in any personnel access opening must not reduce the area of that opening so that the opening does not meet § 154.340.

INSTRUMENTATION

§ 154.1300 Liquid level gauging system: General.

(a) If Table 4 lists a closed gauge for a cargo, the liquid level gauging system under § 154.1305 must be closed gauges that do not have any opening through which cargo liquid or vapor could escape, such as an ultrasonic device, float type device, electronic or magnetic probe, or bubble tube indicator.

(b) If Table 4 lists a restricted gauge for a cargo, the liquid level gauging system under § 154.1305 must be closed gauges that meet paragraph (a) of this section or restricted gauges that do not vent the cargo tank's vapor space, such as a fixed tube, slip tube, or rotary tube.

§ 154.1305 Liquid level gauging system: Standards.

(a) Each cargo tank must have at least one liquid level gauging system that is operable:

(1) At pressures up to, and including, the MARVS of the tank; and

(2) At temperatures that are within the cargo handling temperature range for all cargoes carried.

(b) Unless the cargo tank has one liquid gauging system that can be repaired and maintained when the tank contains cargo, each cargo tank must have at least two liquid level gauging systems that meet paragraph (a) of this section.

(c) Each liquid level gauging system must measure liquid levels from 400 mm (16 in.) or less from the lowest point in the cargo tank, except collection wells, to 100 percent full.

§ 154.1310 Closed gauge shut-off valve.

Each closed gauge that is not mounted directly on the cargo tank must have a shut-off valve that is as close to the tank as practical.

§154.1315 Restricted gauge excess flow valve.

Each restricted gauge that penetrates a cargo tank must have an excess flow valve unless the gauge meets §154.536.

§154.1320 Sighting ports, tubular gauge glasses, and flat plate type gauge glasses.

(a) Cargo tanks may have sighting ports as a secondary means of liquid level gauging in addition to the gauges under §154.1305, if:

(1) The tank has a MARVS that is less than 69 kPa gauge (10 psig);

(2) The port has a protective cover and an internal scale; and

(3) The port is above the liquid level.

(b) Tubular gauge glasses must not be liquid level gauges for cargo tanks.

(c) Plate type gauge glasses must not be liquid level gauges for cargo tanks, except deck tanks if the gauge connections have excess flow valves.

§154.1325 Liquid level alarm system: All cargo tanks.

Except as allowed under §154.1330, each cargo tank must have a high liquid level alarm system that:

(a) Is independent of the liquid level gauging system under §154.1305;

(b) Actuates quick-closing valves under §§154.530, 154.532, and 154,538 or a stop valve in the cargo tank loading line to prevent the tank from becoming 100 percent liquid full and without causing the pressure in the loading lines to exceed the design pressure; and

(c) Actuates an audible and visual alarm at the cargo control station at the liquid level at which the valves under paragraph (b) of this section are actuated or at some lower liquid level.

§154.1330 Liquid level alarm system: Independent tank type C.

Independent tanks type C need not have the high liquid level alarm system under §154.1325 if:

(a) The tank volume is less than 200 m^3 (7,060 $ft.^3$); or

(b) The tank can withstand the maximum possible pressure during loading, that pressure is below the relief valve setting, and overflow of the tank cannot occur.

§154.1335 Pressure and vacuum protection.

(a) Each cargo tank must have the following:

(1) A pressure gauge that:

(i) Monitors the vapor space;

(ii) Is readable at the tank; and

(iii) Has remote readouts at the cargo control station.

(2) If vacuum protection is required under §154.804, a vacuum gauge meeting paragraphs (a)(1)(i), (a)(1)(ii), and (a)(1)(iii) of this section.

(b) The vessel must have at least one high pressure alarm that:

(1) Actuates before the pressure in any cargo tank exceeds the maximum pressure specially approved by the Commandant (G–MSO); and

(2) Actuates an audible and visual alarm at the cargo control station, and a remote group alarm in the wheelhouse.

(c) If vacuum protection is required under §154.804, the vessel must have at least one low pressure alarm that:

(1) Actuates before the pressure in any cargo tank falls below the minimum pressure specially approved by the Commandant (G–MSO); and

(2) Actuates an audible and visual alarm at the cargo control station, and a remote group alarm in the wheelhouse.

(d) At least one pressure gauge must be fitted on each:

(1) Enclosed hold;

(2) Enclosed interbarrier space;

(3) Cargo pump discharge line;

(4) Liquid cargo manifold; and

(5) Vapor cargo manifold.

(e) There must be a local manifold pressure gauge between each manifold stop valve and each hose connection to the shore.

[CGD 74–289, 44 FR 26009, May 3, 1979, as amended by CGD 82–063b, 48 FR 4782, Feb. 3, 1983]

§154.1340 Temperature measuring devices.

(a) Each cargo tank must have devices that measure the temperature:

(1) At the bottom of the tank; and

(2) Near the top of the tank and below the maximum liquid level allowed under §154.1844.

(b) Each device required by paragraph (a) must have a readout at the cargo control station.

