

RULE 432 Polyester Resin Operations - Adopted 3/13/2014

I. Applicability

The purpose of this rule is to reduce volatile organic compounds (VOC) emissions from polyester resin operations. The provisions of this rule apply to commercial polyester resin operations, industrial polyester resin operations, and organic solvents (use {including cleaning}, storage, waste, and disposal {off-site transfer}) associated with polyester resin operations.

II. Definitions

- A. APCO: Air Pollution Control Officer of the Eastern Kern Air Pollution Control District.
- B. Application Equipment: Device, including, but not limited to, a spray gun, brush, and roller, used to apply adhesives, coatings, or inks.
- C. ARB: California Air Resources Board.
- D. Assembly Adhesive: Chemical material used to join two or more fiberglass, metal, foam, plastic, or wood parts. Assembly adhesives include, but are not limited to, methacrylate adhesives and putties made from polyester or vinylester resin mixed with inert filler or fibers.
- E. ASTM: American Society of Testing and Materials International.
- F. Atomized Resin Application: Technology that utilizes application equipment that breaks resin into droplets (or aerosol) as it exits 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.
- G. Bench Scale Project: Project (not located at Research and Development facility) operated on a small scale, such as one capable of being located on a laboratory bench top.
- H. Catalyst: Substance is added to a resin to initiate or promote polymerization.
- I. CFR: Code of Federal Regulations.
- J. Cleaning Materials: Materials including, but not limited to, materials used for cleaning hands, tools, molds, application equipment, and work areas.
- K. Clear Gel Coat: Clear (translucent) gel coating used to allow underlying colors or patterns to be visible. Tooling gel coat used to build or repair molds is NOT a clear gel coat.

- L. Closed Molding Process: Molding process that utilizes pressure to distribute resin through the reinforcing fabric placed between two mold surfaces to either saturate the fabric or fill the mold cavity. Pressure utilized can be one or combination of the following forms: clamping, fluid (hydraulic), vacuum, or atmospheric. 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. The following are not close molding processes:
1. Processes utilizing a closed mold to compact saturated fabric or remove air or excess resin from the fabric (such as in vacuum bagging).
 2. Open molding steps, such as application of gel coat or skin coat layer by conventional open molding prior to a closed molding process.
- M. Coating: A material applied onto or impregnated into a substrate for protective, decorative, or functional purposes.
- N. Corrosion-Resistant Material: Polyester resin material used to make products for corrosion resistant applications such as tooling, fuel or chemical tanks, boat hulls, pools and outdoor spas.
- O. Cure: Polymerization process where small molecules, called monomers, combine chemically to produce a very large chainlike or network molecule. Chemicals are transformed from a liquid to a solid state or semisolid state to achieve desired physical properties for the product, including hardness.
- P. Cured Coating: Coating that is dry to the touch.
- Q. Degreaser: Solvent containing tank, tray, drum, etc. utilized to clean objects. Objects are cleaned by immersion into solvent or exposure to solvent vapor. Objects include, but not limited to, parts, products, tools, machinery, and equipment. An enclosed spray application equipment cleaning system is not a degreaser.
- R. Dissolver: Organic solvent that is added to an adhesive, coating, or ink to melt or to liquefy solid particles.
- S. EPA: United States Environmental Protection Agency.
- T. Filament Application: Resin application method to an open mold where reinforcement fibers are fed through a resin bath and winding the resin impregnated fibers on a rotating mandrel.
- U. Filled Polyester Resin Material: Material formulated by adding compatible filler(s) to polyester resin material(s).

- V. Filler: Inert (non-VOC) substance added to the resin to enhance its mechanical properties or extend its volume. Resin fillers include, but are not limited to, silica, carbon black, talc, mica and calcium carbonate.
- W. Fire Retardant Material: Polyester resin material used to make products that are resistant to flame or fire.
- X. Fluid Impingement Technology: Spray gun that produces an expanding non-misting curtain of liquid by the impingement of low-pressure uninterrupted liquid streams.
- Y. Gel Coat: Polyester resin topcoat that provides a cosmetic enhancement and improves resistance to degradation from environmental exposure.
- Z. Grams of VOC per Liter of Material: The weight of VOC per volume of material and can be calculated by the following equation:

$$\text{Grams of VOC per liter of material} = \frac{W_s - W_w - W_{ec}}{V_m}$$

Where:

W_s = weight of volatile compounds (grams)

W_w = weight of water (grams)

W_{ec} = weight of exempt compounds (grams)

V_m = volume of material (liters)

- AA. High-Strength Material: Polyester resins which have a casting tensile strength of 10,000-psi or more.
- BB. High-Volume, Low-Pressure (HVLP): Spray equipment permanently labeled as such and which is designed and operated between 0.1 and 10 pounds per square inch, gauge, (psig) air atomizing pressure measured dynamically at the center of the air cap and at the air horns and with liquid supply pressure less than 50 psig.
- CC. Lamination Resin: Orthophthalate, isophthalate and dicyclopentadiene (DCPD) resin which is used in composite system made of layers of reinforcement fibers and resins.
- DD. Liquid Leak: Visible solvent leak from a container at a rate of more than three drops per minute, or a visible liquid mist.
- EE. Maintenance Cleaning: Cleaning of tools, forms, molds, jigs, machinery, and equipment (excluding coating, ink and adhesive application equipment), and the cleaning of work areas where maintenance or manufacturing occurs.
- FF. Manual Application: Application of resin to an open mold using a hand layup technique. Components of successive plies of resin-impregnated reinforcement fibers are applied using hand tools such as brushes and rollers.
- GG. Manufacturing Process: Process of making goods or products by hand or by machine.
- HH. Marble Resin: Orthophthalate and modified acrylic isophthalate resin, which is designed for the fabrication of cast products, such as vanities.

