

12.2.9 VSE Factor calculation:
 VSE Factor = $1 - (\text{Average \% VS Emission Weight Loss} / \text{Average NVS Emission Weight Loss})$

TABLE 12.1.—EXAMPLE CALCULATION

Test #	% VS weight loss	% NVS weight loss
1	6.87	10.86
2	6.76	11.23
3	5.80	12.02
4	5.34	11.70
5	6.11	11.91
6	6.61	10.63
Average Weight Loss	6.25	11.39
VSE Factor		0.4

VSE Factor = 0.45

VSE Factor is used as input into the appropriate equation in Table 1 to this subpart.

Example from Table 1 to this subpart:
 Manual Resin Application, 35 percent HAP resin, VSE Factor of 0.45
 HAP Emissions with vapor suppressants = $((0.286 \times \% \text{HAP}) - 0.0529) \times 2000 \times (1 - (0.5 \times \text{VSE factor}))$
 HAP Emissions with vapor suppressants = $((0.286 \times .35) - 0.0529) \times 2000 \times (1 - (0.5 \times .45))$
 HAP Emissions with vapor suppressants = 73 pounds of HAP emissions per ton of resin.

13. Method Performance

13.1 Bias:
 The bias of this test method has not been determined.

13.2 Precision Testing

13.2.1 Subsequent to the initial development of this test protocol by the

Composites Fabricators Association, a series of tests were conducted in three different laboratory facilities. The purpose of this round robin testing was to verify the precision of the test method in various laboratories. Each laboratory received a sample of an orthophthalic polyester resin from the same production batch, containing 48 per cent styrene by weight. Each testing site was also provided with the same vapor suppressant additive. The suppressant manufacturer specified the percentage level of suppressant additive. The resin manufacturer specified the type and level of initiator required to produce a 20 minute gel time. The target glass content was 30 percent by weight.

13.2.2 Each laboratory independently conducted the VSE test according to this method. A summary of the results is included in Table 13.1.

TABLE 13.1.—ROUND ROBIN TESTING RESULTS

	Test Lab 1		Test Lab 2		Test Lab 3	
	NVS	VS	NVS	S	NVS	VS
Average percent WT Loss	4.24	1.15	4.69	1.84	5.73	1.61
Standard Deviation	0.095	0.060	0.002	0.002	0.020	0.003
VSE Factor		0.730		0.607		0.720

13.3 Comparison to EPA Reference Methods This test has no corresponding EPA reference method.

14. Pollution Prevention

The sample size used in this method produces a negligible emission of HAP, and has an insignificant impact upon the atmosphere.

15. Waste Management

The spent and waste materials generated during this test are disposed according to required facility procedures, and waste management recommendations on the corresponding material safety data sheets.

16. References and footnotes

16.1 Footnotes:

¹ Balance Enclosure—The purpose of the balance enclosure is to prevent localized airflow from adversely affecting the laboratory balance. The enclosure may be a simple three-sided box with a top and an open face. The configuration of the enclosure is secondary to the purpose of providing a stable and steady balance reading, free from the effects of airflow, for accurate measurements. The enclosure can be fabricated locally. A typical enclosure is shown in Figure 17.1.

² Laboratory Balance—Ohaus Precision Standard Series P/N TS400D or equivalent—Paul N. Gardner Co. 316 NE 1st St. Pompano Beach, FL 33060 or other suppliers.

³ Stop Watch—Local supply.

⁴ Thermometer—Mercury thermometer—ASTM No. 21C or equivalent; Digital thermometer—P/N TH-33033 or equivalent—Paul N. Gardner Co. 316 NE 1st

St. Pompano Beach, FL 33060 or other suppliers.

⁵ Aluminum Pan—Local supply.

⁶ Mylar—Local supply.

⁷ Double Sided Tape—3M Double Stick Tape or equivalent, local supply.

⁸ Laboratory Beakers—250 to 400ml capacity—Local laboratory supply.

⁹ Eye Dropper or Pipette—Local laboratory supply.

¹⁰ Disposable Resin Application Roller Source—Wire Handle Roller P/N 205-050-300 or Plastic Handle Roller P/N 215-050-300 or equivalent; ES Manufacturing Inc., 2500 26th Ave. North, St. Petersburg, FL 33713, www.esmfg.com, or other source. Refer to Figure 17.3.

¹¹ Hygrometer or Psychrometer—Model# THWD-1, or equivalent—Part # 975765 by Amprobe Instrument, 630 Merrick Road, P.O. Box 329, Lynbrook, NY 11563, 516-593-5600

¹² Insulating Board (Teflon, cardboard, foam board etc.)—Local supply.

¹³ Laboratory Balance With Digital Output—Ohaus Precision Standard Series P/N TS120S or equivalent—Paul N. Gardner Co. 316 NE 1st St. Pompano Beach, FL 33060 or other suppliers.

¹⁴ Chopped Strand Mat—1.5 oz/ft² Sources: Owens Corning Fiberglas—Fiberglas M-723; PPG Industries—ABM HTX; Vetrotex America—M-127 or equivalent.

¹⁵ Certificate of Analysis: Resin gel time, as recorded on the resin certificate of analysis, is measured using a laboratory standard gel time procedure. This procedure typically uses a 100 gram cup sample at 77°F (25°C), a specific type of initiator and a specified percentage.

¹⁶ Roll-out times may vary with resin viscosity or resin additive. The important

aspect of this step is to produce the same roll-out time for both the suppressed and non-suppressed samples.

¹⁷ While this test can be used with filled resin systems, the test is not designed to determine the effect of the filler on emissions, but rather to measure the effect of the suppressant additive in the resin system. When evaluating a filled system both the non-vapor suppressed and vapor suppressed samples should be formulated with the same type and level of filler.

16.2 References

1. Phase 1—Baseline Study Hand Lay-up, CFA, 1996

2. CFA Vapor Suppressant Effectiveness Test Development, 4/3/98, correspondence with Dr. Madeleine Strum, EPA, OAQPS

3. CFA Vapor Suppressant Effectiveness Screening Tests, 4/4/98

4. Styrene Suppressant Systems Study, Reichhold Chemical, 11/30/98

5. Evaluation of the CFA's New Proposed Vapor Suppressant Effectiveness Test, Technical Service Request #: ED-01-98, BYK Chemie, 6/3/98

6. Second Evaluation of the CFA's New Proposed Vapor Suppressant Effectiveness Test, Technical Service Request #: ED-02-98, BYK Chemie, 1/26/99

17. Data Sheets and Figures

17.1 This data sheet, or a similar data sheet, is used to record the test data for filled, unfilled, suppressed and non-suppressed tests. If additional time is required, the data sheet may be extended.

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