

ANTELOPE VALLEY AIR QUALITY MANAGEMENT DISTRICT

RULE 1130.1 -- SCREEN PRINTING OPERATIONS

(Adopted: 08/02/91; Amended: 07/09/93; Amended: 07/09/93; Amended: 12/13/96)

(a) Purpose and Applicability

The purpose of this rule is to reduce emissions of volatile organic compounds (VOC) from screen printing operations. This rule applies to persons performing screen printing operations or who sell, distribute, or require the use of screen printing materials in the District.

(b) Definitions

For purposes of this rule, the following definitions shall apply:

- (1) **ADDITIVES** are compounds added to screen printing materials to improve flow or workability or to obtain a desired characteristic or property. The term "additives" excludes thinners.
- (2) **ADHESIVE** is any substance that is used to bond one surface to another surface.
- (3) **CAPTURE EFFICIENCY**, in percent, is the ratio of the weight of the VOC in the screen printing operation effluent stream entering the control device to the weight of VOC emitted from screen printing operations, both measured simultaneously, and shall be calculated by the following equation:
$$\text{Capture Efficiency} = \left(\frac{W_c}{W_e} \right) \times 100$$

Where: W_c = weight of VOC in screen printing operation effluent stream entering control device
 W_e = weight of VOC emitted
- (4) **CERAMIC DECALS** are water-slide decals which are used to transfer images onto ceramic materials by firing above 800°F.
- (5) **CERAMIC DECAL INK** is any ink which is screen printed onto treated paper stock and is used in the production of ceramic decals.
- (6) **CHLORINE INDICATOR** is a product which is screen printed with an ink that changes color to indicate chlorine concentrations in the range of 0 - 11 parts per million (ppm).

- (7) CLEAR INK is a colorless ink that is screen printed on decal paper and either serves as the base film on which opaque inks are screen printed, or as a protective film over opaque inks, and is used in the production of water-slide decals.
- (8) COATING is a layer of material applied to a substrate in a substantially unbroken film.
- (9) COLD BENDING is a process which subjects the printed color, design, alphabet, symbol, or numeral on a printed object to permanent bending through the application of force.
- (10) CONDUCTIVE INKS are screen printing inks which transmit electricity and are used in the production of electronic circuits.
- (11) CONTAINERS are plastic products manufactured for storing materials. Containers include, but are not limited to, bottles, buckets, and jars.
- (12) CONTROL DEVICE EFFICIENCY, in percent, is the ratio of the weight of the VOC removed by the control device from the screen printing operation effluent stream entering the control device to the weight of the VOC in the screen printing operation effluent stream entering the control device, both measured simultaneously, and shall be calculated by the following equation:
- $$\text{Control Device Efficiency} = \left(\frac{W_c - W_a}{W_c} \right) \times 100$$
- Where: W_c = weight of VOC in screen printing operation effluent stream entering control device
 W_a = weight of VOC discharged from the control device
- (13) DEGREE is a unit for measuring temperature or an angle.
- (14) ELECTRONIC CIRCUIT is a product which consists of a substrate and a circuitry created by screen printing a conductive ink on the substrate.
- (15) EMBOSSING is a process which subjects the printed color, design, alphabet, symbol, or numeral on a printed object to a mechanical force which results in permanently raising the level of the impacted area.
- (16) EXEMPT COMPOUNDS (See Rule 102-Definition of Terms).
- (17) EXTREME PERFORMANCE SCREEN PRINTING MATERIALS are screen printing inks and coatings which qualify for extreme performance classification under the provisions of subdivision (e).
- (18) FINE DETAIL LOOSELEAF BINDER INK is a printing ink used in the manufacturing of loose-leaf binders to print graphics which are lighter in color than the background on which they are printed and which have a width of 1/24th of an inch or smaller.

