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## Liquid Fire Sizing Information Sheet

Contact Name: \_\_\_\_\_ Phone #: (\_\_\_\_) \_\_\_\_\_ Fax #: (\_\_\_\_) \_\_\_\_\_  
 Customer Company: \_\_\_\_\_ Tag/PSV Numbers: \_\_\_\_\_  
 Location: \_\_\_\_\_ Quantity: \_\_\_\_\_

**1. Vessel Data**

- Vessel Inside Diameter (D): \_\_\_\_\_ in
- Vessel Length Seam to Seam (L) (Not Applicable for Spherical Tanks): \_\_\_\_\_ ft
- Vessel Mounting:     Horizontal     Vertical     Spherical
- Type of Ends (Not Applicable for Spherical Tanks):     Flat Head     Elliptical     Hemispherical
- Insulation Thickness: \_\_\_\_\_ in                      Fluid Level Height: \_\_\_\_\_ ( % or in )
- Is there ideal drainage and fire fighting equipment available?    YES or NO

**2. Operating Data**

- Operating Pressure, (P<sub>o</sub>): \_\_\_\_\_ psig
- Operating Temperature, (T<sub>o</sub>): \_\_\_\_\_ °F
- Set Pressure, (P<sub>set</sub>): \_\_\_\_\_ psig
- Back Pressure:
  - Superimposed: \_\_\_\_\_ psig    Constant **or** variable
  - Built-up: \_\_\_\_\_ psig

**3. Fluid Data (The liquid will be boiling off and turning into a vapor)**

- Liquid Name: \_\_\_\_\_
- Fluid Saturation Temperature (Boiling Point at Relieving Pressure), (T<sub>g</sub>): \_\_\_\_\_ °F
- Latent Heat of Vaporization at Overpressure, (h): \_\_\_\_\_ BTU/lb
- Molecular Weight, (M): \_\_\_\_\_
- Gas Constant, (C): \_\_\_\_\_
- Compressibility Factor, (Z): \_\_\_\_\_

The Formulas used in these calculations are from API RP 521 and ASME BPVC, Section VII, Division I.

Bare Vessel, F=1  
 Insulated Vessels with k<sub>1</sub> equal to:  
     k<sub>1</sub>=4, F = 0.3  
     k<sub>1</sub>=2, F = 0.15  
     k<sub>1</sub>=1, F = 0.075  
     k<sub>1</sub>=0.67, F = 0.05  
     k<sub>1</sub>=0.5, F = 0.0376  
     k<sub>1</sub>=0.4, F = 0.03  
     k<sub>1</sub>=0.33, F = 0.026  
 Earth Covered Storage, F = 0.03  
 Below-grade Storage, F = 0.00

Or use the Following Equation:  

$$F = \frac{k_1 \times (1660 - T_f)}{21000 \times t}$$

Heat Absorption Rate

$$Q = C_1 \times F \times A_w^{0.82}$$

If there is adequate drainage and fire fighting equipment available  
     C<sub>1</sub> = 21000  
     Otherwise  
     C<sub>1</sub> = 34500

Generated Weight Flow

$$W = \frac{Q}{h}$$

Required Orifice Area

$$A = \frac{W}{K \times C \times P_1} \times \sqrt{\frac{T \times Z}{M}}$$

**Variables**

F=Environmental Factor  
 t=Insulation Thickness, (in)  
 k<sub>1</sub>=Thermal Conductivity of Insulation, (BTU-in/hr-ft<sup>2</sup>-°F)  
 T<sub>f</sub>=Temperature of Vessel Contents at Relieving Conditions, (°F)  
 Q=Total Heat Absorption to the Wetted Surface, (BTU/hr)  
 A<sub>w</sub>=Wetted Surface Area of the Vessel is the Surface Area of the Vessel that is exposed to the fire and the liquid, (in<sup>2</sup>)  
 C<sub>1</sub>=Constant for Drainage and Fire Fighting Equipment  
 W=Generated Weight Flowrate, (lb/hr)  
 h=Latent Heat of Vaporization, (BTU/lb)  
 A=Required Orifice Area, (in<sup>2</sup>)  
 K=Discharge Coefficient  
 C=Gas Constant  
 P<sub>1</sub>=Flowing Pressure, P<sub>set</sub> + Overpressure + P<sub>atm.</sub> (psia)  
 T=Temperature, (°R)  
 Z=Compressibility Factor  
 M=Molecular Weight