(c) Except for independent tanks type C, each cargo containment system for a design temperature colder than −55° C (−67°F) must have temperature measuring devices that meet the following:

(1) The number and location of the devices must be specially approved by the Commandant (G–MSO).

(2) The devices must be within the cargo tank's insulation or on the adjacent hull structure.

(3) Each device must show the temperature continuously or at regular intervals of one hour or less.

(4) Each device must actuate an audible and visual alarm at the cargo control station and a remote group alarm in the wheelhouse before the temperature of the steel of the adjacent hull structure is cooled below the lowest temperature allowed for the steel under § 154.172.

(d) For each cargo tank with a design temperature colder than −55°C (−67°F), the number and arrangement of the devices that show the temperature of the tank during cool down procedures must be specially approved by the Commandant (G–MSO).

[CGD 74–289, 44 FR 26009, May 3, 1979, as amended by CGD 82–063b, 48 FR 4782, Feb. 3, 1983]

§ 154.1345 Gas detection.

(a) Each vessel carrying a cargo that is designated with an ''I'' or ''I and T'' in Table 4 must have:

(1) A fixed flammable gas detection system that meets § 154.1350; and

(2) Two portable gas detectors that can each measure 0 to 100% of the lower flammable limit of the cargo carried.

(b) Each vessel carrying a cargo that is designated with a ''T'' or ''I and T'' in Table 4 must have:

(1) Two portable gas detectors that show if the concentration of cargo is above or below the threshold limit value listed in 29 CFR 1910.1000 for that cargo; and

(2) Fixed gas sampling tubes in each hold space and interbarrier space with:

(i) The number of tubes specially approved by the Commandant (G–MSO);

(ii) Each tube valved and capped above the main deck unless it is connected to a fixed toxic gas detector;

(iii) If the vessel carries cargo that is heavier than the atmosphere of the space, each tube's open end in the lower part of the space;

(iv) If the vessel carries cargo that is lighter than the atmosphere of the space, each tube's open end in the upper part of the space;

(v) If the vessel carries cargo that is heavier than the atmosphere of the space and another cargo that is lighter than the atmosphere of the space, tubes with their open ends in the lower part of the space and tubes with their open ends in the upper part of the space; and

(vi) If the vessel carries cargo that can be both heavier and lighter than the atmosphere of the space, tubes with their open ends in the lower part of the space and tubes with their open ends in the upper part of the space.

(c) A vessel that carries methyl bromide or sulfur dioxide must have a fixed gas detection system that is not located in a gas-safe space.

(d) A vessel that carries sulfur dioxide must have a fixed gas detection system that meets § 154.1350 except paragraph (j).

(e) Each alarm under § 154.1350(e) on a vessel that carries methyl bromide or sulfur dioxide must be set at or below the threshold limit value listed in 29 CFR 1910.1000 for the cargo carried.

[CGD 74–289, 44 FR 26009, May 3, 1979, as amended by CGD 82–063b, 48 FR 4782, Feb. 3, 1983]

§ 154.1350 Flammable gas detection system.

(a) The vessel must have a fixed flammable gas detection system that has sampling points in:

(1) Each cargo pump room;

(2) Each cargo compressor room;

(3) Each motor room for cargo handling machinery;

(4) Each cargo control station that is not gas-safe;

(5) Each hold space, interbarrier space, and other enclosed spaces, except fuel oil or ballast tanks, in the cargo area, unless the vessel has independent tanks type C; and

(6) Each space between the doors of an air lock under §154.345.

(b) The sampling points under paragraph (a) of this section must meet §154.1345(b)(2) (iii) through (vi).

(c) Gas sampling lines for the flammable gas detection system must not pass through any gas-safe space, except the gas-safe space in which the gas detection equipment is located.

(d) Gas detection systems must have a readout with meters that show flammable gas concentration over the concentration or volume ranges under paragraph (t) or (u) of this section.

(e) Each flammable gas detection system must have audible and visual alarms that are actuated at a cargo concentration that is 30% or less of the lower flammable limit in air of the cargo carried.

(f) Each flammable gas detection system must have an audible and visual alarm for power failure and loss of gas sampling flow.

(g) The alarms under paragraphs (e) and (f) of this section must signal in the space where the gas detection system's readout is located and must meet §154.1365.

(h) Remote group alarms, that indicate that one of the alarm conditions under paragraphs (e) and (f) of this section exists, must meet §154.1365 and must be in each wheelhouse and in each cargo control station if the gas detection system's readout is not located in those spaces.

(i) Each flammable gas detection system must monitor each sampling point at 30 minute or shorter intervals.

(j) Electrical equipment for each flammable gas detection system that is in a gas-dangerous space or area must meet §§154.1000 through 154.1015.

(k) Each flammable gas detection system must have enough flame arrestors for all gas sampling lines to prevent flame propagation to the spaces served by the system through the sampling lines.

(l) Each flammable gas detection system must have a filter that removes particulate matter in each gas sampling line.