- (19) FLUORESCENT INK is a printing ink which glows brighter than conventional ink when exposed to light due to pigments which have the property of emitting radiation in the visible range as a result of absorption of radiation in the ultraviolet range from some other source.
- (20) GRAMS OF VOC PER LITER OF COATING (OR INK OR ADHESIVE), LESS WATER AND LESS EXEMPT COMPOUNDS, is the weight of VOC per combined volume of VOC and coating (or ink or adhesive) solids, and which is calculated by the following equation:

Grams of VOC per Liter of Coating (or Ink or Adhesive),

$$\text{Less Water and Less Exempt Compounds} = \frac{W_s - W_w - W_{es}}{V_m - V_w - V_{es}}$$

Where:

- W_s = weight of volatile compounds, in grams
- W_w = weight of water, in grams
- W_{es} = weight of exempt compounds, in grams
- V_m = volume of material, in liters
- V_w = volume of water, in liters
- V_{es} = volume of exempt compounds, in liters

- (21) GRAMS OF VOC PER LITER OF MATERIAL is the weight of VOC per volume of material (ink, coating or adhesive) which is calculated by the following equation:

$$\text{Grams of VOC per Liter of Material} = \frac{W_s - W_w - W_{es}}{V_m}$$

Where:

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

- (22) HEAT-BENDING is a process which subjects the printed color, design, alphabet, symbol, or numeral on a printed object to permanent bending through the application of heat and force.
- (23) HIGH-VOC SERIGRAPH INKS are screen printing materials used in making serigraphs and which contain, on an as applied basis, VOC in excess of 400 grams per liter (3.3 pounds per gallon), less water and exempt compounds.
- (24) INFLATING is a process of filling a printed object with air or gas which results in the swelling of the printed area of the object.
- (25) LOOSE-LEAF BINDER METALLIC INK is a metallic ink as defined in paragraph (b)(29) which is used on loose-leaf binders and is not silver or golden in color.

- (26) MAN-MADE FIBERS are threadlike materials produced from the spinning of synthetic organic polymers or cellulose-based organic polymers and which are used in the manufacture of man-made textiles. Man-made fibers include, but are not limited to, rayon, acetate, triacetate, nylon, and polyester and exclude fiberglass.
- (27) MAN-MADE TEXTILES are woven or knitted fabrics made of one hundred percent (100%) man-made fibers, or natural fibers which are coated with plastic materials.
- (28) MECHANICALLY-FORMED PRODUCTS are screen-printed products made of plastic substrates which are subjected to vacuum-forming, embossing, inflating, heat-bending, or cold bending processes after the screen printing operation.
- (29) METALLIC INK is ink containing at least 50 grams of elemental metal particles per liter of ink (0.4 lb/gal) as applied and which is not used in the manufacture of an electronic circuit.
- (30) NATURAL FIBERS are naturally-occurring materials, such as wool, silk, cotton, and flax.
- (31) NON-POROUS SUBSTRATE is a substrate that has no tiny pores or openings in its physical structure in which to absorb fluids. Non-porous substrates include, but are not limited to, glass, metals and plastics.
- (32) OPAQUE INK is an ink containing colored pigments which is screen printed over a clear base ink to form the colored images in the production of water slide decals.
- (33) OVERALL CONTROL EFFICIENCY (C.E.), in percent, is the ratio of the weight of the VOC removed by the emission control system from the screen printing operation effluent stream entering the control device to the total VOC emitted from the screen printing operations, both measured simultaneously, and shall be calculated by the following equation:

$$C.E. = \frac{(W_c - W_a)}{W_e} \times 100$$

$$C.E. = \frac{(\text{Capture Efficiency}) \times (\text{Control Device Efficiency})}{100}$$

Where: W_c = weight of VOC in screen printing operation effluent stream entering control device
 W_a = weight of VOC discharged from the control device
 W_e = weight of VOC emitted

