must be injected into the exhaust system as near to the engine manifold as practicable. The water must pass through the entire length of the exhaust pipe.

(3) The part of the exhaust system between the point of cooling water injection and the engine manifold must be water-jacketed or effectively insulated and protected in compliance with §§ 177.405(b) and 177.970 of this chapter.

(4) Vertical exhaust pipes must be water-jacketed or suitably insulated as required by § 182.430(g).

(5) When the exhaust cooling water system is separate from the engine cooling water system, a suitable warning device, visual or audible, must be installed at the operating station to indicate any reduction in normal water flow in the exhaust cooling system.

(6) A suitable hull strainer must be installed in the circulating raw water intake line for the exhaust cooling system.

(c) Engine exhaust cooling system built in accordance with the requirements of ABYC P–1 (incorporated by reference; see 46 CFR 175.600) will be considered as meeting the requirements of this section.

[CGD 85–080, 61 FR 986, Jan. 10, 1996; 61 FR 20557, May 7, 1996, as amended by USCG–2003–16630, 73 FR 65207, Oct. 31, 2008]

§ 182.430 Engine exhaust pipe installation.

(a) The design of all exhaust systems must ensure minimum risk of injury to personnel. Protection must be provided in compliance with § 177.970 of this chapter at such locations where persons or equipment might come in contact with an exhaust pipe.

(b) Exhaust gas must not leak from the piping or any connections. The piping must be properly supported by noncombustible hangers or blocks.

(c) The exhaust piping must be so arranged as to prevent backflow of water from reaching engine exhaust ports under normal conditions.

(d) Pipes used for wet exhaust lines must be Schedule 80 or corrosion-resistant material and adequately protected from mechanical damage.

(e) Where flexibility is necessary, a section of flexible metallic hose may be used. Nonmetallic hose may be used for wet exhaust systems provided it is especially adapted to resist the action of oil, acid, and heat, has a wall thickness sufficient to prevent collapsing or panting, and is double clamped where practicable.

(f) Where an exhaust pipe passes through a watertight bulkhead, the watertight integrity of the bulkhead must be maintained. Noncombustible packing must be used in bulkhead penetration glands for dry exhaust systems. A wet exhaust pipe may be welded to a steel or equivalent bulkhead in way of a penetration and a fiberglass wet exhaust pipe may be fiberglassed to a fiberglass reinforced plastic bulkhead if suitable arrangements are provided to relieve the stresses resulting from the expansion of the exhaust piping.

(g) A dry exhaust pipe must:

(1) If it passes through a combustible bulkhead or partition, be kept clear of, and suitably insulated or shielded from, combustible material.

(2) Be provided with noncombustible hangers and blocks for support.

(h) An exhaust pipe discharge terminating in a transom must be located as far outboard as practicable so that exhaust gases cannot reenter the vessel.

(i) Arrangements must be made to provide access to allow complete inspection of the exhaust piping throughout its length.

(j) An exhaust installation subject to pressures in excess of 105 kPa (15 psig) gauge or having exhaust pipes passing through living or working spaces must meet the material requirements of part 56 of subchapter F (Marine Engineering) of this chapter.

(k) Engine exhaust pipe installations built in accordance with the requirements of ABYC P–1 (incorporated by reference; see 46 CFR 175.600), will be considered as meeting the requirements of this section.

[CGD 85–080, 61 FR 986, Jan. 10, 1996; 61 FR 20557, May 7, 1996; 61 FR 24464, May 15, 1996, as amended at 62 FR 51358, Sept. 30, 1997; USCG–2003–16630, 73 FR 65207, Oct. 31, 2008]

§ 182.435 Integral fuel tanks.

(a) Gasoline fuel tanks must be independent of the hull.

(b) Diesel fuel tanks may not be built integral with the hull of a vessel unless the hull is made of:

(1) Steel;
(2) Aluminum; or
(3) Fiber reinforced plastic when:
(i) Sandwich construction is not used; or
(ii) Sandwich construction is used with only a core material of closed cell polyvinyl chloride or equivalent.

(c) During the initial inspection for certification of a vessel, integral fuel tanks must withstand a hydrostatic pressure test of 35 kPa (5 psig), or the maximum pressure head to which they may be subjected in service, whichever is greater. A standpipe of 3.5 meters (11.5 feet) in height attached to the tank may be filled with water to accomplish the 35 kPa (5 psig) test.