(m) Each filter under paragraph (l) of this section must be located where it can be removed during vessel operation, unless it can be freed by back pressure.

(n) Each flammable gas detection system in a gas-safe space must:

(1) Have a shut-off valve in each sampling line from an enclosed space, such as a hold or interbarrier space; and

(2) Exhaust gas to a safe location in the open atmosphere and away from all ignition sources.

(o) Each flammable gas detection system must not have common sampling lines, except sampling lines may be manifolded at the gas detector location if each line has an automatic valve that prevents cross-communication between sampling points.

(p) Each flammable gas detection system must have at least one connection for injecting zero gas and span gas into the system for testing and calibration.

(q) Each flammable gas detection system must have span gas for testing and calibration that is of known concentration.

(r) The calibration test procedure and type and concentration of span gas under paragraph (q) of this section must be on or in each gas analyzer cabinet.

(s) Each flammable gas detection system must have at least one flow meter capable of measuring the flow to the gas analyzer, and must provide a means for ensuring that there is a positive flow in the right direction in each sampling line at all times.

(t) Each flammable gas detection system must measure gas concentrations that:

(1) Are at least 0% through 200% of the alarm concentration; and

(2) Allow calibration of the equipment with span gas.

(u) In each hold and each interbarrier space that contains tanks other than independent tanks type A, B, or C, the flammable gas detection system must measure cargo concentrations of 0 to 100% by volume with:

(1) An analyzer other than the one under paragraph (t) of this section; or

(2) The analyzer under paragraph (t) of this section with a scale switch that automatically returns the analyzer to the concentration range under paragraph (t) of this section when released.

§ 154.1360 Oxygen analyzer.

The vessel must have a portable analyzer that measures oxygen levels in an inert atmosphere.

§ 154.1365 Audible and visual alarms.

(a) Each audible alarm must have an arrangement that allows it to be turned off after sounding. For remote group alarms this arrangement must not interrupt the alarm's actuation by other faults.

(b) Each visual alarm must be one that can be turned off only after the fault that actuated it is corrected.

(c) Each visual alarm must be marked to show the type and, except for remote group alarms, the location of each fault that actuates it.

(d) Each vessel must have means for testing each alarm.

§ 154.1370 Pressure gauge and vacuum gauge marking.

Each pressure gauge and vacuum gauge under § 154.1335(a) must be marked with the maximum and minimum pressures that are specified on the vessel's certificate for the cargo carried.

§ 154.1375 Readout for temperature measuring device: Marking.

Each readout under § 154.1340 for a device that measures temperature in a cargo tank must be marked with the design temperature specified for the cargo tank on the vessel's certificate.

SAFETY EQUIPMENT

§ 154.1400 Safety equipment: All vessels.

(a) Instead of the equipment under § 35.30–20 of this chapter, a vessel of less than 25,000 m^3 cargo capacity must have the following personnel safety equipment:

(1) Six self-contained, pressure-demand-type, air-breathing apparatus approved by the Mining Enforcement and Safety Administration (MESA) or the National Institute for Occupational Safety and Health (NIOSH), each having at least a 30 minute capacity.

(2) Nine spare bottles of air for the self-contained air-breathing apparatus, each having at least a 30 minute capacity.

(3) Six steel-cored lifelines.

(4) Six Type II or Type III flashlights constructed and marked in accordance with ASTM F1014–1986.

(5) Three fire axes.

(6) Six helmets that meet ANSI Safety Requirements for Industrial Head Protection, Z–89.1 (1969).

(7) Six sets of boots and gloves that are made of rubber or other electrically non-conductive material.

(8) Six sets of goggles that meet the specifications of ANSI Practice for Occupational and Educational Eye and Face Protection, Z–87.1 (1979).

(9) Three outfits that protect the skin from scalding steam and the heat of a fire, and that have a water resistant outer surface.

(10) Three chemical protective outfits that protect the wearers from the particular personnel hazards presented by the cargo vapor.

(b) Instead of the equipment under § 35.30–20 of this chapter, a vessel of 25,000 m^3 cargo capacity or more must have the following personnel safety equipment:

(1) Eight self-contained, pressure-demand-type, air-breathing apparatus approved by the Mining Enforcement and Safety Administration (MESA) or the National Institute for Occupational Safety and Health (NIOSH), each having at least a 30 minute capacity.

(2) Nine spare bottles of air for the self-contained air-breathing apparatus, each having at least a 30 minute capacity.

(3) Eight steel-cored lifelines.

(4) Eight Type II or Type III flashlights constructed and marked in accordance with ASTM F1014–1986.

(5) Three fire axes.

(6) Eight helmets that meet ANSI Safety Requirements for Industrial Head Protection, Z–89.1 (1969).

(7) Eight sets of boots and gloves that are made of rubber or other electrically non-conductive material.

(8) Eight sets of goggles that meet the specifications of ANSI Practice for Occupational and Educational Eye and Face Protection, Z–87.1 (1979).

(9) Five outfits that protect the skin from scalding steam and the heat of a fire, and that have a water resistant outer surface.