- (34) OVERLAY is a screen-printed product made of polycarbonate, polyester, or clear vinyl plastic substrate which activates the circuitry on an electronic circuit, as defined in paragraph (b)(14), underneath it when pressed against the electronic circuit. Overlays and electronic circuits are used in membrane switches of products such as computer keyboards, calculators, control panels, and home appliances.
- (35) PLASTICS are man-made materials, excluding rubber, produced from high molecular weight synthetic or natural organic polymers which are capable of being shaped or flowing under heat and pressure into desired forms at some stage of their manufacture. Plastics include, but are not limited to, acrylonitrile butadiene styrene (ABS), acrylic, butylate, epoxy, vinyl, polyvinyl chloride (PVC), polyethylene, polypropylene, polystyrene, polycarbonate, polyamide, polyester, and polyurethane.
- (36) POLYETHYLENE PRODUCTS are screen-printed flags, banners, signs, or displays made of polyethylene plastic substrate.
- (37) PRINTING is any operation that imparts a color, design, alphabet, symbol, or numeral on a substrate.
- (38) PRINTING INK is any viscous fluid used in printing, impressing, or transferring an image onto a substrate.
- (39) RESISTS are inks that are screen printed to (A) form the required alphabets, numerals, designs, or symbols on the surface of the substrate; and (B) protect the screen printed or covered surface from the subsequent application of etching or plating solution, and (C) are inks that may be later removed from the substrate by a resist stripper. Resists applications include, but are not limited to, etched electronic circuits, display screens, chemical milling of parts, nameplates and signage.
- (40) SCRATCH-OFF INK is an opaque printing ink formulated to be applied on a substrate to hide the information already printed on the substrate and to be scratched-off to reveal the printed information. Scratch-off inks are used to make products, which include but are not limited to, lottery tickets and contest games.
- (41) SCREEN PRINTING is a printing process in which printing ink, coating, or adhesive material is passed through a taut web or fabric to which a refined form of stencil has been applied. The stencil openings determine the form and dimensions of the imprint.
- (42) SCREEN PRINTING EQUIPMENT is equipment used for applying screen printing materials, including the flash-off area, ovens or dryers, conveyors, or other equipment operating as part of screen printing operations.
- (43) SCREEN PRINTING MATERIALS are any inks, coatings, or adhesives, including added thinners or additives, used in screen printing.

- (44) SCREEN PRINTING OPERATIONS are operations which include screen printing and any subsequent drying, curing, or conveying of the screen-printed substrate.
- (45) SERIGRAPHS are color paintings made by screen printing operations
- (46) STAINED GLASS OVERLAY is untreated polyester film, screen printed with polyester-based screen printing ink, to simulate the appearance of stained glass.
- (47) STERILIZATION INDICATOR is a product which is screen printed with an ink that changes color to indicate that sterilization has occurred. Sterilization indicators are used to monitor the sterilization of medical instruments, autoclave efficiency, and the thermal processing of foods for prevention of spoilage.
- (48) SUB-PRINTED PRODUCTS are screen-printed products, which include, but are not limited to, overlays or nameplates, made of a polycarbonate, polyester, or clear vinyl plastic substrate on which the screen printing material is applied on the unexposed side followed by an adhesive coat.
- (49) UNSEALED ALUMINUM is chemically anodized aluminum used to make products which are screen printed with a dye and subsequently immersed in a sealing bath to seal the printed dye in the pores of the aluminum.
- (50) VACUUM-FORMING is a process which imparts a desired shape to a printed object by subjecting the screen printed area of the object to a vacuum.
- (51) VOLATILE ORGANIC COMPOUND (VOC) is any chemical compound that contains the element carbon, excluding methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, ammonium carbonate and exempt compounds.
- (52) WATER SLIDE DECALS are decals which are screen printed onto treated paper stock, and are removable from the stock by the dissolution of an underlying, water-soluble adhesive or a similar carrier.
- (53) WATER SLIDE DECAL ADHESIVE is any adhesive which is screen printed onto treated paper stock, in the production of water slide decals.

(c) Requirements

(1) VOC Content of Screen Printing Materials

A person shall not apply to any substrate any screen printing material, excluding extreme performance screen printing materials, which contains, as applied, a total amount of VOC in excess of the limits specified in subparagraphs (c)(1)(A), (c)(1)(B), or (c)(1)(C). The applicable VOC limit for a screen printing operation shall be determined by first looking for the product in subparagraph (c)(1)(A). If the product is not listed in subparagraph (c)(1)(A), look for the product's substrate in subparagraph (c)(1)(B). If the substrate is not listed in subparagraph (c)(1)(B), look for the applicable limit in subparagraph (c)(1)(C).

In lieu of meeting the requirements in subparagraph (c)(1)(C), a person may comply with the requirements in paragraph (c)(2) if the screen printing material qualifies for an extreme performance classification under subdivision (e).

(A) For screen printing coatings and inks used in the production of the following products:

<u>PRODUCT</u>	<u>VOC LIMIT</u> grams per Liter of Coating (or Ink), Less water and Less Exempt Compounds	
	On and After December 13, 1996	
	<u>g/L</u>	<u>lbs/gal</u>
Chlorine Indicator	500	4.2
Containers	800	6.7
Electronic Circuit	850	7.1
Mechanically-Formed Products	800	6.7
Overlays	800	6.7
Polyethylene Products	800	6.7
Stained Glass Overlay	800	6.7
Sterilization Indicator	600	5.0
Sub-Printed Products	800	6.7
Water Slide Decals:		
Opaque Inks	800	6.7
Clear Inks	800	6.7
Ceramic Decal Inks	800	6.7

(B) For screen printing coatings and inks not regulated by subparagraph (c)(1)(A) and which are applied to the following specified substrates:

SUBSTRATE**VOC LIMIT**

Grams per Liter of Coating (or Ink), Less
water and Less Exempt Compounds:
On and After December 13, 1996

	<u>g/L</u>	<u>lbs/gal</u>
Ceramic	800	6.7
Fiberglass	600	5.0
Glass or Metal	600	5.0
Man-Made Textile	800	6.7
Unsealed Aluminum	800	6.7

If a substrate is regulated under more than one substrate category listed in subparagraph (c)(1)(B), the category with the highest VOC limit shall apply.

- (C) For screen printing materials not regulated by the provisions in subparagraph (c)(1)(A) or (c)(1)(B), which have the following material classifications:

SCREEN PRINTING MATERIAL**VOC LIMIT**

grams per Liter of Coating(or Ink or Adhesive),
Less water and Less Exempt Compounds
On and After December 13, 1996

	<u>g/L</u>	<u>lbs/gal</u>
Adhesive	400	3.3
Coating	400	3.3
Fine Detail Loose-leaf Binder Ink	745	6.2
Fluorescent Ink	540	4.5
High-VOC Serigraph Ink	800	6.7
Loose-leaf Binder Metallic Ink	745	6.2
Metallic Ink	400	3.3
Printing Ink	400	3.3
Resists	600	5.0
Scratch-Off Ink	800	6.7
Water-Slide Decal Adhesive	800	6.7

If a screen printing material is regulated under more than one screen printing material category listed in subparagraph (c)(1)(C), the category with the highest VOC limit shall apply.

- (2) **VOC Content of Extreme Performance Screen Printing Materials**
A person shall not apply any extreme performance screen printing material in excess of the limits specified below:

VOC LIMIT

Grams of VOC per Liter of
Extreme Performance Screen Printing Material,
Less Water and Less Exempt Compounds

	<u>g/L</u>	<u>lbs/gal</u>
On and after July 9, 1993	800	6.7
On and after January 1, 2003	400	3.3

(3) Usage of High-VOC Serigraph Inks

The total usage of high-VOC serigraph inks, as defined in paragraph (b)(23), shall not exceed 10 percent, (by volume), of the total usage of screen printing materials applied on all serigraphs at a facility, on a monthly basis, unless an approved emission control system is used to reduce emissions from high-VOC serigraph inks by an equivalent or greater level to that which would have been achieved by the use of an ink containing 3.3 pounds per gallon VOC (less water and exempt compounds). The required overall control efficiency of the emission control system shall be determined by the equation in paragraph (d)(1).

(4) Solvent Cleaning Operations; Storage and Disposal of VOC-Containing Materials

Solvent cleaning of application equipment, parts, products, tools, machinery, equipment, general work areas, and the storage and disposal of VOC-containing materials used in cleaning operations shall be carried out pursuant to Rule 1171 - Solvent Cleaning Operations.

(5) Recordkeeping

Any person who owns or operates a facility at which screen printing operations are conducted shall maintain records in accordance with District Rule 109.

(6) Prohibition of Specification and Sale

No person shall sell, distribute, or require any other person to use in the District any VOC-containing material subject to the provisions of this rule which, when thinned or reduced according to the manufacturer's recommendation for application, does not meet the applicable VOC limits required by this rule for the specific application.

