RULE 4684 POLYESTER RESIN OPERATIONS (Adopted May 19, 1994; Amended December 20, 2001; Amended September 20, 2007; Amended September 17, 2009; Amended August 18, 2011)

1.0 Purpose

The purpose of this rule is to reduce emissions of volatile organic compounds (VOC) from polyester resin operations, fiberglass boat manufacturing operations and the organic solvent cleaning, and the storage and disposal of solvents and waste solvent materials associated with such operations.

2.0 Applicability

The provisions of this rule apply to commercial and industrial polyester resin operations, fiberglass boat manufacturing operations, and to the organic solvent cleaning, and the storage and disposal of all solvents and waste solvent materials associated with such operations.

3.0 Definitions

The following definitions apply for the purpose of this rule.

3.1 Air Pollution Control Officer (APCO): as defined in Rule 1020 (Definitions).

3.2 Application Equipment: a device, including, but not limited to, a spray gun, brush, and roller, used to apply adhesives, coatings, or inks.

3.3 ARB: California Air Resources Board.

3.4 Assembly Adhesive: a chemical material used in joining fiberglass, metal, foam, or wood parts to another to form a temporary or permanently bonded assembly. Assembly adhesives include, but are not limited to, methacrylate adhesives and putties made from polyester or vinylester resin mixed with inert filler or fibers.

3.5 ASTM: American Society of Testing and Materials International.

3.6 Atomized Resin Application: a resin application technology in which the resin leaves the application equipment and breaks into droplets or an aerosol as it travels from the application equipment to the surface of the part. Atomized resin application includes, but is not limited to, resin spray guns and resin chopper spray guns.

3.7 Bench Scale Project: a project (other than at a research and development facility) that is operated on a small scale, such as one capable of being located on a laboratory bench top.

3.8 Catalyst: a substance that is added to resin to initiate or promote polymerization.

3.9 CFR: Code of Federal Regulations.

3.10 Cleaning Materials: materials including, but not limited to, materials used for cleaning hands, tools, molds, application equipment, and work areas.

3.11 Clear Gel Coat: a gel coat that is clear or translucent so that underlying colors are visible. Clear gel coat is used to manufacture parts for sale. Clear gel coat does not include tooling gel coat used to build or repair molds.

3.12 Closed Molding Process: a molding process in which pressure is used to distribute the resin through the reinforcing fabric placed between two mold surfaces to either saturate the fabric or fill the mold cavity. The pressure may be clamping pressure, fluid pressure, atmospheric pressure, or vacuum pressure used either alone or in combination. The mold surfaces may be rigid or flexible. Closed molding includes, but is not limited to, compression molding with sheet molding compound, infusion molding, resin injection molding (RIM), vacuum-assisted resin transfer molding (VARTM), resin transfer molding (RTM), and vacuum-assisted compression molding. Processes in which a closed mold is used only to compact saturated fabric or remove air or excess resin from the fabric (such as in vacuum bagging) are not considered closed molding. Open molding steps, such as application of gel coat or skin coat layer by conventional open molding prior to a closed molding process are not closed molding.

3.13 Coating: a material applied onto or impregnated into a substrate for protective, decorative, or functional purposes. Such materials include, but are not limited to, paints, varnishes, sealers, and stains.

3.14 Corrosion–Resistant Material: a polyester resin material used to make products for corrosion resistant applications such as tooling, fuel or chemical tanks, boat hulls, pools and outdoor spas.

3.15 Cure: to polymerize, i.e., to transform from a liquid to a solid state or semi-solid state to achieve desired physical properties for the product, including hardness.

3.16 Cured Coating: a coating that is dry to the touch.

3.17 Degreaser: a tank, tray, drum or other container in which objects to be cleaned are exposed to a solvent or solvent vapor in order to remove contaminants. The objects to be cleaned include, but are not limited to, parts, products, tools, machinery, and equipment. An enclosed spray application equipment cleaning system is not a degreaser.

3.18 Dissolver: an organic solvent that is added to an adhesive, coating, or ink in order to melt or to liquefy solid particles.

3.19 EPA: United States Environmental Protection Agency.

3.20 Fiberglass Boat: a vessel in which either the hull or deck is built from a composite material consisting of thermosetting resin matrix reinforced with fibers of glass, carbon, or other material.

3.21 Fiberglass Boat Manufacturing: facilities that manufacture hulls or decks of boats from fiberglass, or build molds to make fiberglass boat hulls or decks. Facilities that manufacture solely parts of boats (such as hatches, seats, or lockers), or boat trailers, but do not manufacture boat hulls or decks from fiberglass or build molds to make fiberglass boats or hulls are not considered fiberglass boat manufacturing. A facility that manufactures hulls or decks, or molds for hulls or decks, and other fiberglass boat parts, including small parts such as hatches, seats, and lockers, is considered fiberglass boat manufacturing. Fiberglass boat manufacturing operations include open molding resin and gel coat operations (these include pigmented gel coat, clear gel coat, production resin, tooling gel coat, and tooling resin), resin and gel coat mixing operations, and resin and gel coat application equipment cleaning operations.

