(1) Have a detonation arrester located not more than 6 meters (19.7 ft.) from the facility vapor connection; or

(2) Have an inerting system that meets the requirements of §154.824 of this subpart.

(c) A vapor control system with a single facility vapor connection that receives vapor from a vessel with cargo tanks that are not inerted and processes vapor with a vapor recovery unit must:

(1) Have a detonation arrester located not more than 6 meters (19.7 ft.) from the facility vapor connection; or

(2) Have an inerting, enriching, or diluting system that meets the requirements of §154.824 of this subpart.

(d) A vapor control system with a single facility vapor connection that receives vapor from a vessel with cargo tanks that are not inerted and processes the vapor with a vapor destruction unit must:

(1) Have a detonation arrester located not more than 6 meters (19.7 ft.) from the facility vapor connection; and

(2) Have an inerting, enriching, or diluting system that meets the requirements of §154.824 of this subpart.

(e) A vapor control system with multiple facility vapor connections that processes vapor with a vapor recovery unit must have a detonation arrester located not more than 6 meters (19.7 ft.) from each facility vapor connection.

(f) A vapor control system with multiple facility vapor connections that processes vapor with a vapor destruction unit must:

(1) Have a detonation arrester located not more than 6 meters (19.7 ft.) from each facility vapor connection; and

(2) Have an inerting, enriching, or diluting system that meets the requirements of §154.824 of this subpart.

(g) A vapor control system that uses a vapor balancing system in which cargo vapor from a vessel is transferred through the facility vapor collection system to facility storage tanks must:

(1) Have a detonation arrester located not more than 6 meters (19.7 ft.) from each facility vapor connection;

(2) Have a detonation arrester located within the storage tank containment area as close as practical to the vapor return connection of each facility storage tank; and

(3) Have facility storage tank high level alarm systems and facility storage tank overfill control systems arranged to prevent cargo from entering the vapor return line.

(h) Except for a discharge vent from a vapor destruction unit, each outlet of a vapor control system that vents to atmosphere and is not isolated with a pressure-vacuum relief valve must have a flame arrester located at the outlet.

§154.822 Detonation arresters, flame arresters, and flame screens.

(a) Each detonation arrester required by this part must:

(1) Be capable of arresting a detonation from either side of the device; and

(2) Be acceptable to the Commandant (G–MSO). A detonation arrester designed, built, and tested in accordance with appendix A of this part will be acceptable to the Commandant (G–MSO).

(b) Each flame arrester required by this part must be acceptable to the Commandant (G–MSO). A flame arrester designed, built, and tested in accordance with appendix B of this part will be acceptable to the Commandant (G–MSO).

(c) Each flame screen required by this part must be either a single screen of corrosion resistant wire of at least 30 by 30 mesh, or two screens, both of corrosion resistant wire, of at least 20 by 20 mesh, spaced not less than 12.7 millimeters (½ in.) or more than 38.1 millimeters (1½ in.) apart.

[CGD 88–102, 55 FR 25429, June 21, 1990; 55 FR 39270, Sept. 26, 1990, as amended by CGD 96–026, 61 FR 33666, June 28, 1996; USCG–2002–12471, 67 FR 41333, June 18, 2002]

§154.824 Inerting, enriching, and diluting systems.

(a) A vapor control system which uses inerting, enriching, or diluting gas must be capable of inerting, enriching, or diluting the vapor collection line prior to receiving cargo vapor.

(b) Except as permitted by §154.820(a) of this subpart, a vapor control system which uses an inerting, enriching, or diluting system must be equipped with a gas injection and mixing arrangement located as close as practical but

not more than 10 meters (32.8 ft.) from the facility vapor connection that ensures complete mixing of the gases within 20 pipe diameters of the injection point;

(c) A vapor control system that uses an inerting or enriching system may not be operated at a vacuum after the injection point unless:

(1) There are no sleeve-type pipe couplings, vacuum relief valves, or other devices which could allow air into the vapor collection system downstream of the injection point; or

(2) An additional analyzer is used to monitor the downstream vapor concentration and a means is provided to inject additional inerting or enriching gas.

(d) A vapor control system that uses analyzers to control the amount of inerting, enriching, or diluting gas injected into the vapor collection line must be equipped with at least 2 analyzers. The analyzers must be connected so that:

(1) When oxygen analyzers are used, the higher oxygen concentration reading controls the inerting or enriching system and activates the alarm and automatic shutdown system required by paragraph (h), (j) or (k)(2) of this section;

(2) When hydrocarbon analyzers are used, the lower hydrocarbon concentration reading controls the enriching system and activates the alarm and automatic shutdown system required by paragraph (i) or (k)(1) of this section; and

(3) When hydrocarbon analyzers are used, the higher hydrocarbon concentration reading controls the diluting system and activates the alarm and automatic shutdown system required by paragraph (l) of this section.

(e) A vapor control system that uses volumetric measurements to control the amount of inerting, enriching, or diluting gas injected into the vapor collection line must be equipped with at least one analyzer to activate the alarms and automatic shutdown systems required by this section.

