

3745-76-15

Flare requirements.

[Comment: For dates of non-regulatory government publications, publications of recognized organizations and associations, federal rules, and federal statutory provisions referenced in this rule, see ~~the last (C)~~ paragraph of rule 3745-76-01 of the Administrative Code titled "~~Incorporation by reference~~[referenced materials](#)."]]

(A) General requirements

- (1) Flares shall be designed for and operated with no visible emissions as determined by the methods specified in paragraph (D)(1) of this rule, except for periods not to exceed a total of five minutes during any two consecutive hours.
 - (2) Flares shall be operated with a flame present at all times, as determined by the methods specified in paragraph (D)(2) of this rule.
 - (3) Flares used to comply with provisions of this chapter shall be operated at all times when emissions may be vented to them.
 - (4) Flares used to comply with this rule shall be steam-assisted, air-assisted, or nonassisted.
- (B) The owner or operator ~~shall~~[has the choice of adhering to](#) either ~~comply with the requirements for~~ the heat content specifications and the maximum tip velocity in ~~paragraphs~~[paragraph](#) (B)(1) of this rule or the requirements for nonassisted flares having a hydrogen content of 8.0 per cent or greater in paragraph (B)(2) of this rule:

(1) Heat content and maximum tip velocity specifications

- (a) Flares shall be used only with the net heating value of the gas being combusted being 11.2 megajoules per standard cubic meter (three hundred Btu per standard cubic foot) or greater if the flare is steam-assisted or air-assisted; or with the net heating value of the gas being combusted being 7.45 megajoules per standard cubic meter (two hundred Btu per standard cubic foot) or greater if the flare is nonassisted. The net heating value of the gas being combusted shall be determined by the methods specified in paragraph (D)(3) of this rule.
- (b) Steam-assisted and nonassisted flares shall be designed for and operated with an exit velocity, [as determined by the methods specified in paragraph \(D\)\(4\) of this rule](#), less than 18.3 meters per second (sixty feet per second); ~~as determined by the methods specified in paragraph~~

~~(D)(4) of this rule~~, except as provided in paragraphs (B)(1)(c) and (B)(1)(d) of this rule.

(c) ~~If the net heating value of the gas being combusted is greater than 37.3 megajoules per standard cubic foot (one thousand Btu per standard cubic foot), steam-assisted and nonassisted flares can be designed for and operated with an exit velocity equal to or greater than 18.3 meters per second (sixty feet per second) but less than one hundred and twenty two meters per second (four hundred feet per second), as determined by the methods specified in paragraph (D)(4) of this rule.~~ Steam-assisted and nonassisted flares designed and operated with an exit velocity, as determined by the methods specified in (D)(4) of this rule, equal to or greater than 18.3 meters per second (sixty feet per second) but less than one hundred twenty two meters per second (four hundred feet per second) are allowed if the net heating value of the gas being combusted is greater than 37.3 megajoules per standard cubic meter (one thousand Btu per standard cubic foot).

(d) Steam-assisted and nonassisted flares may be designed for and operated with an exit velocity, as determined by the methods specified in paragraph (D)(4) of this rule, less than the velocity V_{max} , for flares complying with paragraph (B)(1)(d)(i) of this rule ~~that calculated for the velocity (V_{max}) below~~ and less than one hundred and twenty two meters per second (four hundred feet per second) are allowed. ~~This maximum permitted velocity shall be calculated as follows:~~

(i) The maximum permitted velocity, V_{max} , for flares complying with paragraph (B)(1)(d) of this rule shall be determined by the following equation:

$$\text{Log}_{10}(V_{max}) = (H_T + 28.8)/31.7$$

~~where~~ Where:

V_{max} = maximum permitted velocity, meters per second;

28.8 = constant;

31.7 = constant; ~~and~~

H_T = the net heating value as determined in paragraph (D)(3) of this rule;

The actual exit velocity of the flare shall be determined by the methods specified in paragraph (D)(4) of this rule.