3.22 Filament Application: a method of applying resin to an open mold that involves feeding reinforcement fibers through a resin bath and winding the resin-impregnated fibers on a rotating mandrel.

3.23 Filled Polyester Resin Material: a material formulated by adding compatible filler(s) to polyester resin material(s).

3.24 Filler: a finely divided inert (non-VOC) material, which may be added to the resin to enhance its mechanical properties and extend its volume. Resin fillers include, but are not limited to, silica, carbon black, talc, mica and calcium carbonate.

3.25 Fire Retardant Material: a polyester resin material used to make products that are resistant to flame or fire.

3.26 Fluid Impingement Technology: a spray gun that produces an expanding non-misting curtain of liquid by the impingement of low-pressure uninterrupted liquid streams.

3.27 Gel Coat: a polyester resin topcoat that provides a cosmetic enhancement and improves resistance to degradation from environmental exposure.

3.28 Grams of VOC per liter of material: grams VOC per liter of material is determined as follows:

Grams VOC per liter of material = $(W_s - W_w - W_{es}) / V_m$

Where:

W_s = weight of all volatile compounds, in grams
W_w = weight of water, in grams
W_{es} = weight of exempt solvents, in grams
V_m = volume of the material, in liters

3.29 High-Strength Material: polyester resins which have a casting tensile strength of 10,000 psi or more and which are used primarily for manufacturing high performance boats and skis.

3.30 High-Volume, Low-Pressure (HVLP) Spray Equipment: equipment used to apply materials by means of a spray gun which is designed and intended to be operated, and which is operated, between 0.1 and 10.0 psig of air atomizing pressure, measured dynamically at the center of the air cap and the air horns.

3.31 Lamination Resin: an orthophthalate, isophthalate and dicyclopentadiene (DCPD) resin which is used in composite system made of layers of reinforcement fibers and resins, such as in boat fabrication.

3.32 Liquid Leak: a visible solvent leak from a container at a rate of more than three drops per minute, or a visible liquid mist.

3.33 Maintenance Cleaning: the cleaning of tools, forms, molds, jigs, machinery, and equipment (except coating application equipment, ink application equipment, or adhesive application equipment), and the cleaning of work areas where maintenance or manufacturing occurs.

3.34 Manual Application: the application of resin to an open mold using a hand lay-up technique. Components of successive plies of resin-impregnated reinforcement fibers are applied using hand tools such as brushes and rollers.

3.35 Manufacturing Process: the process of making goods or articles by hand or by machine.

3.36 Marble Resin: an orthophthalate and modified acrylic isophthalate resin, which is designed for the fabrication of cast products, such as vanities.

3.37 Mold: the cavity or surface into or on which gel coat, resin, and fibers are placed and from which finished fiberglass parts take their form.

3.38 Monomer: an organic compound, such as styrene, that reacts with unsaturated polyester resins to form a cured polyester resin.

3.39 Month: a calendar month.

3.40 Neat Resin: a resin to which no filler has been added.

3.41 Non-Absorbent Container: a container made of non-porous material that does not allow the migration of solvents through it.

3.42 Non-Atomized Resin Application: an application technology in which the resin is not broken into droplets or an aerosol as it travels from the application equipment to the surface of the part. Non-atomized resin application technology includes, but is not limited to, non-atomizing spray guns, flowcoaters, chopper flowcoaters, pressure fed resin rollers, resin impregnators, or fluid impingement technology.

3.43 Non-Atomized Solvent Flow: solvents in the form of a liquid stream without the introduction of any propellant.

3.44 Non-Atomizing Spray Gun: a spray gun from which the resin flows in a steady and observable coherent flow, with no droplets formed in the area that is within the first three (3) inches of the applicator orifice. Droplets may form in the area greater than three (3) inches from the applicator orifice.

3.45 Non-Leaking Container: a container without a liquid leak.

3.46 Normal Business Hours: Monday through Friday, 8:00 am to 5:00 pm.

3.47 Open Molding Resin and Gel Coat Process: a process in which the reinforcing fibers and resin are placed in the mold and are open to the surrounding air while the reinforcing fibers are saturated with resin. For the purpose of this rule, open molding includes operations in which a vacuum bag or similar cover is used to compress the uncured laminate to remove bubbles or excess resin, or to achieve a bond between core material and a laminate.