- II. Mold: Cavity or surface where gel coat, resin, and fibers are placed and from which finished fiberglass parts take their form.
- JJ. Monomer: Organic compound, such as styrene, that reacts with unsaturated polyester resins to form a cured polyester resin.
- KK. Month: Calendar month.
- LL. Neat Resin: Resin that has no added filler.
- MM. Non-Absorbent Container: Container made of non-porous material that does not allow the migration of solvents through it.
- NN. Non-Atomized Resin Application: Technology that utilizes application equipment that does not break resin into droplets (or aerosol) as it exits application equipment to the surface of the part. Non-atomized resin application technology includes, but are not limited to, non-atomizing spray guns, flowcoaters, chopper flowcoaters, pressure fed resin rollers, resin impregnators, or fluid impingement technology.
- OO. Non-Atomized Solvent Flow: Solvents in the form of a liquid stream without the introduction of any propellant.
- PP. Non-Atomizing Spray Gun: Spray gun where 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.
- QQ. Non-Leaking Container: Container without a liquid leak.
- RR. Normal Business Hours: Monday through Friday, 8:00 am to 5:00 pm.
- SS. Open Molding Resin and Gel Coat Process: Process where reinforcing fibers and resin are placed in an open-air mold while the reinforcing fibers are saturated with resin. Open molding operations include vacuum bags (or similar) used to compress uncured laminate to remove bubbles, excess resin, and to achieve a bond between core material and laminate.
- TT. Organic Solvent: The same as “Solvent.”
- UU. Organic Solvent Cleaning: Activity, operation, or process, (including surface preparation, cleanup, or wipe cleaning), performed outside of a degreaser, that uses organic solvents to remove uncured adhesives, uncured coatings, uncured inks or other contaminants. These operations including, but not limited to, dirt, soil, oil, lubricants, coolants, moisture, fingerprints, and grease, from parts, products, tools, machinery, general work areas and application equipment (including coatings, adhesives, and ink spray equipment).

- VV. Pigmented Gel Coat: Opaque gel coat that provides a colored, glossy surface which improves the aesthetic appearance of the products. Pigmented gel coat does not include tooling gel coat used to build or repair molds.

- WW. 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.

- XX. Polyester Resin Operations: 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.

- YY. Polymer: Chemical compound comprised of a large number of chemical units, formed by chemical linking of monomers.

- ZZ. Production Resin: General purpose resin material that is not especially corrosion resistant, fire retardant, high strength, or gel coats.

- AAA. Propellant: Gas, including air, in a pressure container utilized to expel the contents when the pressure is released.

- BBB. Repair Cleaning: Solvent cleaning operation or activity carried out during a repair process.

- CCC. Repair Process: Process of returning a damaged or not operating properly object to good condition.

- DDD. Research and Development: Facility or part of a facility used to development 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 production manufacturing operations.

- EEE. Resin: Class of natural or synthetic organic polymers used to encapsulate and bind together reinforcement fibers in the construction of fiberglass parts.

- FFF. Resin and Gel Coat Operation: Operation in which resins or gel coats (including putties or polyputties) is combined with additives (including, but are not limited to, fillers, promoters, or catalysts).

- GGG. SCAQMD: South Coast Air Quality Management District.

- HHH. Skin Coat: Layer of resin and fibers applied over gel coat to protect the gel coat from deformation by the subsequent laminate layers.

- III. 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.

- JJJ. Solid Surface Resin: Resin, used without gel coats, to fabricate homogenous solid surface products.
- KKK. Solvent: As defined in Rule 410.3, Organic Solvent Degreasing Operations.
- LLL. Specialty Gel Coat: Gel coat used in conjunction with fire retardant, corrosion resistant or high-strength materials.
- MMM. Specialty Resin: 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: corrosive agents, caustic agents, acidic agents, or flame (heat).
- NNN. Stationary Source: As defined in Rule 210.1 (New and Modified Stationary Source Review Rule).
- OOO. Tooling Resin: Resins used to build or repair molds (tools) or prototypes (plugs) that comprise the molds.
- PPP. Tooling Gel Coat: Gel coat used to build or repair molds (tools) or prototypes (plugs) that comprise the molds.
- QQQ. Touch-up: Application of resin or gel coat to correct minor cosmetic imperfections that occur during fabrication or field installations.
- RRR. Tub/Shower Resin: Dicyclopentadiene (DCPD), orthophthalate and isophthalate resins, used to fabricate bath ware products.
- SSS. Vapor Suppressant: Substance added to resin to minimize the transfer of monomer vapor into the atmosphere.
- TTT. Vinylester Resin: Thermosetting resin containing esters of acrylic or methacrylic acids having a double-bond and ester linkage sites at the end of the resin molecules.
- UUU. Volatile Organic Compound (VOC): As defined in Rule 102, Definitions.
- VVV. Waste Materials: Materials including but not limited to paper or cloth used for cleaning operations, waste resins, or spent cleaning materials.

