METHOD 307—DETERMINATION OF EMISSIONS FROM HALOGENATED SOLVENT VAPOR CLEANING MACHINES USING A LIQUID LEVEL PROCEDURE

1. Applicability and Principle

1.1 Applicability. This method is applicable to the determination of the halogenated solvent emissions from solvent vapor cleaners in the idling mode.

1.2 Principle. The solvent level in the solvent cleaning machine is measured using inclined liquid level indicators. The change in liquid level corresponds directly to the amount of solvent lost from the solvent cleaning machine.

2. Apparatus

NOTE: Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

2.1 Inclined Liquid Level Indicator. A schematic of the inclined liquid level indicators used in this method is shown in figure 307-1; two inclined liquid level indicators having 0.05 centimeters divisions or smaller shall be used. The liquid level indicators shall be made of glass, Teflon, or any similar material that will not react with the solvent being used. A 6-inch by 1-inch slope is recommended; however the slope may vary depending on the size and design of the solvent cleaning machine.

NOTE: It is important that the inclined liquid level indicators be constructed with ease of reading in mind. The inclined liquid level indicators should also be mounted so that they can be raised or lowered if necessary to suit the solvent cleaning machine size.

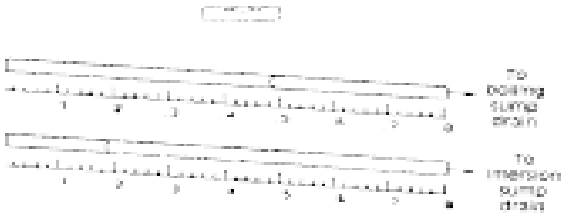

Figure 307-1. Inclined Liquid Level Indicator Apparatus.

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2.2 Horizontal Indicator. Device to check the inclined liquid level indicators orientation relative to horizontal.

2.3 Velocity Meter. Hotwire and vane anemometers, or other devices capable of measuring the flow rates ranging from 0 to 15.2 meters per minute across the solvent cleaning machine.

3. Procedure

3.1 Connection of the Inclined Liquid Level Indicator. Connect one of the inclined liquid level indicators to the boiling sump drain and the other inclined liquid level indicator to the immersion sump drain using Teflon tubing and the appropriate fittings. A schematic diagram is shown in figure 307-2.

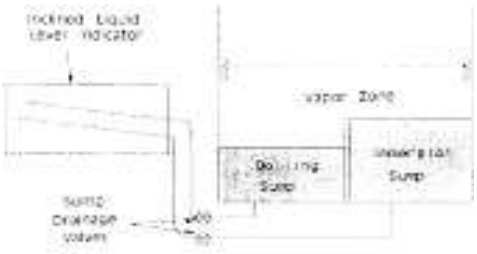

Figure 307-2. Solvent Cleaner Test Setup.

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3.2 Positioning of Velocity Meter. Position the velocity meter so that it measures the flow rate of the air passing directly across the solvent cleaning machine.

3.3 Level the Inclined Liquid Level Indicators.

3.4 Initial Inclined Liquid Level Indicator Readings. Open the sump drainage valves. Allow the solvent cleaning machine to operate long enough for the vapor zone to form and the system to stabilize (check with manufacturer). Record the inclined liquid level indicators readings and the starting time on the data sheet. A sample data sheet is provided in figure 307-3.

Date
Run
Solvent type
Solvent density, g/m^3 (lb/ft^3)
Length of boiling sump (S_B), m (ft)
Width of boiling sump (W_B), m (ft)
Length of immersion sump (S_I), m (ft)
Width of immersion sump (W_I), m (ft)

Length of solvent vapor/air interface (S_V), m (ft) _____

Width of solvent vapor/air interface (W_V), m (ft) _____

Clock time	**Boiling sump reading**	**Immersion sump reading**	**Flow rate reading**

Figure 307-3. Data sheet.

3.5 Final Inclined Liquid Level Indicator Readings. At the end of the 16-hour test run, check to make sure the inclined liquid level indicators are level; if not, make the necessary adjustments. Record the final inclined liquid level indicators readings and time.

3.6 Determination of Solvent Vapor/Air Interface Area for Each Sump. Determine the area of the solvent/air interface of the individual sumps. Whenever possible, physically measure these dimensions, rather than using factory specifications. A schematic of the dimensions of a solvent cleaning machine is provided in figure 307-4.

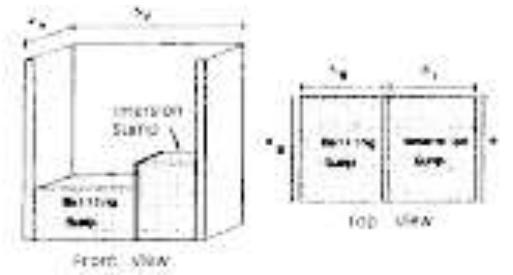

Figure 307-4 Solvent Cleaner Dimensions

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4. Calculations

4.1 Nomenclature.

A_B = area of boiling sump interface, m^2 (ft^2).

A_I = area of immersion sump interface, m^2 (ft^2).

A_V = area of solvent/air interface, m^2 (ft^2).

E = emission rate, kg/m^2-hr (lb/ft^2-hr).

K = 100,000 cm . g/m . kg for metric units.

= 12 in./ft for English units.

L_{BF} = final boiling sump inclined liquid level indicators reading, cm (in.).

L_{Bi} = initial boiling sump inclined liquid level indicators reading, cm (in.).

L_{If} = final immersion sump inclined liquid level indicators reading, cm (in.).

L_{Ii} = initial immersion sump inclined liquid level indicators reading, cm (in.).

S_B = length of the boiling sump, m (ft).

S_I = length of the immersion sump, m (ft).

S_V = length of the solvent vapor/air interface, m (ft).

W_B = width of the boiling sump, m (ft).

W_I = width of the immersion sump, m (ft).

W_V = width of the solvent vapor/air interface, m (ft).

ρ = density of solvent, g/m3 (lb/ft3).

θ = test time, hr.

4.2 Area of Sump Interfaces. Calculate the areas of the boiling and immersion sump interfaces as follows:

$A_B = S_B W_B$ Eq. 307-1

$A_I = S_I W_I$ Eq. 307-2

4.3 Area of Solvent/Air Interface. Calculate the area of the solvent vapor/air interface as follows:

$A_V = S_V W_V$ Eq. 307-3

4.4 Emission Rate. Calculate the emission rate as follows:

$$E = \frac{\left(L_{B_f} - L_{B_i}\right)\rho A_B + \left(L_{I_f} - L_{I_i}\right)\rho A_I}{K A_V \theta}$$

Eq. 307-4