3.48 Organic Solvent: the same as "Solvent."

3.49 Organic Solvent Cleaning: as defined in Rule 4663 (Organic Solvent Cleaning, Storage, and Disposal).

3.50 Pigmented Gel Coat: opaque gel coat used to manufacture parts for sale. Pigmented gel coat does not include tooling gel coat used to build or repair molds.

3.51 Polyester Resin Materials: materials including, but not limited to: unsaturated polyester resins such as isophthalic, orthophthalic, halogenated, Bisphenol-A, vinyl-ester, or furan resins; cross-linking agents; catalysts, gel coats, inhibitors, accelerators, promoters, and any other materials used in polyester resin operations.

3.52 Polyester Resin Operations: methods used for the production or rework of products by mixing, pouring, hand layup, impregnating, injecting, forming, winding, spraying, and/or curing with fiberglass, fillers, or any other reinforcement materials and associated cleanup.

3.53 Polymer: a chemical compound comprised of a large number of chemical units and which is formed by chemical linking of monomers.

3.54 Production Resin: a general purpose resin material that is not especially corrosion resistant, fire retardant, high strength, or gel coats.

3.55 Propellant: any gas, including air, in a pressure container for expelling the contents when the pressure is released.

3.56 Repair: the process of returning a damaged object or an object not operating properly to good condition.

3.57 Repair Cleaning: a solvent cleaning operation or activity carried out during a repair.

3.58 Research and Development: a facility or portion thereof used to further the development of useful materials, devices, systems, or methods, including, but not limited to, design, development, and improvement of prototypes and processes. Research and development does not include the manufacturing process itself.

3.59 Resin: a class of organic polymers of natural or synthetic origin used in reinforced products to surround and hold fibers or filler particles, and is solid or semisolid in the cured state.

3.60 Resin and Gel Coat Operation: an operation in which resin or gel coat, including the mixing of putties or polyputties, is combined with additives that include, but are not limited to, fillers, promoters, or catalysts.

3.61 SCAQMD: South Coast Air Quality Management District.

3.62 Skin Coat: a layer of resin and fibers applied over gel coat to protect the gel coat from being deformed by the next laminate layers.

3.63 Small Job: minor resin or gel coat application project which requires only a very limited amount of materials. Total material use for all small jobs at a facility shall not exceed two (2) gallons a day.

3.64 Solid Surface Resin: a resin, which is used, without gel coats, to fabricate homogenous solid surface products.

3.65 Solvent: as defined in Rule 4663 (Organic Solvent Cleaning, Storage, and Disposal).

3.66 Specialty Gel Coat: a gel coat which is used in conjunction with fire retardant, corrosion resistant or high-strength materials.

3.67 Specialty Resin: a halogenated, furan, bisphenol A, vinyl-ester, or isophthalic resin used to make products for exposure to one or more of the following extreme environmental conditions: acute or chronic exposure to corrosive agents, caustic agents, acidic agents, or flame.

3.68 Stationary Source: as defined in Rule 2201 (New and Modified Stationary Source Review Rule).

3.69 Tooling Gel Coat: the gel coat used to build or repair molds (also known as tools) or prototypes (also known as plugs) from which the molds will be made.

3.70 Tooling Resin: the resins used to build or repair molds (also known as tools) or prototypes (also know as plugs) from which the molds will be made.

3.71 Touch-up: The application of resin or gel coat to correct minor cosmetic imperfections that occur during fabrication or field installations.

3.72 Tub/Shower Resin: a dicyclopentadiene (DCPD) resin, along with orthophthalate and isophthalate resins, which are used to fabricate bathware products.

3.73 Vapor Suppressant: a substance added to resin to minimize the transfer of monomer vapor into the atmosphere.

3.74 Vinylester Resin: a thermosetting resin containing esters of acrylic or methacrylic acids having a double-bond and ester linkage sites at the end of the resin molecules.

3.75 Volatile Organic Compound (VOC): as defined in Rule 1020 (Definitions).

3.76 Waste Materials: materials including but not limited to paper or cloth used for cleaning operations, waste resins, or spent cleaning materials.

4.0 Exemptions

4.1 Except for fiberglass boat manufacturing operations, the provisions of this rule, other than the recordkeeping requirements of Section 6.1, shall not apply to any polyester resin operation provided the volume of polyester resin materials used is less than 20 gallons per month.

4.2 For fiberglass boat manufacturing, production resins (including skin coats) that must meet the specifications for use in military vessels or must be approved by the U.S. Coast Guard for use in construction of lifeboats, rescue boats, and other life-saving appliances approved under 40 CFR subchapter Q, or to the construction of small passenger vessels regulated by 46 CFR subchapter T are exempt from the requirements of Section 5.2.2. Production resins that meet these criteria shall be applied with nonatomizing resin application equipment.