(7) Labeling

Labels of screen printing materials shall comply with the provisions of Rules 443 and 443.1.

(d) Approved Emission Control System

- (1) Any person who owns or operates a facility at which screen printing operations are conducted may comply with the provisions of subparagraph (c)(1)(A), (c)(1)(B), or (c)(1)(C), or paragraph (c)(2) by using an approved emission control system for reducing emissions of VOC, consisting of collection and control devices which have been approved in writing by the Executive Officer. The approved emission control system shall reduce the VOC emissions resulting from the use of non-compliant inks, adhesives and coatings by an equivalent or greater level to that which would have been achieved by the provisions of subparagraph (c)(1)(A), (c)(1)(B), (c)(1)(C), or paragraph (c)(2).

The required efficiency of an emission control system at which an equivalent or greater level of VOC emission reduction will be achieved shall be calculated by the following equation:

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

Where:	C.E.	= Overall Control Efficiency, percent
	VOC_{LWc}	= VOC Limit of Rule 1130.1, less water and less exempt compounds, g/L, pursuant to subdivision (c).
	VOC_{LWc}	= 400 g/L for high-VOC serigraph inks if compliance with the 10% requirement in paragraph (c)(3) is not achieved.
	VOC_{LWc}	= 800 g/L for high-VOC serigraph inks if compliance with the 10% requirement in paragraph (c)(3) is achieved.
	$VOC_{LWn, Max}$	= Maximum VOC content of non-compliant ink (or coating or adhesive) used in conjunction with a control device, less water and exempt compounds, g/L.
	$D_{n, Max}$	= Density of solvent, reducer, or thinner contained in the non-compliant ink (or coating, or adhesive) which has the maximum VOC content of all non-compliant inks (or coatings, or adhesives) used on a printing line, g/L.
	D_c	= Density of corresponding solvent, reducer, or thinner used in the compliant ink (or coating, or adhesive) system = 880 g/L

- (2) The control device efficiency, as defined in paragraph (b)(12), of a control device shall not be less than 95 percent.

- (e) **Qualification for Classification as an Extreme Performance Screen Printing Material**
A screen printing ink or coating may be classified as an extreme performance screen printing material, provided that the applicator receives written approval of such classification from the Executive Officer prior to the application of such ink or coating, and it is shown that the ink or the coating, in its intended use, is screen printed on a non-porous substrate and exposed to any of the following:
- (1) Petroleum-based fuels, or hydraulic fluids containing phosphate esters, or industrial-grade acid or alkaline solutions;
 - (2) Industrial-grade detergents, cleaners, or abrasive scouring agents;
 - (3) Other chemicals having similar degrading properties as in paragraphs (e)(1) or (e)(2), as determined by the Executive Officer;
 - (4) Continuous outdoor conditions for more than five (5) years; or
 - (5) Other harsh environmental conditions as determined by the Executive Officer.

Screen printing materials subject to subparagraph (c)(1)(A) or (c)(1)(B) shall not be eligible for extreme performance classification. If a screen printing material complies with the requirements of subparagraph (c)(1)(C), an extreme performance classification is not required.

(f) **Rule 442 Applicability**

Any screen printing operation which is exempt from all or a portion of the VOC limits of this rule shall comply with the provisions of Rule 442.

(g) **Test Methods**

(1) **Methods of Analysis**

For purposes of this rule, the following test methods shall be used:

(A) **VOC Content of Adhesives, Coatings, and Inks**

The VOC content shall be determined by the methods specified in clauses (g)(1)(A)(i) or (g)(1)(A)(ii).