III. Exemptions

- A. The provisions of this rule, excluding recordkeeping requirements of Section V.A, shall not apply to any polyester resin operation provided the volume of polyester resin materials used is less than 20 gallons per month.
- B. The solvent cleaning provisions of Section IV.B.2, Table 1 shall not apply to the following applications:
1. Cleaning of solar cells, laser hardware, scientific instruments, or high precision optics.

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

IV. Requirements

A. Polyester Resin Operation

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

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 Sections IV.A.2, IV.A.3, or IV.A.4.

**TABLE 1
VOC CONTENT LIMITS FOR OPEN MOLDING RESIN AND GEL COAT**

Compliant Materials Weighted Average Monomer	
Material	Weight Percent Limit
a. General Purpose Resin	
• Marble Resin	10% or 32%, as supplied, with no fillers
• Solid Surface	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	29%
c. Specialty Resin	
• Fire Retardant Resin	38%
• High Strength Materials	40%
• Corrosion Resistant Resin	48%
d. All Other Resins	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%

2. 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;
3. Use a closed-mold system; or
4. Install and operate a VOC emissions control system which meets all of the requirements of Sections IV.A.4.a. through IV.A.4.c during periods of emission producing activities:
 - a. The VOC emission control system shall be approved, in writing, by the APCO.
 - b. 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 V.B.
 - c. 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 Overall Capture and Control Efficiency, percent. |
| VOC_{LWc} | = | VOC Limit, less water and exempt compounds. |
| $VOC_{LWn,Max}$ | = | Maximum VOC content of noncompliant coating used in conjunction with a control device, less water and exempt compounds. |
| $D_{n,Max}$ | = | Density of solvent, reducer, or thinner contained in the noncompliant coating, containing the maximum VOC content of the multi-component coating. |
| D_c | = | Density of corresponding solvent, reducer, or thinner used in the compliant coating system. |

5. 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.

- B. 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.
1. High-Volume, Low-Pressure (HVLP) spray equipment shall be operated in accordance with the manufacturer's recommendations.
 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.
 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 II.
- C. In lieu of complying with the applicable requirements of IV.B, an operator may install and maintain a VOC emission control system that meets the requirements of Section IV.A.4 around the coating application operation.

TABLE 2
VOC CONTENT LIMITS FOR ORGANIC SOLVENTS

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)

2. In lieu of complying with the VOC content limits in Table 2, an operator may control VOC emissions from cleaning operations with an APCO-approved VOC emission control system that meets the requirements of Section IV.A.4 for the solvent cleaning operations.

E. 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.

V. Administrative Requirements

A. Recordkeeping

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

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.
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.
3. Records of the VOC content of all cleaning materials used and stored at the stationary source as specified in Section IV.D.
4. Records showing the weight loss per square meter during resin polymerization for each vapor-suppressed resin.
5. VOC Emission Control System records an operator using a VOC emission control system pursuant to Section IV.A.4 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. An operator claiming exemption under Section III shall maintain records of polyester materials usage to support the claim of exemption.
7. The operator shall retain the records specified in Sections V.A.1 through V.A.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.

B. Test Methods

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

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.
2. Determination of Overall Capture and Control Efficiency of VOC Emission Control Systems:

- a. 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.
- b. 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.
- c. 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:

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

Where:

$CE_{\text{Capture and Control}}$	=	Overall Capture and Control Efficiency, in percent.
CE_{Capture}	=	Capture Efficiency of the collection device, in percent.
CE_{Control}	=	Control Efficiency of the control device, in percent.

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

C. 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.

V. Compliance Schedule

A. New Sources

1. Owners or Operators of any facility proposing to install polyester resin operations and required to comply with Section IV of this rule shall obtain an Authority to Construct (ATC) in accordance with Rule 210.1 prior to installation or operation of any polyester resin operation.
2. Owners or Operators of any facility with polyester resin operations exempt by Section III.A of this rule shall maintain records of polyester resin use upon initial operations.

B. Existing Sources

1. Owners or Operators of any facility with polyester resin operations required to comply with Section IV of this rule shall obtain a valid Permit to Operate (PTO) or an Authority to Construct (ATC), and shall apply for an ATC within 180-days from the adoption of this Rule.
2. Owners or Operators of any facility with polyester resin operations exempt by Section III.A of this rule shall commence maintaining records of polyester resin use within 180 days of this rule adoption.
3. Owners or operators with valid PTO(s), required to comply with Section IV of this rule shall obtain shall be in full compliance within 12 months after rule adoption.

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