4.3 The solvent cleaning provisions of Section 5.3 Table 4 shall not apply to the following applications:

4.3.1 Cleaning of solar cells, laser hardware, scientific instruments, or high precision optics.

4.3.2 Cleaning in laboratory tests and analyses, or bench scale or research and development projects.

5.0 Requirements

5.1 Polyester Resin Operation, except for Fiberglass Boat Manufacturing subject to Section 5.2.2.

5.1.1 An operator of a polyester resin operation shall comply with one of the following process or control requirements:

5.1.1.1 Prior to January 1, 2013, use low-VOC polyester resins with the following monomer content: Low VOC resins, except for specialty resins and gel coats, containing no more than 35% monomer by weight. Low VOC pigmented gel coats containing

no more than 45% monomer by weight. Low VOC specialty resins and clear gel coats containing no more than 50% monomer by weight; or comply with Section 5.1.1.3, 5.1.1.4, or 5.1.1.5.

5.1.1.2 On and after January 1, 2013, use materials in an open molding process that comply with the weighted average monomer VOC content limits in Table 1. In addition to complying with Table 1 limits, the non-monomer VOC content of each resin and gel coat shall not contain more than 5 percent by weight of the resin or gel coat; or comply with Section 5.1.1.3, 5.1.1.4, or 5.1.1.5.

Table 1 Compliant Materials Weighted Average Monomer VOC Content for Open Molding Resin and Gel Coat

Material	Weight Percent Limit on and after January 1, 2013
a. General Purpose Resin	
- Marble Resin	10% or 32%, as supplied, with no fillers
- Solid Surface Resin	17%
- Tub/Shower Resin	24% or 35%, as supplied, with no fillers
- Lamination Resin	31% or 35%, as supplied, with no fillers
b. Tooling Resin	
- Atomized (spray)	30%
- Non-atomized	39%
c. Specialty Resin	
- Fire Retardant Resin	38%
- High Strength Materials	40%
- Corrosion Resistant Resin	48%
d. All Other Resin	35%
e. Tooling Gel Coat	40%
f. Pigmented Gel Coat	
- White and Off White	30%
- Non-White	37%
- Primer	28%
g. Clear Gel Coat	
- Marble Resin	40%
- Other Resin	44%
h. Specialty Gel Coat	48%

5.1.1.3 Use resin containing a vapor suppressant, such that the weight loss from the VOC emissions does not exceed 50 grams per square meter of exposed surface during resin polymerization; or

5.1.1.4 Use a closed-mold system; or

5.1.1.5 Install and operate a VOC emission control system which meets all of the requirements of Sections 5.1.1.5.1 through 5.1.1.5.3 during periods of emission producing activities.

5.1.1.5.1 The VOC emission control system shall be approved, in writing, by the APCO.

5.1.1.5.2 The VOC emission control system shall have an overall capture and control efficiency of at least 90 percent by weight, demonstrated using the applicable test method(s) in Section 6.2.

5.1.1.5.3 The VOC emission control system shall reduce VOC emissions, at all times, to a level that is not greater than the emission which would have been achieved through the use of compliant materials, compliant equipment, or compliant work practices, as applicable. The following equation shall be used to determine if the minimum required overall capture and control efficiency of an emission control system is at an equivalent or greater level of VOC reduction as would be achieved using compliant materials, equipment, or work practices:

$$CE = \left[1 - \left(\frac{VOC_{LWc}}{VOC_{LWn,Max}} \times \frac{1 - (VOC_{LWn,Max} / D_{n,Max})}{1 - (VOC_{LWC} / D_c)}\right)\right] \times 100$$

Where:

CE = Minimum Required Control Efficiency specified in Section 5.1.1.5.2 in percent.

VOC_{LWc} = VOC content of applicable resin, gel coat, or solvent of Rule 4684, less water and less exempt compounds.

$VOC_{LWn,Max}$ = Maximum VOC content of resin, gel coat, or solvent, used in conjunction with a control device, less water and less exempt compounds.

$D_{n,Max}$ = Density of the noncompliant resin, gel coat, or solvent, containing the maximum VOC content of the multi-component material.

D_c = Density of corresponding resin, gel coat or solvent, used in the compliant resin, gel coat, or solvent.

5.1.1.6 Resins and gel coats used for touch up, repair, or small jobs, may have a monomer content limit up to 10% more than the applicable limit set forth in Table 1. Such resins or gel coats shall only be applied by a hand-held atomized spray gun which has a container for the resin or gel coat as part of the gun. Resins or gels applied by another method shall comply with the applicable limit in Table 1. Total material use for all small jobs at a facility shall not exceed two (2) gallons a day.

5.1.2 Spray application of polyester resin shall only be performed using airless, air assisted airless, high-volume, low-pressure (HVLP) spray equipment, or electrostatic spray equipment.

5.1.2.1 High-Volume, Low-Pressure (HVLP) spray equipment shall be operated in accordance with the manufacturer's recommendations.

5.1.2.2 For HVLP spray guns manufactured prior to January 1, 1996, the end user shall demonstrate that the gun meets HVLP spray equipment standards. Satisfactory proof will be either in the form of manufacturer's published technical material or by a demonstration using a certified air pressure tip gauge, measuring the air atomizing pressure dynamically at the center of the air cap and at the air horns.

5.1.2.3 A person shall not sell or offer for sale for use within the District any HVLP spray gun without a permanent marking denoting the maximum inlet air pressure in psig at which the gun will operate within the parameters specified in Section 3.0.

5.1.3 In lieu of complying with the applicable requirements of 5.1.2, an operator may install and maintain a VOC emission control system that meets the requirements of Section 5.1.1.5 around the coating application operation.

5.2 Fiberglass Boat Manufacturing Operation

5.2.1 Requirements for Closed Molding Process

An operator of a fiberglass boat manufacturing facility who uses a closed molding process, as defined in Section 3.0, shall comply with the applicable requirements of Sections 5.1, 5.3, 5.4, and 6.0.

5.2.2 Requirements for Open Molding Process

5.2.2.1 An operator of a fiberglass boat manufacturing facility who uses an open molding process, as defined in Section 3.0, and whose total actual VOC emissions from all fiberglass boat manufacturing operations, including related solvent cleaning activities, at a stationary source are equal to or greater than 2.7 tons of VOC per 12-month rolling period, before consideration of controls, shall comply with at least one of the Compliance Options in Section 5.2.2.4 through 5.2.2.6, and the applicable requirements of Sections 5.3, 5.4, and 6.0.

5.2.2.2 An operator subject to Section 5.2.2.1 shall comply with the applicable recordkeeping requirements of Section 6.1 and calculate the fiberglass boat manufacturing facility emissions to demonstrate if the VOC emissions from all fiberglass boat manufacturing operations, including related solvent cleaning activities, at a stationary source are equal to or greater than 2.7 tons of VOC per 12-month rolling period, before consideration of controls.

5.2.2.3 An operator of an open molding process whose total actual VOC emissions from all fiberglass boat manufacturing operations, including related solvent cleaning activities, at a stationary source are less than 2.7 tons of VOC per 12-month rolling period, before consideration of controls, shall comply with the applicable requirements of Sections 5.1, 5.3, 5.4, and 6.0. The operator shall comply with the applicable recordkeeping requirements of Section 6.1 and calculate the fiberglass boat manufacturing facility emissions to demonstrate if the VOC emissions from all open molding fiberglass boat manufacturing operations, including related cleaning activities are less than 2.7 tons of VOC per 12-month rolling period.

5.2.2.4 Requirements for Compliant Materials

5.2.2.4.1 An operator subject to Section 5.2.2.1 shall not use materials in any open molding process that exceed the weighted average monomer VOC content limits in Table 2. In addition to complying with Table 2 limits, the non-monomer VOC content of each resin and gel coat shall not contain more than 5 percent by weight of the resin or gel coat.

Table 2 Compliant Materials Monomer VOC Content for Open Molding Resin and Gel Coat for Fiberglass Boat Manufacturing Operation		
Material	Application Method	Weighted Average Monomer VOC content (weight percent) limit
Production Resin	Atomized (spray)	28%
Production Resin	Non-atomized	35%
Pigmented Gel Coat	Any method	33%
Clear Gel Coat	Any method	48%
Tooling Resin	Atomized	30%
Tooling Resin	Non-atomized	39%
Tooling Gel Coat	Any method	40%

5.2.2.4.2 The weighted average monomer VOC content shall be determined based on a 12-month rolling average. The operator shall use Equation 1 to determine weighted average monomer content for a particular open molding resin or gel coat material.

Equation 1:

$$\text{Weighted Average Monomer VOC Content} = \frac{\sum_{i=1}^{n}(M_{(i)}\,VOC_{(i)})}{\sum_{i=1}^{n}(M_{(i)})}$$

Where:

$M_{(i)}$ = Mass of open molding resin or gel coat i used in the past 12 months in an operation, megagrams.

$VOC_{(i)}$ = Monomer VOC content, by weight percent, of open molding resin or gel coat i used in the past 12 months in an operation.

n = Number of different open molding resins or gel coats used in the past 12 months in an operation.

5.2.2.5 Requirements for Emissions Averaging Option

5.2.2.5.1 In lieu of complying with the requirements of Section 5.2.2.4, an operator that is subject to Section 5.2.2.1 may comply by meeting a facility-specific monomer VOC mass emission limit (12-month rolling average) that is determined using Equation 2, provided all resins and gel coats included in this option do not exceed 5 percent by weight non-monomer VOC content.

5.2.2.5.2 At the end of the first 12-month averaging period and at the end of every subsequent month, the operator shall use Equation 3 to show that the monomer VOC emissions from the operations included in the average do not exceed the emission limit calculated using Equation 2 for the same 12-month period. The operator shall include in Equation 2 and Equation 3 the terms for only those operations and materials included in the average.

5.2.2.5.3 For those materials that are not included in the emissions average, the facility would resort to one of the other two options for limiting monomer and non-monomer VOC emissions from resin and gel coats.

Equation 2:

$$\text{Monomer VOC Limit} = 46(M_R) + 159\,(M_{PG}) + 291(M_{CG}) + 54(M_{TR}) + 214(M_{TG})$$

Where:

Monomer VOC Limit = Total allowable monomer VOC that can be emitted from open molding operations included in the average, kilograms per 12-month period.

M_R = Mass of production resin used in the past 12 months, excluding any materials that are exempt pursuant to Section 4.2, in megagrams.

M_{PG} = Mass of pigmented gel coat used in the past 12 months, excluding any materials that are exempt pursuant to Section 4.2, in megagrams.

M_{CG} = Mass of clear gel coat used in the past 12 months, excluding any materials that are exempt, in megagrams.

M_{TR} = Mass of tooling resin used in the past 12 months, excluding any materials that are exempt pursuant to Section 4.2, in megagrams.

M_{TG} = Mass of tooling gel coat used in the past 12 months, excluding any materials that are exempt pursuant to Section 4.2, in megagrams.

Equation 3:

Monomer VOC Emissions = $(PV_R)(M_R)+(PV_{PG})(M_{PG})+(PV_{CG})(M_{CG})+(PV_{TR})(M_{TR})+(PV_{TG})(M_{TG})$

Where:

Monomer VOC Emissions = Monomer VOC emissions calculated using the monomer VOC emission equations for each operation included in the average, in kilograms.

PV_R = Weighted-average monomer VOC emission rate for production resin used in the past 12 months, in kilograms per megagrams.

M_R = Mass of production resin used in the past 12 months, in megagrams.

PV_{PG} = Weighted-average monomer VOC emission rate for pigmented gel coat used in the past 12 months, in kilograms per megagrams.

M_{PG} = Mass of pigmented gel coat used in the past 12 months, in megagrams.

PV_{CG} = Weighted-average monomer VOC emission rate for clear gel coat used in the past 12 months, in kilograms per megagrams.

M_{CG} = Mass of clear gel coat used in the past 12 months, in megagrams

PV_{TR} = Weighted-average monomer VOC emission rate for tooling resin used in the past 12 months, in kilograms per megagrams.

M_{TR} = Mass of tooling resin used in the past 12 months, in megagrams.

PV_{TG} = Weighted-average monomer VOC emission rate for tooling gel coat used in the past 12 months, in kilograms per megagrams.

M_{TG} = Mass of tooling gel coat used in the past 12 months, in megagrams.

5.2.2.5.4 For purposes of Equation 3, the operator shall use Equation 4 to compute the weighted-average monomer VOC emission rate for the previous 12 months for each open molding resin and gel coat operation included in the average.

Equation 4:

$$PV_{OP} = \frac{\sum_{i=1}^{n}(Mi\ PVi)}{\sum_{i=1}^{n}(Mi)}$$

Where:

PV_{OP} = Weighted-average monomer VOC emission rate for each open molding operation (PV_R, PV_{PG}, PV_{CG}, PV_{TR}, and PV_{TG}) included in the average, kilograms of monomer VOC per megagram of material applied.

Mi = Mass of resin or gel coat i used within an operation in the past 12 months, in megagrams.

n = Number of different open molding resins and gel coats used with the operation in the past 12 months.

PVi = The monomer VOC emission rate for resin and gel coat i used within an operation in the past 12 months, in kilograms of monomer VOC per megagram of material applied. Use Table 3 to compute PVi.

