

Special Hazard Systems

Symbol	Description	Equation	Source	Value	Units
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Problem Statement

A 24-foot diameter atmospheric storage tank contains benzene. The vertical tank is to be protected by Type II fixed foam discharge outlets using 3% AFF foam concentrate. If the insurer-mandated design criteria for this tank is 0.1 gpm/sqft for a minimum of 55 min, what is the minimum required foam concentrate supply rate for the entire tank without any reserve supply?

- a. 66 gal
- b. 75 gal
- c. 310 gal
- d. 300 gal

Given/Assumed

d	Diameter of tank	-	Given	24	ft
D	Design Density	-	NFPA 11 Table 5.2.5.2.2	0.10	gpm/ft ²
FC	Foam Concentrate Rate	-	Given	3	%
t	Time of Discharge	-	NFPA 11 Table 5.2.5.2.2	55	min

Solution

A	Surface Area to be Protected	$A = \pi d^2 / 4$ $= [(3.14) (24^2)] / 4$	Area of a Circle	452	ft ²
Q'	Total Minimum Rate of Discharge	$Q' = D \times A$ $= (0.1) \times (452)$	Discharge Calculation; SFPE	45	gpm
Q' _{FC}	Foam Concentration Rate of Discharge	$Q'_{FC} = Q' \times FC$ $= (45) \times (0.03)$	Percentage of Foam Solution	1.36	gpm
Q _{FC}	Total Discharge of Foam Concentrate	$Q_{FC} = Q'_{FC} \times t$ $= (1.36) \times (55)$	Capacity; SFPE 4th p4-135 to 4-138, 5th p1715	75	gal

References Used

1	NFPA 11	Standard for Low-, Medium-, and High-Expansion Foam, 2016 Edition
2	SFPE	Fire Protection Engineering Handbook, 4th or 5th Edition

Tips & Notes

(1) NFPA 11 may not explicitly describe this process, but the density/area conversion is relatively straightforward. See SFPE 4th p4-135 through 4-138 or 5th p1715 for a breakout of this process.