- (e) Air-assisted flares shall be designed and operated with an exit velocity less than the velocity, V_{\max} , as determined by the method specified in paragraph (B)(1)(e)(i) of this rule.~~calculated as follows:~~

(i) The maximum permitted velocity, V_{\max} , for air-assisted flares shall be determined by the following equation:

$$V_{\max} = 8.706 + 0.7084 (H_T)$$

~~where~~Where:

V_{\max} = maximum permitted velocity, meters per second;

8.706 = constant;

0.7084 = constant;~~and~~

H_T = the net heating value as determined in paragraph (D)(3) of this rule;

The actual exit velocity of the flare shall be determined by the methods specified in paragraph (D)(4) of this rule.

- (2) Nonassisted flares with a hydrogen content of at least eight per cent (by volume)

- (a) Nonassisted flares shall be used that have a diameter of three inches or greater, and a hydrogen content of 8.0 per cent (by volume), or greater, and shall be designed for and operated with an exit velocity of less than 37.2 meters per second (one hundred and twenty two feet per second) and less than the velocity, V_{\max} , as determined by the following equation:

$$V_{\max} = (X_{H_2} - K_1) K_2$$

Where:

V_{\max} = maximum permitted velocity, meters per second;

K_1 = constant, 6.0 volume-per cent hydrogen;

K_2 = constant, 3.9 meters per second per volume-per cent hydrogen;~~and~~

X_{H_2} = the volume-per cent of hydrogen, on a wet basis, as calculated by

using the ASTM ~~method D1946-90~~method D1946-77.

The actual exit velocity of the flare shall be determined by the methods specified in paragraph (D)(4) of this rule.

(C) Owners or operators of flares used to comply with the provisions of this chapter shall monitor these control devices to ensure that they are operated and maintained in conformance with their design. Monitoring and record keeping shall be maintained as required in paragraph (C)(4) of rule 3745-76-13 and paragraph (C) of rule 3745-76-11 of the Administrative Code.

(D) Compliance determination

- (1) ~~Reference~~USEPA Method~~method~~ 22 of appendix A-7 of 40 CFR part 60 shall be used to determine the compliance of flares with the visible emission provisions of this rule. ~~An~~The observation period ~~of~~is two hours and shall be used ~~in accordance with the requirements of~~ according to USEPA Method~~method~~ 22.
- (2) The presence of a flare pilot flame shall be monitored using a thermocouple or other equivalent device to detect the presence of a flame.
- (3) The net heating value of the gas being combusted in a flare shall be calculated using the following equation:

$$H_T = k \sum_{i=1}^n C_i H_i$$

Where:

k = constant, 1.740×10^{-7} (megajoule-gram mole per parts per million-standard cubic meter-kilocalorie), where the standard temperature for (gram mole per standard cubic meter) is twenty degrees Celsius;

H_T = net heating value of the sample, megajoules per standard cubic meter; where the net enthalpy per mole of offgas is based on combustion at twenty five degrees Celsius and seven hundred sixty millimeters of mercury, but the standard temperature for determining the volume corresponding to one mole is twenty degrees Celsius;

C_i = concentration of sample component i in ppm on a wet basis, as measured for organics by ~~USEPA Method~~ [method 18](#) of ~~Appendix~~[appendix A-6](#) of 40 CFR ~~Part 60 and~~[part 60 and](#) measured for hydrogen and carbon monoxide by ASTM D1946- 90([2015](#));

H_i = net heat of combustion of sample component i , kilocalorie per gram mole at twenty five degrees Celsius and seven hundred sixty millimeters of mercury. The heats of combustion may be determined using ASTM ~~D4809-95~~[D4809-00](#) if published values are not available or cannot be calculated.

- (4) The actual exit velocity of a flare shall be determined by dividing the volumetric flowrate (in units of standard temperature and pressure), as determined by ~~Reference Methods~~[USEPA method 2](#), [method 2A](#), [method 2C](#), or [method 2D of appendix A-1 of 40 CFR part 60](#), as appropriate; by the unobstructed (free) cross sectional area of the flare tip.