Table 3 Monomer VOC Emission Rate Formulas for Open Molding for Fiberglass Boat Manufacturing Operation

Material	Application Method	Formula to calculate monomer VOC emission rate*
Production resin, Tooling resin	Atomized	$0.014 \times (\text{Resin VOC\%})^{2.425}$
	Atomized, plus vacuum bagging with roll-out	$0.01185 \times (\text{Resin VOC\%})^{2.425}$
	Atomized, plus vacuum bagging without roll-out	$0.009454 \times (\text{Resin VOC\%})^{2.425}$
	Non-atomized	$0.014 \times (\text{Resin VOC\%})^{2.275}$
	Non-atomized, plus vacuum bagging with roll-out	$0.0110 \times (\text{Resin VOC\%})^{2.275}$
	Non-atomized, plus vacuum bagging without roll-out	$0.0076 \times (\text{Resin VOC\%})^{2.275}$
Pigmented gel coat, clear gel coat, tooling gel coat	All methods	$0.445 \times (\text{Gel coat VOC\%})^{1.675}$

* The formulas in Table 3 calculate monomer VOC emissions in kilograms of monomer per megagram of resin or gel coat applied. The formulas for vacuum bagging with roll-out are applicable when a facility rolls out the applied resin and fabric prior to applying the vacuum bagging materials. The formulas for vacuum bagging without roll-out are applicable when a facility applies the vacuum bagging materials immediately after resin application without rolling the resin and fabric. VOC% = monomer VOC content as supplied, expressed as a weight-percent value between 0 and 100%.

5.2.2.6 Requirements for Add-on VOC Control System Option

5.2.2.6.1 In lieu of complying with the requirements of Compliant Materials Option in Section 5.2.2.4 or the requirements of Emissions Averaging Option in Section 5.2.2.5, an operator may choose to use an APCO-approved add-on control equipment to meet the emission limit determined by Equation 2 above. However, instead of using the mass of each material used over the past 12 months in Equation 2, the operator shall use the mass of each material used during control device performance source testing in Equation 2 to determine the emission limit (in kilograms of monomer VOC) that is applicable during the source testing. If the

measured emissions at the outlet of the control device (in kilogram of monomer VOC) are less than the emission limit, then the control device shall be considered to have achieved the emission limit, and provided the control device also meets the requirements of Sections 5.1.1.5.1 through 5.1.1.5.3.

5.2.2.6.2 All resins and gel coats used during add-on VOC controlled operations shall not exceed 5 percent by weight non-monomer VOC content limit.

5.2.2.6.3 The operator shall monitor and record relevant control device and capture system operating parameters such as temperature, pressure, and flow rate, and use the recorded values to establish operating limits for the emission control device and capture system, and maintain such parameters within the established operating limits.

5.2.2.7 Requirements for Filled Resins

5.2.2.7.1 An operator who uses resins to which fillers are added shall use Equation 5 to adjust the emission rate for filled resins under all three options specified in Section 5.2.2.4 through Section 5.2.2.6. If an operator uses a filled production resin or filled tooling resin, the operator shall calculate the emission rate for filled material on an as-applied basis using Equation 5.

5.2.2.7.2 All filled resins used shall not exceed 5 percent by weight non-monomer VOC content limit.

5.2.2.7.3 If the filled resin is used as a production resin, the value of PVF calculated by Equation 5 shall not exceed 46 kilograms of monomer VOC per megagram of filled resin applied.

5.2.2.7.4 If the filled resin is used as a tooling resin, the value of PVF calculated by Equation 5 shall not exceed 54 kilograms of monomer VOC per megagram of filled resin applied.

5.2.2.7.5 If the operator is including a filled resin in the emissions averaging option procedure, the operator shall use the value of PV_F calculated using Equation 5 for the value of PVi in Equation 4 of this rule.

Equation 5:

$$PV_F = PV_U \times \left[\frac{(100 - \%\,\text{Filler})}{100} \right]$$

Where:

PV_F = The as-applied monomer VOC emission rate for the filled production resin or tooling resin, in kilograms monomer VOC per megagram of filled material.

PV_U = The monomer VOC emission rate for the neat (unfilled) resin, before filler is added, as calculated using the formulas in Table 3 of this rule.

% Filler = The weight percent of filler in the as-applied filled resin system.

5.2.2.8 Work Practice Standards for Resins and Gel Coat

An operator shall ensure that all containers with a capacity equal to or greater than 208 liters (55 gallons), including those used for on-site mixing of putties and polyputties, have a cover with no visible gaps in place at all times, except when material is being manually added or removed from a container, or when mixing or pumping equipment is being placed in or removed from a container.

5.3 Organic Solvent Cleaning Requirements

5.3.1 An operator shall not use organic solvents for cleaning operations that exceed the VOC content limits specified in Table 4, in accordance with the corresponding effective date.

Table 4 VOC Content Limits for Organic Solvents Used in Cleaning Operations	
Type of Solvent Cleaning Operation	VOC Content Limit Grams of VOC/liter of material (lb/gal)
A. Product Cleaning During Manufacturing Process or Surface Preparation for Coating Application	25 (0.21)
B. Repair and Maintenance Cleaning	25 (0.21)
C. Cleaning of Polyester Resin Application Equipment	25 (0.21)

5.3.2 In lieu of complying with the VOC content limits in Table 4, an operator may control VOC emissions from cleaning operations with an APCO-approved VOC emission control system that meets the requirements of Section 5.1.1.5 for the solvent cleaning operations.