[CGD 85–080, 61 FR 986, Jan. 10, 1996, as amended at 62 FR 51358, Sept. 30, 1997]

§ 182.440 Independent fuel tanks.

(a) *Materials and construction.* Independent fuel tanks must be designed and constructed as described in this paragraph (a).

(1) The material used and the minimum thickness allowed must be as indicated in Table 182.440(a)(1), except that other materials that provide equivalent safety may be approved for use under paragraph (a)(3) of this section. Tanks having a capacity of more than 570 liters (150 gallons) must be designed to withstand the maximum head to which they may be subjected in service, but in no case may the thickness be less than that specified in Table 182.440(a)(1).

TABLE 182.440(a)(1)

Material	ASTM specification (all incorporated by reference; see 46 CFR 175.600)	Thickness in millimeters (inches) and [gage number][1] vs. tank capacities for:		
		4 to 300 liter (1 to 80 gal) tanks	More than 300 liter (80 gal) and not more than 570 liter (150 gal) tanks	Over 570 liter (150 gal)[2] tanks
Nickel-copper	B 127, hot rolled sheet or plate	0.94 (0.037) [USSG 20][3].	1.27 (0.050) [USSG 18].	2.72 (0.107) [USSG 12].
Copper-nickel[4]	B 122, UNS alloy C71500	1.14 (0.045) [AWG 17].	1.45 (0.057) [AWG 15].	3.25 (0.128) [AWG 8].
Copper[4]	B 152, UNS alloy C11000	1.45 (0.057) [AWG 15].	2.06 (0.081) [AWG 12].	4.62 (0.182) [AWG 5].
Copper-silicon[4]	B 96, alloys C65100 and C65500	1.29 (0.051) [AWG 16].	1.63 (0.064) [AWG 14].	3.66 (0.144) [AWG 7].
Steel or iron[5,6]	1.90 (0.0747) [MSG 14]	2.66 (0.1046) [MSG 12].	4.55 (0.1793) [MSG 7]..	
Aluminum[7]	B 209, alloy 5052, 5083, 5086	6.35 (0.250) [USSG 3].	6.35 (0.250) [USSG 3].	6.35 (0.250) [USSG 3].
Fiber reinforced plastic.	As required[8]	As required[8]	As required[8]..	

[1] The gage numbers used in this table may be found in many standard engineering reference books. The letters "USSG" stand for "U.S. Standard Gage," which was established by the act of March 3, 1892 (15 U.S.C. 206), for sheet and plate iron and steel. The letters "AWG" stand for "American Wire Gage" (or Brown and Sharpe Gage) for nonferrous sheet thicknesses. The letters "MSG" stand for "Manufacturer's Standard Gage" for sheet steel thickness.
[2] Tanks over 1514 liters (400 gallons) must be designed with a factor of safety of four on the ultimate strength of the material used with a design head of not less than 1220 millimeters (4 feet) of liquid above the top of the tank.
[3] Nickel-copper not less than 0.79 millimeter (0.031 inch) [USSG 22] may be used for tanks up to 114-liter (30-gallon) capacity.
[4] Acceptable only for gasoline service.
[5] Gasoline fuel tanks constructed of iron or steel, which are less than 5 millimeter (0.1875) inch) thick, must be galvanized inside and outside by the hot dip process. Tanks intended for use with diesel oil must not be internally galvanized.
[6] Stainless steel tanks are not included in this category.
[7] Anodic to most common metals. Avoid dissimilar metal contact with tank body.
[8] The requirements of 46 CFR 182.440(a)(2) apply.

(2) Fiber reinforced plastic may be used for diesel fuel tanks under the following provisions:

(i) The materials must be fire retardant. Flammability of the material must be determined by the standard test methods in ASTM D 635 and ASTM D 2863 (both incorporated by reference; see 46 CFR 175.600), or other standard specified by the Commandant. The results of these tests must show that the average extent of burning is less than 10 millimeters (0.394 inches), the average time of burning is less than 50 seconds, and the limiting oxygen index is greater than 21.

(ii) Tanks must meet UL 1102 (incorporated by reference; see 46 CFR