- (i) United States Environmental Protection Agency (USEPA) Reference Method 24, (40 Code of Federal Regulations, Part 60, Appendix A). The exempt compounds content shall be determined by District Method 303 (Determination of Exempt Compounds) contained in the District Laboratory Methods of Analysis for Enforcement Samples-manual; or

- (ii) District Method 304 [Determination of Volatile Organic Compounds (VOCs) in Various Materials] contained in the District Laboratory Methods of Analysis for Enforcement Samples manual.
- (iii) Exempt Perfluorocarbon Compounds
The following classes of compounds: cyclic, branched, or linear, completely fluorinated alkanes; cyclic, branched, or linear, completely fluorinated ethers with no unsaturations; cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations; and sulfur-containing perfluoro-carbons with no unsaturations and with sulfur bonds only to carbon and fluorine, will be analyzed as exempt compounds for compliance with subdivision (c), only at such time as manufacturers specify which individual compounds are used in the formulation of the screen printing material and identify the test methods, which have been approved by the USEPA and the District prior to such analysis, that can be used to quantify the amount of each exempt compound.

(B) Metal Content in Inks

The metal content of metallic inks shall be determined by District Method 318 (Determination of Elemental Metal in Coatings by X-Ray Diffraction) contained in the District Laboratory Methods of Analysis for Enforcement Samples-manual.

(C) Determination of Fibers

The presence of natural fibers in textiles shall be determined by District Method 317 (Determination of Natural Fibers) contained in the District Laboratory Methods of Analysis for Enforcement Samples manual.

(2) Determination of Efficiency of Emission Control Systems

- (A) The capture efficiency of an emission control system as defined in paragraph (b)(3) shall be determined by a minimum of three sampling runs subject to the data quality objective (DQO) presented in the USEPA technical guideline document, "Guidelines for Determining Capture Efficiency, January 9, 1995". Individual capture efficiency test runs subject to the USEPA technical guidelines shall be determined by:
 - (i) Applicable USEPA Methods 204, 204A, 204B, 204C, 204E, and/or 204F; or
 - (ii) District's Protocol for Determination of Volatile Organic Compounds (VOC) Capture Efficiency; or
 - (iii) any other method approved by the USEPA, the California Air Resources Board (ARB), and the District Executive Officer.
 - (iv) The capture efficiency of a collection device which meets the requirements of a totally enclosed chamber as specified in USEPA

methods 204, 204A, 204B, 204C, 204E, and/or 204F shall be deemed 100 percent.

- (B) The control device efficiency of an emission control system as defined in paragraph (b)(12) and the VOC content in the control device exhaust gases, measured and calculated as carbon, shall be determined by USEPA Test Methods 25, 25A, or District Method 25.1 (Determination of Total Gaseous Non-Methane Organic Emissions as Carbon) as applicable. USEPA Test Method 18, or ARB Method 422 shall be used to determine emissions of exempt compounds.

(3) Multiple Test Methods

When more than one test method or set of test methods are 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 the rule.

(4) Equivalent Test Methods

Other test methods determined to be equivalent after review by the staffs of the District, ARB, and the USEPA, and approved in writing by the District Executive Officer may also be used for methods of analysis.

(5) Test Method Dates

All test methods referenced in this section shall be the most recent versions approved by the District, ARB, and USEPA. The Executive Officer may update test methods as necessary to reflect the most accurate method available, provided the method does not affect the stringency of the rule. These updates are subject to approval by ARB and USEPA.

(h) Exemptions

- (1) The requirements of subparagraphs (c)(1)(A), (c)(1)(B), or (c)(1)(C) shall not apply to a facility which emits two (2) pounds or less of VOC each and every day from the use of screen printing materials.
- (2) The requirements of subparagraphs (c)(1)(A), (c)(1)(B), or (c)(1)(C) shall not apply to screen printing operations performed by manufacturers of screen printing materials for purposes of conducting performance laboratory tests or doing research and development, provided that the VOC emissions from such screen printing operations are two (2) pounds or less per day.
- (3) The prohibition specified in paragraph (c)(6) shall not apply to VOC-containing materials subject to the provisions of this rule which will be used solely outside of the District if records are maintained to the satisfaction of the Executive Officer.

- (4) The prohibition specified in paragraph (c)(6) shall not apply to persons selling to, distributing to, or requiring the use of non-compliant materials by, other persons who are operating an approved emission control system under subdivision (d), or operating pursuant to paragraph (h)(1).

[SIP: Withdrawn 6/12/96, 61 FR 43977; 40 CFR 52.220(c)(194)(i)(G)(1)]