5.4 Solvent Storage and Disposal

An owner or operator shall store or dispose of all uncured polyester resin materials, fresh or spent solvents, waste solvent cleaning materials such as cloth, paper, etc., coatings, adhesives, catalysts, and thinners in self-closing, non-absorbent and non-leaking containers. The containers shall remain closed at all times except when depositing or removing the contents of the containers or when the container is empty.

6.0 Administrative Requirements

6.1 Recordkeeping

An operator subject to this rule shall maintain the following records:

6.1.1 Daily records of the type and quantity of all resins, gel coats, fillers, catalysts, and cleaning materials (including cleaning solvents) used in each operation. Records shall also indicate the amount used and VOC content, in weight percent, of all polyester resin and gel coat materials used for touch up, repair, and small jobs.

6.1.2 Records of the VOC content, in weight percent, of all polyester resin and gel coat, filler materials, including the weight percent of non-monomer VOC content of the resin and gel coat, used or stored at the stationary source.

6.1.3 Records of the VOC content of all cleaning materials used and stored at the stationary source as specified in Section 5.3.

6.1.4 Records showing the weight loss per square meter during resin polymerization for each vapor-suppressed resin.

6.1.5 VOC Emission Control System Records

An operator using a VOC emission control system pursuant to Section 5.1.1.5 to comply with this rule shall maintain daily records of key system operating parameters to demonstrate continuous operation and compliance of the VOC emission control system during periods of emission-producing activities. Key system operating parameters are those parameters necessary to ensure compliance, including, but not limited to, temperature, pressure drop, and air flow rate.

6.1.6 An operator claiming exemption under Section 4.1 shall maintain records of polyester materials usage to support the claim of exemption.

6.1.7 The operator shall retain the records specified in Sections 6.1.1 through 6.1.6, as applicable, on site for a period of five years, make the records available on site during normal business hours to the APCO, ARB, or EPA, and submit the records to the APCO, ARB, or EPA upon request.

6.2 Test Methods

The analysis of cleaning materials, polyester resin materials and control efficiency shall be determined by the following methods:

6.2.1 The emission rate per square meter of exposed surface during polymerization of Polyester Resins is to be determined using: SCAQMD Method 309 (Static Method for Determination of Volatile Emissions from Polyester and Vinyl Resins Operations), Attachment A, 1/8/91.

6.2.2 Determination of Overall Capture and Control Efficiency of VOC Emission Control Systems

6.2.2.1 The capture efficiency of a VOC emission control system's collection device(s) shall be determined according to EPA's "Guidelines for Determining Capture Efficiency," January 9, 1995 and 40 CFR 51, Appendix M, Test Methods 204-204F, as applicable, or any other method approved by EPA, ARB, and the APCO.

6.2.2.2 The control efficiency of a VOC emission control system's VOC control device(s) shall be determined using EPA Test Methods 2, 2A, or 2D for measuring flow rates and EPA Test

Methods 25, 25A, or 25B for measuring total gaseous organic concentrations at the inlet and outlet of the control device(s). EPA Method 18 or ARB Method 422 shall be used to determine the emissions of exempt compounds.

6.2.2.3 For VOC emission control systems that consist of a single VOC emission collection device connected to a single VOC emission control device, the overall capture and control efficiency shall be calculated by using the following equation:

$$CE_{Capture\ and\ Control} = [\ CE_{Capture} \times CE_{Control}\ ] / 100$$

Where:

$CE_{Capture\ and\ Control}$ = Overall Capture and Control Efficiency, in percent

$CE_{Capture}$ = Capture Efficiency of the collection device, in percent, as determined in Section 6.2.2.1.

$CE_{Control}$ = Control Efficiency of the control device, in percent, as determined in Section 6.2.2.2.

6.2.3 The monomer content of uncatalyzed resin materials is to be determined using ASTM D2369-87 (Standard Test Method for Volatile Content of Coatings) or SCAQMD Test Method 312.

6.2.4 The VOC content of cleaning materials shall be determined using EPA Method 24 (40 CFR Part 60, Appendix A).

6.2.5 Determination of emissions of VOC from spray gun cleaning systems shall be made using SCAQMD "General Test Method for Determining Solvent Losses from Spray Gun Cleaning Systems," October 3, 1989.

6.2.6 The transfer efficiency of alternative coating application methods shall be determined in accordance with the SCAQMD method “Spray Equipment Transfer Efficiency Test Procedure for Equipment User,” May 24, 1989.

6.3 Multiple Test Methods

When more than one test method or set of test methods is specified for any testing, a violation of any requirement of this rule established by any one of the specified test methods or set of test methods shall constitute a violation of this rule.