(f) Each oxygen or hydrocarbon analyzer required by this section must:

(1) Be installed in accordance with API Recommended Practice 550;

(2) Have a response time of not more than 30 seconds from the time the vapor is sampled; and

(3) Sample the vapor concentration continuously not more than 30 pipe diameters from the gas injection point.

(g) Oxygen analyzers which operate at elevated temperatures (i.e. zirconia oxide or thermomagnetic) must not be used.

(h) An inerting system must:

(1) Supply sufficient inert gas to the vapor stream to ensure that the oxygen concentration throughout the vapor collection system is maintained below 8.0 percent by volume;

(2) Activate an alarm when the oxygen concentration in the vapor collection line exceeds 8.0 percent by volume;

(3) Close the remotely operated cargo vapor shutoff valve required by §154.810(a) of this part when the oxygen concentration in the vapor collection line exceeds 9.0 percent by volume; and

(4) If a combustion device is used to produce the inert gas, have a hydraulic seal and non-return valve between the combustion device and the vapor collection line.

(i) An enriching system must:

(1) Supply sufficient compatible hydrocarbon vapor to the vapor stream to ensure that the hydrocarbon concentration throughout the vapor collection system is maintained above 170 percent by volume of the upper flammable limit;

(2) Activate an alarm when the hydrocarbon concentration in the vapor collection line falls below 170 percent by volume of the upper flammable limit; and

(3) Close the remotely operated cargo vapor shutoff valve required by §154.810(a) of this subpart when the hydrocarbon concentration in the vapor collection line falls below 150 percent by volume of the upper flammable limit.

(j) Oxygen analyzers may be used in lieu of hydrocarbon analyzers in an enriching system at a facility that receives cargo vapor only from a vessel with non-inerted cargo tanks, provided that the analyzers:

(1) Activate an alarm when the oxygen concentration in the vapor collection line exceeds 15.5 percent by volume; and

(2) Close the remotely operated cargo vapor shutoff valve required by §154.810(a) of this subpart when the oxygen concentration in the vapor collection line exceeds 16.5 percent by volume.

(k) An enriching system may be used in a vapor collection system that receives cargo vapor from a vessel with inerted cargo tanks if:

(1) Hydrocarbon analyzers are used to comply with paragraph (i)(2) and (i)(3) of this section; or

(2) If oxygen analyzers are used, the analyzers activate an alarm when the oxygen concentration in the vapor collection line exceeds 8 percent by volume, and close the remotely operated cargo vapor shutoff valve required by §154.810(a) of this subpart when the oxygen concentration exceeds 9 percent by volume.

(l) An air dilution system must:

(1) Supply sufficient additional air to the vapor stream to ensure that the hydrocarbon concentration throughout the vapor collection system is maintained below 30 percent by volume of the lower flammable limit;

(2) Activate an alarm when the hydrocarbon concentration in the vapor collection line exceeds 30 percent by volume of the lower flammable limit; and

(3) Close the remotely operated cargo vapor shutoff valve required by §154.810(a) of this subpart when the hydrocarbon concentration in the vapor collection line exceeds 50 percent by volume of the lower flammable limit.

[CGD 88–102, 55 FR 25429, June 21, 1990; 55 FR 39270, Sept. 26, 1990]

§154.826 Vapor compressors and blowers.

(a) Each inlet and outlet to a compressor or blower which handles vapor that has not been inerted, enriched, or diluted in accordance with §154.824 of this subpart must be fitted with:

(1) A detonation arrester;

(2) A flame arrester; or

(3) An explosion suppression system acceptable to the Commandant (G–MSO).

(b) If a reciprocating or screw-type compressor handles vapor in the vapor collection system, it must be provided with indicators and audible and visible alarms to warn against the following conditions:

(1) Excessive discharge gas temperature at each compressor chamber or cylinder;

(2) Excessive cooling water temperature;

(3) Excessive vibration;

(4) Low lube oil level;

(5) Low lube oil pressure; and

(6) Excessive shaft bearing temperatures.

(c) If a liquid ring-type compressor handles vapor in the vapor collection system, it must be provided with indicators and audible and visible alarms to warn against the following conditions:

(1) Low level of liquid sealing medium;

(2) Lack of flow of liquid sealing medium;

(3) Excessive temperature of the liquid sealing medium;

(4) Low lube oil level;

(5) Low lube oil pressure, if pressurized lubricating system; and

(6) Excessive shaft bearing temperature.

(d) If a centrifugal compressor, fan, or lobe blower handles vapor in the vapor collection system, construction of the blades and/or housing must meet one of the following:

(1) Blades or housing of nonmetallic construction;

(2) Blades and housing of nonferrous material;

(3) Blades and housing of corrosion resistant steel;

(4) Ferrous blades and housing with one-half inch or more design tip clearance; or

(5) Blades of aluminum or magnesium alloy and a ferrous housing with a nonferrous insert sleeve at the periphery of the impeller.

[CGD 88–102, 55 FR 25429, June 21, 1990, as amended by CGD 96–026, 61 FR 33666, June 28, 1996]

§154.828 Vapor recovery and vapor destruction units.

(a) The inlet to a vapor recovery unit which receives cargo vapor that has not been inerted, enriched, or diluted in accordance with §154.824 of this subpart must be fitted with one of the following: