

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:)
)
PROPOSED NEW 35 ILL. ADM. CODE)
PART 223 STANDARDS AND) **R08 - 017**
LIMITATIONS FOR ORGANIC) **(Rulemaking – Air)**
MATERIAL EMISSIONS FOR AREA)
SOURCES)
)

NOTICE

TO:

John Therriault, Assistant Clerk
Illinois Pollution Control Board
State of Illinois Center
100 West Randolph, Suite 11-500
Chicago, Illinois 60601

SEE ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that I have today filed with the Office of the Pollution Control Board the ILLINOIS ENVIRONMENTAL PROTECTION AGENCY'S THIRD ERRATA SHEET TO ITS PROPOSAL FOR THE ADDITION OF 35 ILL. ADM. CODE 223 and the ILLINOIS ENVIRONMENTAL PROTECTION AGENCY'S POST-HEARING COMMENTS TO THE JUNE 4, 2008 HEARING ON THE PROPOSAL FOR THE ADDITION OF 35 ILL. ADM. CODE 223 a copy of which is herewith served upon you.

ILLINOIS ENVIRONMENTAL
PROTECTION AGENCY

By: _____
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DATED: July 10, 2008

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ILLINOIS ENVIRONMENTAL PROTECTION AGENCY’S THIRD ERRATA SHEET TO ITS PROPOSAL FOR THE ADDITION OF 35 ILL. ADM. CODE 223

NOW COMES the Illinois Environmental Protection Agency (“Illinois EPA”), by and through its attorney Charles E. Matoesian, and submits this Third Errata Sheet to its proposal for the addition of 35 Ill. Adm. Code 223. The Illinois EPA proposes the following amendments to the text of the rules submitted in its proposal to the Board dated January 2, 2008:

- 1. Amend Section 223.105 to clarify the abbreviations and acronyms. Several are no longer necessary as Subpart D is being withdrawn.*

Section 223.105 Abbreviations and Acronyms

Unless otherwise specified within this Part, the abbreviations used in this Part shall be the same as those found in 35 Ill. Adm. Code 211. The following abbreviations and acronyms are used in this Part:

ACP	Alternative Control Plan
Act	Environmental Protection Act [415 ILCS 5/1 et seq.]
Agency	Illinois Environmental Protection Agency
ASTM	American Society for Testing and Materials
BAAQMD	Bay Area Air Quality Management District
CARB	California Air Resources Board
°C	Degrees Celsius
CFCs	Chlorofluorocarbons
CO ₂	Carbon Dioxide
°F	Degrees Fahrenheit
FDA	United States Food and Drug Administration

FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. §§136 through 136y
FRP	Fiberglass reinforced plastic
HVOM	High Volatility Organic Material
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
LVP-VOM	Low Vapor Pressure – Volatile Organic Material
MIR	Maximum Incremental Reactivity
MVOM	Medium Volatility Organic Material
N ₂	Nitrogen
N ₂ O	Nitrous Oxide
OER	Original Equipment Manufacturer
PCBTf	Parachlorobenzotrifluoride
PWMIR	Product Weighted Maximum Incremental Reactivity
ROC	Reactive Organic Compound
ROG	Reactive Organic Gas
SCAQMD	South Coast Air Quality Management District
USEPA	United States Environmental Protection Agency
ULKR	Upper Limit Kinetic Reactivity
ULMIR	Upper Limit Maximum Incremental Reactivity
ULMR	Upper Limit Mechanistic Reactivity
VOM	Volatile Organic Material

2. *Amend Section 223.120 to clarify the incorporations by reference. Several inconsistencies were inadvertently included in the proposed rule.*

Section 223.120 Incorporations by Reference

The following materials are incorporated by reference. These incorporations do not include any later amendments or editions.

- a) 40 CFR 59, Subpart D, Appendix A, Determination of Volatile Matter Content of Methacrylate Multicomponent Coatings Used as Traffic Marking Coatings, 64 Fed. Reg. 35002 (June 30, 1999).
- b) 40 CFR 59, Subpart C, National Volatile Organic Compound Emission Standards for Consumer Products, 69 Fed. Reg. 18803 (April 4, 2004).
- c) 40 CFR 60, Appendix A, Method 24, Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings, 36 Fed. Reg. 24877 (December 23, 1971).
- d) 40 CFR 82, Subpart A, Appendix A, Class I Controlled Substances, 68 Fed. Reg. 42892 (July 18, 2003) and Appendix B, Class II Controlled Substances, 68 Fed. Reg. 2859 (January 21, 2003).

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*** * * * * Errata Sheet and PC #3 * * * * ***

- e) 29 CFR 1910.1200(d)(4), Hazard Communication, 61 Fed. Reg. 9245, (March 7, 1996).

- f) ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959 ~~American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA, 19103.~~
 - 1) ASTM E119-05a, Standard Test Methods for Fire Tests of Building Construction and Materials, approved November 1, 2005.
 - 2) ASTM Designation D523-89(1999), Standard Test Method for Specular Gloss, reapproved May 10, 1999.
 - 3) ASTM D 1640-03, Standard Test Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature, approved December 1, 2003.
 - 4) ASTM Method D 3912-95(2001), Test Method for Chemical Resistance of Coating Used in Light-Water Nuclear Power Plants, reapproved 2001.
 - 5) ASTM Method D 4082-02, Test Method for Effects of Radiation on Coatings Used in Light-Water Nuclear Power Plants, approved 2002.
 - 6) ASTM Designation D4214-98, Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films, approved August 10, 1998.
 - 7) ASTM D1613-03, Standard Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used in Paint, Varnish, Lacquer, and Related Products, approved October 1, 2003.
 - 8) ASTM E84-07, Standard Test Method for Surface Burning Characteristics of Building Materials, approved 2007.
 - 9) ASTM D4359-90(2006), Standard Test Method for Determining Whether a Material is a Liquid or a Solid, reapproved 2006.
 - 10) ASTM E260-96(2006), Standard Practice for Packed Column Gas Chromatography, reapproved 2006.
 - 11) ~~ASTM D5043-04, Standard Test Methods for Field Identification of Coatings, approved 2004.~~

- ~~11)~~ 12) ASTM E2167-01, "Standard Guide for Selection and Use of Stone Consolidants" (see section 4, Stone Consolidant), approved 2001.
- ~~12)~~ 13) ASTM C836-06, Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course, approved 2006.
- 13) ASTM D86-07b, Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure, approved 2007
- g) South Coast Air Quality Management District, 21865 Copley Dr., Diamond Bar CA 91765.
- 1) South Coast Air Quality Management District (SCAQMD) Method 304-91, Determination of Volatile Organic Compounds in Various Materials, revised February 1996.
- ~~h)~~ 2) SCAQMD Method 303-91, Determination of Exempt Compounds, revised February 1993.
- ~~i)~~ 3) SCAQMD Method 318-95, Determination of Weight Percent Elemental Metal in Coatings by X-Ray Diffraction, approved August 10, 1998.
- ~~j)~~
- ~~h)~~ Bay Area Air Quality Management, District Office, 939 Ellis Street, San Francisco, CA 94109.
- 1) Bay Area Air Quality Management District (BAAQMD) Method 43, Determination of Volatile Methylsiloxanes in Solvent-Based Coatings, Inks, and Related Materials, amended May 18, 2005.
- ~~k)~~ 2) BAAQMD Method 41, Determination of Volatile Organic Compounds in Solvent-Based Coatings and Related Materials Containing Parachlorobenzotrifluoride, amended May 18, 2005.
- ~~i)~~ California Air Resources Board (CARB) Method 310, Determination of Volatile Organic Compounds in Consumer Products and Reactive Organic Compounds in Aerosol Coating Products, amended May 5, 2005.
California Air Resources Board, 1001 I Street, P.O. Box 2815, Sacramento, CA 95812

- ~~j)m~~) SCAQMD Rule 1174, Ignition Method Compliance Certification Protocol (February 27, 1991).
- ~~k)n~~) Cal. Admin. Code title 17 § 94509(h), Standards for Consumer Products (2005).
- ~~l)o~~) California Code, Health and Safety Code, § 41712(h)(2) (2005).
- ~~m)p~~) Cal. Admin. Code title 17, Article 4, Alternate Control Plan §§ 94540-94555, (1996).
- ~~n)q~~) Cal. Admin. Code title 17 § 94511, Innovative Products (1997).
- ~~o)r~~) Cal. Admin. Code title 17 § 94503.5, Innovative Products (1996).
- ~~p)s~~) 7 USC 136 to 136y, FIFRA, Environmental Pesticide Control, published January 19, 2004, in Supplement III of the 2000 Edition of the United States Code.
- ~~q)t~~) Federal Specification MMM-A-181D, Adhesives, Phenol, Resorcinol, or Melamine Base (1980).

3. *Amend Section 223.203 to clarify the definitions of certain words. Several clarifications need to be made.*

“Colorant” means for purposes of ~~this Subpart~~ ~~Subpart B~~, any pigment or coloring material used in a consumer product for an aesthetic effect, or to dramatize an ingredient. ~~For purposes of Subpart C, “Colorant” means a concentrated pigment dispersion in water, solvent, and/or binder that is added to an architectural coating after packaging in sale units to produce the desired color.~~

“Lacquer” means for purposes of ~~Subparts B and C~~ of this Subpart, a clear or opaque wood coating, including clear lacquer sanding sealers, formulated with cellulosic or synthetic resins to dry by evaporation without chemical reaction and to provide a solid, protective film. ~~For purposes of Subpart D of this Part, “Lacquer” means a thermoplastic film forming material dissolved in organic solvent, which dries primarily by solvent evaporation, and is resolvable in its original solvent.~~

“Liquid” means a substance or mixture of substances which is capable of a visually detectable flow as determined under ~~ASTM D-4359-90~~ ~~ASTM D-4359-90(2000)e1~~, including any subsequent amendments or an equivalent method approved by the California Air Resources Board. This does not include powders or other materials that are composed entirely of solid particles.

“Solid” means a substance or mixture of substances which, either whole or subdivided (such as the particles comprising a powder), is not capable of visually detectable flow as determined under ASTM D-4359-90(2000)e1, or an equivalent method approved by the California Air Resources Board.

“Special Purpose Spray Adhesive” means an aerosol adhesive that meets any of the following definitions:

“Mounting Adhesive” means an aerosol adhesive designed to permanently mount photographs, artwork, and any other drawn or printed media to a backing (paper, board, cloth, etc.) without causing discoloration to the artwork.

“Flexible vinyl adhesive” means an aerosol adhesive designed to bond flexible vinyl to substrates. Flexible vinyl means a nonrigid polyvinyl chloride plastic with at least five percent, by weight, of plasticizer content. A plasticizer is a material, such as a high boiling point organic solvent, that is incorporated into a plastic to increase its flexibility, workability, or distensibility, and may be determined using ASTM Method E260-96 ~~ASTM Method E260-94~~, or from product formulation data or an equivalent method approved by the CARB.

“Polystyrene Foam Adhesive” means an aerosol adhesive designed to bond polystyrene foam to substrates.

“Automobile Headliner Adhesive” means an aerosol adhesive designed to bond together layers in motor vehicle headliners.

“Polyolefin Adhesive” means an aerosol adhesive designed to bond polyolefins to substrates.

“Laminate Repair/Edgebanding Adhesive” means an aerosol adhesive designed for:

The touch-up or repair of items laminated with high pressure laminates (e.g., lifted edges, delaminates, etc.); or

The touch-up, repair, or attachment of edgebanding materials, including but not limited to, other laminates, synthetic marble, veneers, wood molding, and decorative metals.

For the purposes of this definition “high pressure laminate” means sheet materials which consist of paper, fabric, or other core material that have been laminated at temperatures exceeding 265 degrees F, and at pressures between 1,000 and 1,400 psi.

“Automotive Engine Compartment Adhesive” means an aerosol adhesive designed for use in motor vehicle under-the-hood applications which require oil and plasticizer resistance, as well as high shear strength, at temperatures of 200 - 275 degrees F.

“VOM Content” means, for purposes of ~~Subpart B~~ of this Subpart, except for charcoal lighter products, the total weight of VOM in a product expressed as a percentage of the product weight (exclusive of the container or packaging), as determined pursuant to Section 223.285(a) and (b).

4. *Amend Section 223.208 to strike the second reference to Section 223.207. The citation was inadvertently repeated in the proposed rule.*

Section 223.208 Requirements for Aerosol Adhesives

- a) As specified in California Code section 41712(h)(2), incorporated by reference in Section 223.120, the standards for aerosol adhesives apply to all uses of aerosol adhesives, including consumer, industrial, and commercial uses. Except as otherwise provided in Sections 223.207, 223.230, 223.240, 223.245, and ~~223.207~~, no person shall sell, supply, offer for sale, use or manufacture for sale in Illinois any aerosol adhesive which, at the time of sale, use, or manufacture, contains VOMs in excess of the specified standard.

5. *Amend Section 223.250 to clarify the Product Dating requirements. The requirement that the date code be displayed 12 months prior to the effective date of the rule was inadvertently left in the proposed rule.*

Section 223.250 Product Dating

- a) Each manufacturer of a consumer product subject to Section 223.205(a) shall clearly display on each consumer product container or package, the day, month, and year on which the product was manufactured, or a code indicating such date.
- b) A manufacturer who uses the following code to indicate the date of manufacture shall not be subject to the requirements of Section 223.255(a), if the code is represented separately from other codes on the product container so that it is easily recognizable:

YY DDD = year year day day day

Where:

YY = Two digits representing the year in which the product was manufactured,

DDD = Three digits representing the day of the year on which the product was manufactured, with "001" representing the first day of the year, "002" representing the second day of the year, and so forth (i.e., the "Julian date")

- c) This date or code shall be displayed on each consumer product container or package no later than ~~twelve months prior to~~ the effective date of the applicable standard specified in Section 223.205(a).
- d) The date or datecode information shall be located on the container or inside the cover/cap so that it is readily observable or obtainable by simply removing the cap/cover without irreversibly disassembling any part of the container or packaging. For the purposes of this subsection, information may be displayed on the bottom of a container as long as it is clearly legible without removing any product packaging.
- e) The requirements of this Section 223.250 shall not apply to products containing no VOMs (as defined in Section 223.203), or containing VOMs at 0.10% by weight or less.

6. *Amend Section 223.255 to clarify the Product Dating requirements. The requirement that the date code be displayed 12 months prior to the effective date of the rule was inadvertently left in the proposed rule.*

Section 223.255 Additional Product Dating Requirements

- ~~a) If a manufacturer uses a code other than specified in 223.250(b) indicating the date of manufacture for any consumer product subject to Section 223.205(a), an explanation of the date portion of the code must be filed with the Agency no later than 12 months prior to the effective date of the applicable standard specified in Section 223.205.~~
- ~~b) If a manufacturer changes any code indicating the date of manufacture for any consumer product subject to Section 223.255(a), an explanation of the modified code must be submitted to the Agency before any products displaying the modified code are sold, supplied, or offered for sale in Illinois.~~
- ae) No person shall erase, alter, deface, or otherwise remove or make illegible any date or code indicating the date of manufacture from any regulated product container without the express authorization of the manufacturer. No manufacturer shall affix a date-code that is not true for the date the item was manufactured.

bd) Date code explanations for codes indicating the date of manufacture are public information and may not be claimed as confidential.

7. Amend Section 223.285 (c) and (e) to correct the citation to the ASTM and reconcile it with the version which was incorporated by reference.

c) Testing to determine whether a product is a liquid or solid shall be performed using ASTM D4359-90 (~~2000~~)e1, which is incorporated by reference in Section 223.120 or an equivalent method approved by the CARB.

e) Testing to determine distillation points of petroleum distillate-based charcoal lighter materials shall be performed using ASTM D86-07b, 2007, ~~ASTM D86-04b, 2004~~ edition, which is incorporated by reference in Section 223.120 or an equivalent method approved by the CARB.

8. Amend Section 223.307 to correct certain misspellings in definitions and ASTM references. These errors were inadvertently left in the rule. An "s" was inadvertently added to the word "born" in the definition of "Calcamine Recoaters."

"Calcamine Recoaters" means a flat solvent borns coatings formulated and recommended specifically for recoating calcamine-painted ceilings and other calcamine-painted substrates.

"Fire-Retardant Coating" means a coating labeled and formulated to retard ignition and flame spread, that has been fire tested and rated by a testing agency approved by building code officials for use in bringing building and construction materials into compliance with federal, state, and local building code requirements. The fire-retardant coating and the testing agency must be approved by building code officials. The fire-retardant coating shall be tested in accordance with ASTM Designation E 84-07 ~~84-99~~, incorporate by reference in Section 223.120.

"Nuclear Coating" means a protective coating formulated and recommended to seal porous surfaces such as steel (or concrete) that otherwise would be subject to intrusions by radioactive materials. These coatings must be resistant to long-term (service life) cumulative radiation exposure [ASTM Method D 4082-02 ~~4082-89~~], relatively easy to decontaminate, and resistant to various chemicals to which the coatings are likely to be exposed [ASTM Method D 3912-95 ~~3912-80~~].

"VOM Content" means the weight of VOM per volume of coating, calculated according to the procedures specified in subsection 223.340(a) ~~223.400(a)~~.

"Varnish" means a clear or semi-transparent wood coating, excluding lacquers and shellacs, formulated to dry by chemical reaction on exposure to air. Varnishes may contain small amounts of pigment to color a surface, or to control the final ~~final~~

sheen or gloss of the finish.

9. *Amend Section 223.307 to add the definitions of certain words. Several clarifications need to be made.*

“Colorant” means for purposes of this Subpart, “Colorant” means a concentrated pigment dispersion in water, solvent, and/or binder that is added to an architectural coating after packaging in sale units to produce the desired color.

“Lacquer” means for purposes of this Subpart, a clear or opaque wood coating, including clear lacquer sanding sealers, formulated with cellulosic or synthetic resins to dry by evaporation without chemical reaction and to provide a solid, protective film.

“Concrete surface retarder” means a mixture of retarding ingredients such as extender pigments, primary pigments, resin, and solvent that interact chemically with the cement to prevent hardening on the surface where the retarder is applied, allowing the retarded mix of cement and sand at the surface to be washed away to create an exposed aggregate finish.”

10. *Amend Section 310(a) to include “Concrete Surface Retarder” under the most restrictive limit subsection of the rule at the appropriate place. This was inadvertently omitted from the proposal.*

11a. Concrete Surface Retarder 780g/l (6.5)

11. *Amend Section 310(c) to include “Concrete Surface Retarder” under the most restrictive limit subsection of the rule at the appropriate place. This was inadvertently omitted from the proposal.*

21. Concrete Surface Retarder

12. *Amend Section 223.370 to clarify that the various test methods specified were incorporated by reference. The notation was inadvertently omitted from the proposed rule.*

- a) Flame Spread Index. The flame spread index of a fire-retardant coating shall be determined by the ASTM Designation E ~~84-07~~ ~~84-99~~, “Standard Test Method for Surface Burning Characteristics of Building Materials,” (see Section 223.307, Fire-Retardant Coating) or an equivalent method approved by the CARB.
- e) Acid Content of Coatings. The acid content of a coating shall be determined by ASTM Designation D ~~1613-03~~ ~~1613-96~~, “Standard Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used

in Paint, Varnish, Lacquer and Related Products,” as incorporated by reference in Section 223.120, (see Section 223.307, Pre-Treatment Wash Primer) or an equivalent method approved by the CARB.

- f) Drying Times. The set-to-touch, dry-hard, dry-to-touch and dry-to-recoat times of a coating shall be determined by ASTM Designation D 1640-03 ~~1640-95~~, “Standard Methods for Drying, Curing, or Film Formation of Organic Coatings at Room Temperature,” as incorporated by reference in Section 223.120, (see Section 223.307, QuickDry Enamel and Quick-Dry Primer, Sealer, and Undercoater). The tack free time of a quick-dry enamel coating shall be determined by the Mechanical Test Method of ASTM Designation D 1640-03 ~~1640-95~~ or an equivalent method approved by the CARB.
- h) Exempt Compounds – Siloxanes. Exempt compounds that are cyclic, branched, or linear, completely methylated siloxanes, shall be analyzed as exempt compounds for compliance with Section 223.340 by BAAQMD Method 43, “Determination of Volatile Methylsiloxanes in Solvent-Based Coatings, Inks, and Related Materials,” BAAQMD Manual of Procedures, Volume III, adopted May 18, 2005 ~~November 6, 1996~~, as incorporated by reference in Section 223.120, (see Section 223.307, VOM content ~~Volatile Organic Material~~, and subsection 223.340(b)).
- i) Exempt Compounds - Parachlorobenzotrifluoride (PCBTF). The exempt compound parachlorobenzotrifluoride, shall be analyzed as an exempt compound for compliance with Section 223.400 by BAAQMD Method 41, “Determination of Volatile Organic Compounds in Solvent-Based Coatings and Related Materials Containing Parachlorobenzotrifluoride,” BAAQMD Manual of Procedures, Volume III, adopted May 18, 2005 ~~December 20, 1995~~, as incorporated by reference in Section 223.120, (see Section 223.307, VOM content ~~Volatile Organic Material~~, and subsection 223.340(b)).
- m) Methacrylate Traffic Marking Coatings. The VOM content of methacrylate multicomponent coatings used as traffic marking coatings shall be analyzed by the procedures in 40 CFR part 59, subpart D, appendix A, “Determination of Volatile Matter Content of Methacrylate Multicomponent Coatings Used as Traffic Marking Coatings,” (June 30, 1999 ~~September 11, 1998~~), as incorporated by reference in Section 223.120, (see subsection 223.360) or an equivalent method approved by the CARB.

13. *Strike the whole of Subpart D from the rule, including references in the index to the rule. The USEPA has promulgated an identical rule concerning “Aerosol Coatings” thus mooted the proposed Subpart D.*

~~SUBPART D: AEROSOL COATINGS~~

~~Section~~

- ~~223.400 Purpose~~
- ~~223.405 Applicability~~
- ~~223.407 Definitions for Subpart D~~
- ~~223.410 Limits and Requirements for Aerosol Coating Products~~
- ~~223.420 Exemptions~~
- ~~223.430 Most Restrictive Limit~~
- ~~223.440 Labeling Requirements~~
- ~~223.450 Reporting Requirements~~
- ~~223.460 Test Methods~~

~~SUBPART D: AEROSOL COATINGS~~

~~**Section 223.400 Purpose**~~

~~The purpose of this Subpart is to limit emissions of volatile organic materials (VOMs) by requiring reductions in the VOM content of Aerosol Coating products.~~

~~**Section 223.405 Applicability**~~

~~This Subpart shall apply to any person who sells, supplies, offers for sale, applies, or manufactures aerosol coating products for use in the state of Illinois, except as provided in Section 223.420.~~

~~**Section 223.407 Definitions for Subpart D**~~

~~The definitions contained in this Section apply only to the provisions of this Subpart. Unless otherwise defined herein, the definitions of terms used in this Subpart shall have the meanings specified for those terms in 35 Ill. Adm. Code Part 211.~~

~~“Adhesive” means a product used to bond one surface to another.~~

~~“Aerosol Coating Product” means a pressurized coating product containing pigments or resins that dispenses product ingredients by means of a propellant, and is packaged in a disposable can for hand held application or for use in specialized equipment for ground traffic/marketing applications.~~

~~“Anti-Static Spray” means a product used to prevent or inhibit the accumulation of static electricity.~~

~~“Art Fixative or Sealant” means a clear coating, including art varnish, workable art fixative, and ceramic coating, which is designed and labeled exclusively for application to paintings, pencil, chalk, or pastel drawings, ceramic art pieces, or other closely related art uses, in order to provide a final protective coating or to fix preliminary stages of artwork while providing a workable surface for subsequent revisions.~~

~~“Auto Body Primer” means an automotive primer or primer surfacer coating designed and labeled exclusively to be applied to a vehicle body substrate for the purposes of corrosion resistance and building a repair area to a condition in which, after drying, it can be sanded to a smooth surface.~~

~~“Automotive Bumper and Trim Product” means a product, including adhesion promoters and chip sealants, designed and labeled exclusively to repair and refinish automotive bumpers and plastic trim parts.~~

~~“Automotive Underbody Coating” means a flexible coating which contains asphalt or rubber and is designed and labeled exclusively for use on the underbody of motor vehicles to resist rust, abrasion and vibration, and to deaden sound.~~

~~“Aviation Propeller Coating” means a coating designed and labeled exclusively to provide abrasion resistance and corrosion protection for aircraft propellers.~~

~~“Aviation or Marine Primer” means a coating designed and labeled exclusively to meet federal specification TT-P-1757.~~

~~“Base Reactive Organic Gas Mixture” (Base ROG Mixture) means the mixture of reactive organic gases utilized in deriving the MIR scale.~~

~~“Belt Dressing” means a product applied on auto fan belts, water pump belting, power transmission belting, and industrial and farm machinery belting to prevent slipping, and to extend belt life.~~

~~“Cleaner” means a product designed and labeled primarily to remove soil or other contaminants from surfaces.~~

~~“Clear Coating” means a coating which is colorless, containing resins but no pigments except flattening agents, and is designed and labeled to form a transparent or translucent solid film.~~

~~“Coating Solids” means the nonvolatile portion of an aerosol coating product, consisting of the film forming ingredients, including pigments and resins.~~

~~“Commercial Application” means the use of aerosol coating products in the production of goods, or the providing of services for profit, including touch up and repair.~~

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~~“Corrosion Resistant Brass, Bronze, or Copper Coating” means a clear coating designed and labeled exclusively to prevent tarnish and corrosion of uncoated brass, bronze, or copper metal surfaces.~~

~~“Distributor” means any person to whom a consumer product is sold or supplied for the purposes of resale or distribution in commerce, except that manufacturers, retailers, and consumers are not distributors.~~

~~“Dye” means a product containing no resins which is used to color a surface or object without building a film.~~

~~“Electrical Coating” means a coating designed and labeled exclusively as such, which is used exclusively to coat electrical components such as wire windings on electric motors to provide insulation and protection from corrosion.~~

~~“Enamel” means a coating which cures by chemical cross-linking of its base resin and is not resolvable in its original solvent.~~

~~“Engine Paint” means a coating designed and labeled exclusively to coat engines and their components.~~

~~“Exact Match Finish, Engine Paint” means a coating which meets all of the following criteria:~~

~~_____ The product is designed and labeled exclusively to exactly match the _____
_____ color of an original, factory applied engine paint;~~

~~_____ The product is labeled with the manufacturer's name for which they _____
_____ were formulated; and~~

~~_____ The product is labeled with one of the following:~~

~~_____ The original equipment manufacturer's (O.E.M.) color code _____
_____ number;~~

~~_____ The color name; or~~

~~_____ Other designation identifying the specific O.E.M. color to the _____
_____ purchaser.~~

~~“Exact Match Finish, Automotive” means a topcoat which meets all of the following _____
_____ criteria:~~

~~_____~~

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*** * * * * Errata Sheet and PC #3 * * * * ***

~~The product is designed and labeled exclusively to exactly match the color of an original, factory applied automotive coating during the touch-up of automobile finishes;~~

~~The product is labeled with the manufacturer's name for which they were formulated; and~~

~~The product is labeled with one of the following:~~

~~The original equipment manufacturer's (O.E.M.) color code number;~~

~~The color name; or~~

~~Other designation identifying the specific O.E.M. color to the purchaser. Notwithstanding the foregoing, automotive clear coatings designed and labeled exclusively for use over automotive exact match finishes to replicate the original factory applied finish shall be considered to be automotive exact match finishes.~~

“Exact Match Finish, Industrial” means a coating which meets all of the following criteria:

~~The product is designed and labeled exclusively to exactly match the color of an original, factory applied industrial coating during the touch-up of manufactured products;~~

~~The product is labeled with the manufacturer's name for which they were formulated; and~~

~~The product is labeled with one of the following:~~

~~The original equipment manufacturer's (O.E.M.) color code number;~~

~~The color name; or~~

~~Other designation identifying the specific O.E.M. color to the purchaser.~~

“Flat Paint Products” means a coating which, when fully dry, registers specular gloss less than or equal to 15 on an 85° gloss meter, or less than or equal to five on a 60° gloss meter, or which is labeled as a flat coating.

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*** * * * * Errata Sheet and PC #3 * * * * ***

~~“Flatting Agent” means a compound added to a coating to reduce the gloss of the coating without adding color to the coating.~~

~~“Floral Spray” means a coating designed and labeled exclusively for use on fresh flowers, dried flowers, or other items in a floral arrangement for the purposes of coloring, preserving or protecting their appearance.~~

~~“Fluorescent Coating” means a coating labeled as such, which converts absorbed incident light energy into emitted light of a different hue.~~

~~“Glass Coating” means a coating designed and labeled exclusively for use on glass or other transparent material to create a soft, translucent light effect, or to create a tinted or darkened color while retaining transparency.~~

~~“Ground Traffic/Marking Coating” means a coating designed and labeled exclusively to be applied to dirt, gravel, grass, concrete, asphalt, warehouse floors, or parking lots. Such coatings must be in a container equipped with a valve and sprayhead designed to direct the spray toward the surface when the can is held in an inverted vertical position.~~

~~“High Temperature Coating” means a high performance coating, excluding engine paint, labeled and formulated for application to substrates exposed continuously or intermittently to temperatures above 204°C (400°F).~~

~~“Hobby/Model/Craft Coating” means a coating which is designed and labeled exclusively for hobby applications and is sold in aerosol containers of six ounces by weight or less.~~

~~“Ingredient” means a component of an aerosol coating product.~~

~~“Ink” means a fluid or viscous substance used in the printing industry to produce letters, symbols or illustrations, but not to coat an entire surface.~~

~~“Lacquer” means a thermoplastic film-forming material dissolved in organic solvent, which dries primarily by solvent evaporation, and is resolvable in its original solvent.~~

~~“Layout Fluid” (or toolmaker's ink) means a coating designed and labeled exclusively to be sprayed on metal, glass or plastic, to provide a glare free surface on which to scribe designs, patterns or engineering guide lines prior to shaping the piece.~~

~~“Leather preservative or cleaner” means a leather treatment material applied exclusively to clean or preserve leather.~~

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~~“Lubricant” means a substance such as oil, petroleum distillates, grease, graphite, silicone, lithium, etc. that is used to reduce friction, heat, or wear when applied between surfaces.~~

~~“Manufacturer” means any person who imports, manufactures, assembles, produces, packages, repackages, or relabels a consumer product.~~

~~“Marine Spar Varnish” means a coating designed and labeled exclusively to provide a protective sealant for marine wood products.~~

~~“Maskant” means a coating applied directly to a component to protect surface areas when chemical milling, anodizing, aging, bonding, plating, etching, or performing other chemical operations on the surface of the component.~~

~~“Maximum Incremental Reactivity” (MIR) means the maximum change in weight of ozone formed by adding a compound to the “Base ROG Mixture” per weight of compound added, expressed to hundredths of a gram ($\text{g O}_3/\text{g ROC}$). MIR values for individual compounds and hydrocarbon solvents are specified in Appendices A and B to this Part.~~

~~“Metallic Coating” means a topcoat which contains at least 0.5 percent by weight elemental metallic pigment in the formulation, including propellant, and is labeled as “metallic”, or with the name of a specific metallic finish such as “gold,” “silver,” or “bronze.”~~

~~“Mold Release” means a coating applied to molds to prevent products from sticking to the surfaces of the mold.~~

~~“Multi-Component Kit” means an aerosol spray paint system which requires the application of more than one component (e.g. foundation coat and top coat), where both components are sold together in one package.~~

~~“Nonflat Paint Product” means a coating which, when fully dry, registers a specular gloss greater than 15 on an 85° gloss meter or greater than five on a 60° gloss meter.~~

~~“Ozone” means a colorless gas with a pungent odor, having the molecular form O_3 .~~

~~“Percent VOM By Weight” means the ratio of the weight of VOM to the total weight of the product contents expressed as follows:~~

~~————— Percent VOM By Weight = $(W_{\text{VOM}}/W_{\text{total}}) \times 100$~~

~~————— Where:~~

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*** * * * * Errata Sheet and PC #3 * * * * ***

~~_____ For products containing no water and no volatile compounds exempt _____
_____ from the definition of VOM: W_{VOM} = the weight of volatile _____
_____ materials;~~

~~_____ For products containing water or exempt compounds: W_{VOM} = the _____
_____ weight of volatile compounds, less water, and less compounds
exempt _____ from the VOM definition in Section 223.407; and~~

~~_____ W_{total} = the total weight of the product contents.~~

~~“Photograph Coating” means a coating designed and labeled exclusively to be
applied to finished photographs to allow corrective retouching, protection of the
image, changes in gloss level, or to cover fingerprints.~~

~~“Pleasure Craft” means privately owned vessels used for noncommercial purposes.~~

~~“Pleasure Craft Finish Primer/Surfacer/Undercoater” means a coating designed and
labeled exclusively to be applied prior to the application of a pleasure craft topcoat
for the purpose of corrosion resistance and adhesion of the topcoat, and which
promotes a uniform surface by filling in surface imperfections.~~

~~“Pleasure Craft Topcoat” means a coating designed and labeled exclusively to be
applied to a pleasure craft as a final coat above the waterline and below the
waterline when stored out of water. This category does not include clear coatings.~~

~~“Polyolefin Adhesion Promoter” means a coating designed and labeled exclusively
to be applied to a polyolefin or polyolefin copolymer surface of automotive body
parts, bumpers, or trim parts to provide a bond between the surface and subsequent
coats.~~

~~“Primer” means for purposes of this Part, a coating labeled and formulated for
application to a substrate to provide a firm bind between the substrate and
subsequent coats.~~

~~“Product Weighted MIR” (PWMIR) means the sum of all weighted MIR for all
ingredients in a product subject to this article. The PWMIR is the total product
reactivity expressed to hundredths of a gram of ozone formed per gram of product
(excluding container and packaging) and calculated according to the following
equations:~~

~~_____ Weighted MIR (Wtd MIR) ingredient = MIR x Weight fraction _____
_____ ingredient,~~

~~_____ and,~~

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*** * * * * Errata Sheet and PC #3 * * * * ***

$$\frac{\text{Product Weighted MIR} = (\text{Wtd MIR})_1 + (\text{Wtd MIR})_2 + \dots + (\text{Wtd MIR})_n}{\text{MIR}_n}$$

Where,

MIR = ingredient MIR, as specified in Section 223.410(m);

Wtd MIR = MIR of each ingredient in a product multiplied by the weight fraction of that ingredient, as shown in (a);

1,2,3,...,n = each ingredient in the product up to the total n ingredients in the product.

“Propellant” means a liquefied or compressed gas that is used in whole or in part to expel a liquid or any other material from the same self-pressurized container or from a separate container.

“Reactivity Limit” means the maximum “Product Weighted MIR” allowed in an aerosol coating product that is subject to the limits specified in Section 223.410(e) for a specific category, expressed as g O₃/g product.

“Reactive Organic Compound (ROC)” means any compound that has the potential, once emitted, to contribute to ozone formation in the troposphere.

“Responsible Party” means the company, firm or establishment which is listed on the product's label. If the label lists two companies, firms or establishments, the responsible party is the party which the product was “manufactured for” or “distributed by,” as noted on the label.

“Retailer” means any person who sells, supplies, or offers consumer products for sale directly to consumers.

“Retail Outlet” means for purposes of this Part, any establishment at which consumer products are sold, supplied, or offered for sale directly to consumers.

“Rust Converter” means a product designed and labeled exclusively to convert rust to an inert material and which contains a minimum acid content of 0.5 percent by weight, and a maximum coating solids content of 0.5 percent by weight.

“Shellac Sealer” means a clear or pigmented coating formulated solely with the resinous secretion of the lac beetle (*Laccifer lacca*), thinned with alcohol, and formulated to dry by evaporation without a chemical reaction.

“Slip-Resistant Coating” means a coating designed and labeled exclusively as such, which is formulated with synthetic grit and used as a safety coating.

~~“Spatter Coating/Multicolor Coating” means a coating labeled exclusively as such wherein spots, globules, or spatters of contrasting colors appear on or within the surface of a contrasting or similar background.~~

~~“Stain” means a clear, semi-transparent, or opaque coating labeled and formulated to change the color of a surface, but not conceal the grain pattern or texture.~~

~~“Upper Limit Kinetic Reactivity” (ULKR) means the maximum percentage of the emitted ROC which has reacted. For Subpart D, the ULKR is one hundred percent and is used to calculate the ULMIR.~~

~~“Upper Limit Mechanistic Reactivity” (ULMR) means the maximum gram(s) of ozone formed per gram of reactive organic compound (ROC) reacting. The ULMR is used to calculate the ULMIR.~~

~~“Upper Limit MIR” (ULMIR) means the upper limit kinetic reactivity (ULKR) multiplied by the upper limit mechanistic reactivity (ULMR), as calculated using the following equation:~~

$$\text{ULMIR} = \text{Upper Limit KR} \times \text{Upper Limit MR.}$$

~~The units for ULMIR are g O₃/g ROC.~~

~~“Vinyl/Fabric/Leather/Polycarbonate Coating” means a coating designed and labeled exclusively to coat vinyl, fabric, leather, or polycarbonate substrates.~~

~~“Webbing/Veiling Coating” means a coating designed and labeled exclusively to provide a stranded to spider webbed appearance when applied.~~

~~“Weight Fraction” means the weight of an ingredient divided by the total net weight of the product, expressed to thousandths of a gram of ingredient per gram of product (excluding container and packaging). The weight fraction is calculated according to the following equation:~~

$$\text{Weight Fraction} = \frac{\text{Weight of the Ingredient}}{\text{Total Product Net Weight (excluding container and packaging).}}$$

~~“Weld Through Primer” means a coating designed and labeled exclusively to provide a bridging or conducting effect for corrosion protection following welding.~~

~~“Wood Stain” means a coating which is formulated to change the color of a wood surface but not conceal the surface.~~

~~“Wood Touch Up/Repair/Restoration” means a coating designed and labeled exclusively to provide an exact color or sheen match on finished wood products.~~

~~“Working Day” means any day between Monday through Friday, inclusive, except for days that are federal holidays.~~

Section 223.410 — Limits and Requirements for Aerosol Coating Products

~~a) Compliance with Limits. Aerosol coating products manufactured beginning January 1, 2009, shall comply with the reactivity requirements specified in Section 223.410(b).~~

~~b) Reactivity Limits for Aerosol Coating Products.~~

~~Except as provided in Sections 223.410(a) and 223.420, no person shall sell, supply, offer for sale, apply, or manufacture for use in Illinois, any aerosol coating product which, at the time of sale, use, or manufacture, contains reactive organic compounds that have a PWMIR in excess of the limits specified below after January 1, 2009.~~

Aerosol Coating Category	Product-Weighted
MIR in	Grams Ozone per
	Gram Product (gO₃/g
	product)

1) General Coatings

A) Clear Coatings	1.50
B) Flat Paint Products	1.20
C) Fluorescent Coatings	1.75
D) Metallic Coatings	1.90
E) Nonflat Paint Products	1.40
F) Primers	1.20

2) Specialty Coatings

A) Art Fixatives or Sealants	1.80
B) Auto Body Primers	1.55

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*** * * * * Errata Sheet and PC #3 * * * * ***

C) Automotive Bumper and Trim Products	1.75
D) Aviation or Marine Primers	2.00
E) Aviation Propeller Coatings	2.50
F) Corrosion Resistant Brass, Bronze, or Copper Coatings	1.80
G) Exact Match Finishes:	
1) Engine Enamel	1.70
2) Automotive	1.50
3) Industrial	2.05
H) Floral Sprays	1.70
I) Glass Coatings	1.40
J) Ground Traffic/Marking Coatings	1.20
K) High Temperature Coatings	1.85
L) Hobby/Model/Craft Coatings:	
1) Enamel	1.45
2) Lacquer	2.70
3) Clear or Metallic	1.60
M) Marine Spar Varnishes	0.90
N) Photograph Coatings	1.00
O) Pleasure Craft Finish Primers, Surfacers or Undercoaters	1.05
P) Pleasure Craft Topcoats	0.60
Q) Polyolefin Adhesion Promoters	2.50

~~R) Shellac Sealers:~~

~~1) Clear _____ 1.00~~

~~2) Pigmented _____ 0.95~~

~~S) Slip Resistant Coatings _____ 2.45~~

~~T) Spatter/Multicolor Coatings _____ 1.05~~

~~U) Vinyl/Fabric/Leather/Polycarbonate Coatings _____ 1.55~~

~~V) Webbing/Veil Coatings _____ 0.85~~

~~W) Weld Through Primers _____ 1.00~~

~~X) Wood Stains _____ 1.40~~

~~Y) Wood Touch-Up, Repair _____ 1.50
or Restoration Coatings~~

~~e) — If an aerosol coating product is subject to both a general coating limit and a specialty coating limit, as listed in subsection 223.410(b), and the product meets all the criteria of the applicable specialty coating category as defined in Section 223.407, then the specialty coating limit shall apply instead of the general coating limit.~~

~~d) — Notwithstanding the provisions of Sections 223.410(c) and 223.430, high temperature coatings that contain at least 0.5 percent by weight of an elemental metallic pigment in the formulation, including propellant, shall be subject to the limit specified for metallic coatings.~~

~~e) — Notwithstanding the provisions of Section 223.410(a) and (b), an aerosol coating product manufactured prior to each of the effective dates specified for that product in Section 223.410(b) may be sold, supplied, offered for sale, or applied for up to January 1, 2012. This subsection (f) does not apply to any product which does not display on the product container or package the date on which the product was manufactured, or a code indicating such date.~~

~~f) — Products Containing Methylene Chloride or Trichloroethylene.~~

~~1) — For any aerosol coating product subject to the reactivity limits specified in Section 223.410(b), no person shall sell, supply, offer for sale, apply, or manufacture for use in Illinois any aerosol coating product which contains methylene chloride or trichloroethylene.~~

2) ~~The requirements of this Section shall not apply to any aerosol coating product containing methylene chloride or trichloroethylene that is present as an impurity in a combined amount equal to or less than 0.01% by weight of the product.~~

g) ~~Products Containing Perchloroethylene or Ozone Depleting Substances.~~

1) ~~For any aerosol coating product subject to the reactivity limits specified in Section 223.410(b), no person shall sell, supply, offer for sale, apply, or manufacture for use in Illinois any aerosol coating product which contains perchloroethylene.~~

2) ~~For any aerosol coating product subject to the reactivity limits specified in Section 223.410(b), no person shall sell, supply, offer for sale, apply, or manufacture for use in Illinois any aerosol coating product which contains an ozone depleting substance identified by the USEPA in the Code of Federal Regulations, 40 CFR Part 82, Subpart A, under Appendices A and B, July 1, 1998.~~

3) ~~The requirements of Section 223.410(g)(1) and (g)(2) shall not apply to any aerosol coating product containing perchloroethylene, or an ozone depleting substance as identified in Section 223.410(g)(1) or (g)(2), that are present as impurities in a combined amount equal to or less than 0.01% by weight of the product.~~

h) ~~Multicomponent Kits.~~

1) ~~No person shall sell, supply, offer for sale, apply, or manufacture for use in Illinois any multi-component kit, as defined in Section 223.407, in which the total weight of VOM and methylene chloride contained in the multi-component kit $(\text{Total VOM} + \text{MC})_{\text{actual}}$ is greater than the total weight of VOM and methylene chloride that would be allowed in the multi-component kit if each component product in the kit had separately met the applicable VOM standards $(\text{Total VOM} + \text{MC})_{\text{standard}}$ as calculated below:~~

$$(\text{Total VOM} + \text{MC})_{\text{actual}} = (\text{VOM}_1 \times W_1) + (\text{MC}_1 \times W_1) + (\text{VOM}_2 \times W_2) + (\text{MC}_2 \times W_2) + (\text{VOM}_n \times W_n) + (\text{MC}_n \times W_n)$$

$$(\text{Total VOM} + \text{MC})_{\text{standard}} = (\text{STD}_1 \times W_1) + (\text{STD}_2 \times W_2) + (\text{STD}_n \times W_n)$$

Where:

VOM = _____ the percent by weight VOM of the
_____ component product
MC = _____ the percent by weight methylene chloride of
_____ the Component product
STD = _____ the VOM standard specified in Section
_____ 223.410(a) which applies to the component
_____ product
W = _____ the weight of the product contents
_____ (excluding container)

Subscript 1 denotes the first component product in the kit
Subscript 2 denotes the second component product in the kit
Subscript n denotes any additional component product

2) ~~No person shall sell, supply, offer for sale, apply, or manufacture for use in Illinois any multi-component kit, as defined in Section 223.407, in which the Kit PWMIR is greater than the Total Reactivity Limit. The Total Reactivity Limit represents the limit that would be allowed in the multi-component kit if each component product in the kit had separately met the applicable Reactivity Limit. The Kit PWMIR and Total Reactivity Limit are calculated as in equations (A), (B) and (C) below:~~

A) ~~Kit PWMIR = (PWMIR₍₁₎ x W₁) + (PWMIR₍₂₎ x W₂) + ... + (PWMIR_(n) x W_n)~~

B) ~~Total Reactivity Limit = (RL₁ x W₁) + (RL₂ x W₂) + ... + (RL_n x W_n)~~

C) ~~Kit PWMIR ≤ Total Reactivity Limit~~

Where:

W = _____ the weight of the product contents (excluding
_____ container)
RL = _____ the Reactivity Limit specified in Section 223.410(b)
Subscript 1 denotes the first component product in the kit
Subscript 2 denotes the second component product in the kit
Subscript n denotes any additional component product

i) ~~No person shall sell, supply, offer for sale, apply, or manufacture for use in the state of Illinois any aerosol coating product assembled by adding bulk paint to aerosol containers of propellant, unless such products comply with the reactivity limits specified in Section 223.410(b) for products subject to those limits.~~

j) ~~Assignment of Maximum Incremental Reactivity (MIR) Values.~~

- 1) ~~In order to calculate the PWMIR of aerosol coating products as specified in Section 223.407, the MIR values of product ingredients are assigned as follows:~~
 - A) ~~Any ingredient which does not contain carbon is assigned a MIR value of 0.0.~~
 - B) ~~Any aerosol coating solid, including but not limited to resins, pigments, fillers, plasticizers, and extenders is assigned a MIR value of 0.0.~~
 - C) ~~For any ROC not covered under subparagraphs (A) and (B) of this paragraph (1), each ROC is assigned the MIR value set forth in Appendices A and B to this Part.~~
 - D) ~~Except as provided in paragraph (3) of this subsection, only ROCs listed in Appendices A and B to this Part, can be used to comply with the reactivity limits specified in Section 223.410(b).~~
 - E) ~~All individual compounds in an amount equal to or exceeding 0.1 percent shall be considered ingredients in calculating the PWMIR. Such individual compounds shall be considered ingredients whether or not they are reported by the manufacturer pursuant to Appendix A and B.~~
- 2) ~~Calculating PWMIR Values.~~
 - A) ~~The MIR values dated January 1, 2009, shall be used to calculate the PWMIR for aerosol coating products.~~
 - B) ~~If a new ROC is added to Appendices A and B to this regulation, then the new ROC may be used in aerosol coating products, and the MIR value for the new ROC shall be used to calculate the PWMIR after the effective date of the MIR value.~~
- 3) ~~The MIR value for any aromatic hydrocarbon solvent with a boiling range different from the ranges specified in subsection (b) of Appendix B of this Part shall be assigned as follows:~~
 - A) ~~If the solvent dry point is lower than or equal to 420 degrees F, the MIR value specified in subsection (b) of Appendix B of this Part for Bin 23 shall be used.~~

B) — If the solvent initial boiling point is higher than 420 degrees F, the MIR value specified in subsection (b) of Appendix B of this Part for Bin 24 shall be used.

Section 223.420 — Exemptions

- a) — This Subpart shall not apply to aerosol lubricants, mold releases, automotive underbody coatings, electrical coatings, cleaners, belt dressings, anti-static sprays, layout fluids and removers, adhesives, maskants, rust converters, dyes, inks, and leather preservatives or cleaners.
- b) — This Subpart shall not apply to any aerosol coating product manufactured in Illinois for shipment and use outside of Illinois.
- c) — The provisions of this Subpart shall not apply to a manufacturer, distributor, or responsible party who sells, supplies, or offers for sale in Illinois an aerosol coating product that does not comply with the limits specified in subsection 223.410(b), as long as the manufacturer, distributor, or responsible party can demonstrate both that the aerosol coating product is intended for shipment and use outside of Illinois, and that the manufacturer, distributor, or responsible party has taken reasonable prudent precautions to assure that the aerosol coating product is not distributed to Illinois. This subsection (c) does not apply to aerosol coating products that are sold, supplied, or offered for sale by any person to retail outlets in Illinois.
- d) — The requirements in subsection 223.410(b) prohibiting the application of aerosol coating products that exceed the limits specified in the subsection 223.410(b) shall apply only to commercial application of aerosol coating products.

Section 223.430 — Most Restrictive Limit

Except as otherwise provided in Section 223.410(e), if anywhere on the container of any aerosol coating product subject to the specified limits in subsection 223.410(b), or on any sticker or label affixed thereto, or in any sales or advertising literature, any representation is made that the product may be used as, or is suitable for use as a product for which a lower limit is specified, then the lowest applicable limit shall apply.

Section 223.440 — Labeling Requirements

- a) — Both the manufacturer and responsible party for each aerosol coating product subject to this Subpart shall ensure that all products clearly display the following information on each product container which is manufactured 90 days or later after the effective date of this Subpart.

- 1) ~~The applicable reactivity limit for the product that is specified in Section 223.410(b);~~
 - 2) ~~The aerosol coating category as defined in Section 223.407, or an abbreviation of the coating category; and~~
 - 3) ~~The day, month, and year on which the product was manufactured, or a code indicating such date.~~
- b) ~~The information required in Section 223.440(a), shall be displayed on the product container such that it is readily observable without removing or disassembling any portion of the product container or packaging. For the purposes of this subsection, information may be displayed on the bottom of a container as long as it is clearly legible without removing any product packaging.~~
- c) ~~No person shall remove, alter, conceal, or deface the information required in Section 223.440(a) prior to final sale of the product.~~
- d) ~~For any aerosol coating product subject to Section 223.410(a), if the manufacturer or responsible party uses a code indicating the date of manufacture or an abbreviation of the coating category as defined in Section 223.407, an explanation of the code or abbreviation must be filed with the Agency prior to the use of the code or abbreviation.~~

Section 223.450 — Reporting Requirements

- a) ~~Any responsible party for an aerosol coating product subject to this article which is sold, supplied, or offered for sale in Illinois, must supply the Agency, upon request, with the following information within 30 days of the effective date of this Subpart: the company name, mail address, contact person, and the telephone number of the contact person. For responsible parties who do not manufacture their own aerosol coating products, the responsible party shall also supply the information specified in this subsection (a) for those manufacturers which produce products for the responsible party. The responsible party shall also notify the Agency within 30 days of any change in the information supplied to the Agency pursuant to this subsection (a).~~
- b) ~~Upon 30 days written notice, each manufacturer or responsible party subject to this Subpart shall submit to the Agency a written report with all of the following information for each product they manufacture under their name or another company's name:~~
- 1) ~~The brand name of the product;~~
 - 2) ~~Upon request, a copy of the product label;~~

- 3) ~~The owner of the trademark or brand names;~~
- 4) ~~The product category as defined in Section 223.407;~~
- 5) ~~The annual Illinois sales in pounds per year and the method used to calculate Illinois annual sales;~~
- 6) ~~Product formulation data: For products subject to the reactivity limits specified in Section 223.410(e), the WMIR and the weight fraction of all ingredients including: water, solids, each ROC, and any compounds assigned a MIR value of zero as specified in Section 223.410(j), and Appendices A or B to this Part. Each ROC must be reported as an ingredient if it is present in an amount greater than or equal to 0.1% by weight of the final aerosol coatings formulation. If an individual ROC is present in an amount less than 0.1% by weight, then it does not need to be reported as an ingredient. In addition, an impurity that meets the following definition does not need to be reported as an ingredient.~~

~~For the purpose of this section, an “impurity” means an individual chemical compound present in a raw material which is incorporated into the final aerosol coatings formulation, if the compound is present below the following amounts in the raw material:~~

- A) ~~For individual compounds that are carcinogens, as defined in 29 CFR section 1910.1200(d)(4), each compound must be present in an amount less than 0.1% by weight in order to be considered an “impurity.”~~
 - B) ~~For all other compounds present in a raw material, a compound must be present in an amount less than one percent by weight in order to be considered an “impurity”;~~
- 7) ~~An identification of each product brand name as a “household,” “industrial,” or “both” product; and~~
 - 8) ~~Any other information necessary to determine the emissions or the product weighted MIR from aerosol coating products. The information requested in this Subsection 223.450(b) may be supplied as an average for a group of aerosol coating products within the same coating category when the products do not vary in VOM content by more than two percent (by weight), and the coatings are based on the same resin type, or the products are color variations of the same product (even if the coatings vary by more than two percent in VOM content).~~

- e) — Upon written request, the responsible party for aerosol coating products subject to this Subpart shall supply the Agency with a list of all exempt compounds contained in any aerosol coating product within 15 working days.

Section 223.460 — Test Methods

Compliance with the requirements of this Subpart shall be determined by using the following test methods, which are incorporated by reference herein. Alternative test methods which are shown to accurately determine the VOM content, ingredient name and weight percent of each ingredient, exempt compound content, metal content, specular gloss, or acid content may also be used after approval in writing by the Agency:

- a) — The VOM content of all aerosol coating products subject to the provisions of this Subpart shall be determined by the procedures set forth in “Air Resources Board Method 310, Determination of Volatile Organic Compounds (VOM) in Consumer Products and Reactive Organic Compounds in Aerosol Coating Products,” adopted September 25, 1997, and as last amended on May 5, 2005.
- b) — Testing for Products Subject to the Reactivity Limits Specified in Section 223.410(b).
 - 1) — The ingredients and the amount of each ingredient of all aerosol coating products subject to the provisions of this Subpart shall be determined by the procedures set forth in “Air Resources Board Method 310, Determination of Volatile Organic Compounds (VOM) in Consumer Products,” adopted September 25, 1997 and as last amended on May 5, 2005.
 - 2) — Upon written notification from the Agency, the aerosol coating manufacturer shall have 10 working days to provide to the Agency the following information for products selected for testing:
 - A) — The product category as defined in Section 223.407;
 - B) — The PWMIR;
 - C) — The weight fraction of all ingredients including: water, solids, each ROC, and any compounds assigned a MIR value of zero as specified in sections 223.410(j), and Appendices A and B to this Part. Each ROC must be reported as an ingredient if it is present in an amount greater than or equal to 0.1% by weight of the final aerosol coatings formulation. If an individual ROC is present in an amount less than 0.1% by weight, then it does not need to be reported as an

~~ingredient. In addition, an impurity that meets the following definition does not need to be reported as an ingredient.~~

~~For the purpose of this section, an “impurity” means an individual chemical compound present in a raw material which is incorporated into the final aerosol coatings formulation, if the compound is present below the following amounts in the raw material:~~

- ~~i) — For individual compounds that are carcinogens, as defined in 29 CFR Section 1910.1200(d)(4), each compound must be present in an amount less than 0.1% by weight in order to be considered an “impurity.”~~
- ~~ii) — For all other compounds present in a raw material, a compound must be present in an amount less than one percent by weight in order to be considered an “impurity”;~~

~~D) — Any other information necessary to determine the PWMIR of the aerosol coating products to be tested.~~

~~3) — Final determination of the PWMIR of the aerosol coatings shall be determined using the information obtained from Appendix A and B.~~

~~e) — Metal Content. The metal content of metallic aerosol coating products shall be determined by SCAQMD Test Method 318-95 “Determination of Weight Percent Elemental Metal in Coatings by X-ray Diffraction” July 1996, which is incorporated by reference in Section 223.120.~~

~~d) — Specular Gloss. Specular gloss of flat and nonflat coatings shall be determined by ASTM Method D-523-89, March 31, 1989, which is incorporated by reference in Section 223.120.~~

~~e) — Acid Content. The acid content of rust converters shall be determined by ASTM Method D-1613-96, “Standard Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used in Paint, Varnish, Lacquer, and Related Products, May 10, 1996, which is incorporated by reference in Section 223.120.~~

~~f) — Lacquers. Lacquer aerosol coating products shall be identified according to the procedures specified in ASTM Method D-5043-90, “Standard Test Methods for Field Identification of Coatings,” April 27, 1990, which is incorporated by reference in Section 223.120.~~

14. *Strike the whole of Appendix A from the rule, including references in the index to the Appendix. The USEPA has promulgated an identical rule concerning "Aerosol Coatings" thus mooted the proposed Subpart D and related appendices.*

~~APPENDIX A ——— MAXIMUM INCREMENTAL REACTIVITY~~

~~APPENDIX A ——— MAXIMUM INCREMENTAL REACTIVITY~~

Tables of Maximum Incremental Reactivity (MIR) Values

MIR Values for Compounds:

Organic Compound	MIR Value
1. Carbon Monoxide	0.06
2. Methane	0.01
3. Ethane	0.31
4. Propane	0.56
5. n Butane	1.33
6. n Pentane	1.54
7. n Hexane	1.45
8. n Heptane	1.28
9. n Octane	1.11
10. n Nonane	0.95
11. n Decane	0.83
12. n Undecane	0.74
13. n Dodecane	0.66
14. n Tridecane	0.62
15. n Tetradecane	0.58
16. n Pentadecane	0.53
17. n C16	0.52
18. n C17	0.49
19. n C18	0.44
20. n C19	0.44
21. n C20	0.42
22. n C21	0.40
23. n C22	0.38
24. Isobutane	1.35
25. Isopentane	1.68
26. Neopentane	0.69
27. Branched C5 Alkanes	1.68
28. 2,2 Dimethyl Butane	1.33
29. 2,3 Dimethyl Butane	1.14

30.	2 Methyl Pentane (Isohexane)	1.80
31.	3 Methyl Pentane	2.07
32.	Branched C6 Alkanes	1.53
33.	2,2,3 Trimethyl Butane	1.32
34.	2,2 Dimethyl Pentane	1.22
35.	2,3 Dimethyl Pentane	1.55
36.	2,4 Dimethyl Pentane	1.65
37.	2 Methyl Hexane	1.37
38.	3,3 Dimethyl Pentane	1.32
39.	3 Methyl Hexane	1.86
40.	Branched C7 Alkanes	1.63
41.	2,2,3,3 Tetramethyl Butane	0.44
42.	2,2,4 Trimethyl Pentane (Isooctane)	1.44
43.	2,2 Dimethyl Hexane	1.13
44.	2,3,4 Trimethyl Pentane	1.23
45.	2,3 Dimethyl Hexane	1.34
46.	2,4 Dimethyl Hexane	1.80
47.	2,5 Dimethyl Hexane	1.68
48.	2 Methyl Heptane	1.20
49.	3 Methyl Heptane	1.35
50.	4 Methyl Heptane	1.48
51.	Branched C8 Alkanes	1.57
52.	2,2,5 Trimethyl Hexane	1.33
53.	2,3,5 Trimethyl Hexane	1.33
54.	2,4 Dimethyl Heptane	1.48
55.	2 Methyl Octane	0.96
56.	3,3 Diethyl Pentane	1.35
57.	3,5 Dimethyl Heptane	1.63
58.	4 Ethyl Heptane	1.44
59.	4 Methyl Octane	1.08
60.	Branched C9 Alkanes	1.25
61.	2,4 Dimethyl Octane	1.09
62.	2,6 Dimethyl Octane	1.27
63.	2 Methyl Nonane	0.86
64.	3,4 Diethyl Hexane	1.20
65.	3 Methyl Nonane	0.89
66.	4 Methyl Nonane	0.99
67.	4 Propyl Heptane	1.24
68.	Branched C10 Alkanes	1.09
69.	2,6 Dimethyl Nonane	0.95
70.	3,5 Diethyl Heptane	1.21
71.	3 Methyl Decane	0.77
72.	4 Methyl Decane	0.80
73.	Branched C11 Alkanes	0.87
74.	2,3,4,6 Tetramethyl Heptane	1.26
75.	2,6 Diethyl Octane	1.09

76.	3,6 Dimethyl Decane	0.88
77.	3 Methyl Undecane	0.70
78.	5 Methyl Undecane	0.72
79.	Branched C12 Alkanes	0.80
80.	2,3,5,7 Tetramethyl Octane	1.06
81.	3,6 Dimethyl Undecane	0.82
82.	3,7 Diethyl Nonane	1.08
83.	3 Methyl Dodecane	0.64
84.	5 Methyl Dodecane	0.64
85.	Branched C13 Alkanes	0.73
86.	2,4,6,8 Tetramethyl Nonane	0.94
87.	2,3,6 Trimethyl 4 Isopropyl Heptane	1.24
88.	3,7 Dimethyl Dodecane	0.74
89.	3,8 Diethyl Decane	0.68
90.	3 Methyl Tridecane	0.57
91.	6 Methyl Tridecane	0.62
92.	Branched C14 Alkanes	0.67
93.	2,4,5,6,8 Pentamethyl Nonane	1.11
94.	2 Methyl 3,5 Diisopropyl Heptane	0.78
95.	3,7 Dimethyl Tridecane	0.64
96.	3,9 Diethyl Undecane	0.62
97.	3 Methyl Tetradecane	0.53
98.	6 Methyl Tetradecane	0.57
99.	Branched C15 Alkanes	0.60
100.	2,6,8 Trimethyl 4 Isopropyl Nonane	0.76
101.	3 Methyl Pentadecane	0.50
102.	4,8 Dimethyl Tetradecane	0.55
103.	7 Methyl Pentadecane	0.51
104.	Branched C16 Alkanes	0.54
105.	2,7 Dimethyl 3,5 Diisopropyl Heptane	0.69
106.	Branched C17 Alkanes	0.51
107.	Branched C18 Alkanes	0.48
108.	Cyclopropane	0.10
109.	Cyclobutane	1.05
110.	Cyclopentane	2.69
111.	Cyclohexane	1.46
112.	Isopropyl Cyclopropane	1.52
113.	Methylecyclopentane	2.42
114.	C6 Cycloalkanes	1.46
115.	1,3 Dimethyl Cyclopentane	2.15
116.	Cycloheptane	2.26
117.	Ethyl Cyclopentane	2.27
118.	Methylecyclohexane	1.99
119.	C7 Cycloalkanes	1.99
120.	C8 Bicycloalkanes	1.75
121.	1,3 Dimethyl Cyclohexane	1.72

122. Cyclooctane	1.73
123. Ethylcyclohexane	1.75
124. Propyl Cyclopentane	1.91
125. C8 Cycloalkanes	1.75
126. C9 Bicycloalkanes	1.57
127. 1,1,3 Trimethyl Cyclohexane	1.37
128. 1 Ethyl 4 Methyl Cyclohexane	1.62
129. Propyl Cyclohexane	1.47
130. C9 Cycloalkanes	1.55
131. C10 Bicycloalkanes	1.29
132. 1,3 Diethyl Cyclohexane	1.34
133. 1,4 Diethyl Cyclohexane	1.49
134. 1 Methyl 3 Isopropyl Cyclohexane	1.26
135. Butyl Cyclohexane	1.07
136. C10 Cycloalkanes	1.27
137. C11 Bicycloalkanes	1.01
138. 1,3 Diethyl 5 Methyl Cyclohexane	1.11
139. 1 Ethyl 2 Propyl Cyclohexane	0.95
140. Pentyl Cyclohexane	0.91
141. C11 Cycloalkanes	0.99
142. C12 Bicycloalkanes	0.88
143. C12 Cycloalkanes	0.87
144. 1,3,5 Triethyl Cyclohexane	1.06
145. 1 Methyl 4 Pentyl Cyclohexane	0.81
146. Hexyl Cyclohexane	0.75
147. C13 Bicycloalkanes	0.79
148. 1,3 Diethyl 5 Propyl Cyclohexane	0.96
149. 1 Methyl 2 Hexyl Cyclohexane	0.70
150. Heptyl Cyclohexane	0.66
151. C13 Cycloalkanes	0.78
152. C14 Bicycloalkanes	0.71
153. 1,3 Dipropyl 5 Ethyl Cyclohexane	0.94
154. 1 Methyl 4 Heptyl Cyclohexane	0.58
155. Octyl Cyclohexane	0.60
156. C14 Cycloalkanes	0.71
157. C15 Bicycloalkanes	0.69
158. 1,3,5 Tripropyl Cyclohexane	0.90
159. 1 Methyl 2 Octyl Cyclohexane	0.60
160. Nonyl Cyclohexane	0.54
161. C15 Cycloalkanes	0.68
162. 1,3 Dipropyl 5 Butyl Cyclohexane	0.77
163. 1 Methyl 4 Nonyl Cyclohexane	0.55
164. Decyl Cyclohexane	0.50
165. C16 Cycloalkanes	0.61
166. Ethene	9.08
167. Propene (Propylene)	11.58

168. 1-Butene	10.29
169. C4 Terminal Alkenes	10.29
170. 1-Pentene	7.79
171. 3-Methyl 1-Butene	6.99
172. C5 Terminal Alkenes	7.79
173. 1-Hexene	6.17
174. 3,3-Dimethyl 1-Butene	6.06
175. 3-Methyl 1-Pentene	6.22
176. 4-Methyl 1-Pentene	6.26
177. C6 Terminal Alkenes	6.17
178. 1-Heptene	4.20
179. 1-Octene	3.45
180. C8 Terminal Alkenes	3.45
181. 1-Nonene	2.76
182. C9 Terminal Alkenes	2.76
183. 1-Decene	2.28
184. C10 Terminal Alkenes	2.28
185. 1-Undecene	1.95
186. C11 Terminal Alkenes	1.95
187. C12 Terminal Alkenes	1.72
188. 1-Dodecene	1.72
189. 1-Tridecene	1.55
190. C13 Terminal Alkenes	1.55
191. 1-Tetradecene	1.41
192. C14 Terminal Alkenes	1.41
193. 1-Pentadecene	1.27
194. C15 Terminal Alkenes	1.27
195. 2-Methyl Pentene (Isobutene)	6.35
196. 2-Methyl 1-Butene	6.51
197. 2,3-Dimethyl 1-Butene	4.77
198. 2-Ethyl 1-Butene	5.04
199. 2-Methyl 1-Pentene	5.18
200. 2,3,3-Trimethyl 1-Butene	4.62
201. C7 Terminal Alkenes	4.20
202. 3-Methyl 2-Isopropyl 1-Butene	3.29
203. cis 2-Butene	13.22
204. trans 2-Butene	13.91
205. C4 Internal Alkenes	13.57
206. 2-Methyl 2-Butene	14.45
207. cis 2-Pentene	10.24
208. trans 2-Pentene	10.23
209. 2-Pentenes	10.23
210. C5 Internal Alkenes	10.23
211. 2,3-Dimethyl 2-Butene	13.32
212. 2-Methyl 2-Pentene	12.28
213. cis 2-Hexene	8.44

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*** * * * * Errata Sheet and PC #3 * * * * ***

214. cis 3 Hexene	8.22
215. cis 3 Methyl 2 Pentene	12.84
216. cis 3 Methyl 2 Hexene	13.38
217. trans 3 Methyl 2 Hexene	14.17
218. trans 4 Methyl 2 Hexene	7.88
219. trans 2 Hexene	8.44
220. trans 3 Hexene	8.16
221. 2 Hexenes	8.44
222. C6 Internal Alkenes	8.44
223. 2,3 Dimethyl 2 Hexene	10.41
224. cis 3 Heptene	6.96
225. trans 4,4 Dimethyl 2 Pentene	6.99
226. trans 2 Heptene	7.33
227. trans 3 Heptene	6.96
228. 2 Heptenes	6.96
229. C7 Internal Alkenes	6.96
230. cis 4 Octene	5.94
231. trans 2,2 Dimethyl 3 Hexene	5.97
232. trans 2,5 Dimethyl 3 Hexene	5.44
233. trans 3 Octene	6.13
234. trans 4 Octene	5.90
235. 3 Octenes	6.13
236. C8 Internal Alkenes	5.90
237. 2,4,4 Trimethyl 2 Pentene	8.52
238. 3 Nonenes	5.31
239. C9 Internal Alkenes	5.31
240. trans 4 Nonene	5.23
241. 3,4 Diethyl 2 Hexene	3.95
242. cis 5 Decene	4.89
243. trans 4 Decene	4.50
244. C10 3 Alkenes	4.50
245. C10 Internal Alkenes	4.50
246. trans 5 Undecene	4.23
247. C11 3 Alkenes	4.23
248. C11 Internal Alkenes	4.23
249. C12 2 Alkenes	3.75
250. C12 3 Alkenes	3.75
251. C12 Internal Alkenes	3.75
252. trans 5 Dodecene	3.74
253. trans 5 Tridecene	3.38
254. C13 3 Alkenes	3.38
255. C13 Internal Alkenes	3.38
256. trans 5 Tetradecene	3.08
257. C14 3 Alkenes	3.08
258. C14 Internal Alkenes	3.08
259. trans 5 Pentadecene	2.82

260. C15 3 Alkenes	2.82
261. C15 Internal Alkenes	2.82
262. C4 Alkenes	11.93
263. C5 Alkenes	9.01
264. C6 Alkenes	6.88
265. C7 Alkenes	5.76
266. C8 Alkenes	4.68
267. C9 Alkenes	4.03
268. C10 Alkenes	3.39
269. C11 Alkenes	3.09
270. C12 Alkenes	2.73
271. C13 Alkenes	2.46
272. C14 Alkenes	2.28
273. C15 Alkenes	2.06
274. Cyclopentene	7.38
275. 1 Methyl Cyclopentene	13.95
276. Cyclohexene	5.45
277. 1 Methyl Cyclohexene	7.81
278. 4 Methyl Cyclohexene	4.48
279. 1,2 Dimethyl Cyclohexene	6.77
280. 1,3 Butadiene	13.58
281. Isoprene	10.69
282. C6 Cyclic or Di olefins	8.65
283. C7 Cyclic or Di olefins	7.49
284. C8 Cyclic or Di olefins	6.01
285. C9 Cyclic or Di olefins	5.40
286. C10 Cyclic or Di olefins	4.56
287. C11 Cyclic or Di olefins	4.29
288. C12 Cyclic or Di olefins	3.79
289. C13 Cyclic or Di olefins	3.42
290. C14 Cyclic or Di olefins	3.11
291. C15 Cyclic or Di olefins	2.85
292. Cyclopentadiene	7.61
293. 3 Carene	3.21
294. a Pinene (Pine Oil)	4.29
295. b Pinene	3.28
296. d Limonene (Dipentene or Orange Terpene)	3.99
297. Sabinene	3.67
298. Terpene	3.79
299. Styrene	1.95
300. a Methyl Styrene	1.72
301. C9 Styrenes	1.72
302. C10 Styrenes	1.53
303. Benzene	0.81
304. Toluene	3.97
305. Ethyl Benzene	2.79

306. Cumene (Isopropyl Benzene)	2.32
307. n-Propyl Benzene	2.20
308. C9 Monosubstituted Benzenes	2.20
309. s-Butyl Benzene	1.97
310. C10 Monosubstituted Benzenes	1.97
311. n-Butyl Benzene	1.97
312. C11 Monosubstituted Benzenes	1.78
313. C12 Monosubstituted Benzenes	1.63
314. C13 Monosubstituted Benzenes	1.50
315. m-Xylene	10.61
316. o-Xylene	7.49
317. p-Xylene	4.25
318. C8 Disubstituted Benzenes	7.48
319. m-Ethyl Toluene	9.37
320. p-Ethyl Toluene	3.75
321. o-Ethyl Toluene	6.61
322. C9 Disubstituted Benzenes	6.61
323. o-Diethyl Benzene	5.92
324. m-Diethyl Benzene	8.39
325. p-Diethyl Benzene	3.36
326. C10 Disubstituted Benzenes	5.92
327. C11 Disubstituted Benzenes	5.35
328. C12 Disubstituted Benzenes	4.90
329. C13 Disubstituted Benzenes	4.50
330. Isomers of Ethylbenzene	5.16
331. 1,2,3-Trimethyl Benzene	11.26
332. 1,2,4-Trimethyl Benzene	7.18
333. 1,3,5-Trimethyl Benzene	11.22
334. C9 Trisubstituted Benzenes	9.90
335. Isomers of Propylbenzene	6.12
336. 1,2,3,5-Tetramethyl Benzene	8.25
337. C10 Tetrasubstituted Benzenes	8.86
338. C10 Trisubstituted Benzenes	8.86
339. Isomers of Butylbenzene	5.48
340. C11 Pentasubstituted Benzenes	8.03
341. C11 Tetrasubstituted Benzenes	8.03
342. C11 Trisubstituted Benzenes	8.03
343. Isomers of Pentylbenzene	4.96
344. C12 Pentasubstituted Benzenes	7.33
345. C12 Hexasubstituted Benzenes	7.33
346. C12 Tetrasubstituted Benzenes	7.33
347. C12 Trisubstituted Benzenes	7.33
348. Isomers of Hexylbenzene	4.53
349. C13 Trisubstituted Benzenes	6.75
350. Indene	3.21
351. Indane	3.17

352. Naphthalene	3.26
353. Tetralin	2.83
354. Methyl Indans	2.83
355. Methyl Naphthalenes	4.61
356. 1-Methyl Naphthalene	4.61
357. 2-Methyl Naphthalene	4.61
358. C11 Tetralin or Indane	2.56
359. 2,3-Dimethyl Naphthalene	5.54
360. C12 Disubstituted Naphthalenes	5.54
361. Dimethyl Naphthalenes	5.54
362. C12 Monosubstituted Naphthalenes	4.20
363. C12 Tetralin or Indane	2.33
364. C13 Disubstituted Naphthalenes	5.08
365. C13 Trisubstituted Naphthalenes	5.08
366. C13 Monosubstituted Naphthalenes	3.86
367. Acetylene	1.25
368. Methyl Acetylene	6.45
369. 2-Butyne	16.33
370. Ethyl Acetylene	6.20
371. Methanol	0.71
372. Ethanol	1.69
373. Isopropanol (2-Propanol or Isopropyl Alcohol)	0.71
374. n-Propanol (n-Propyl Alcohol)	2.74
375. Isobutanol (Isobutyl Alcohol)	2.24
376. 1-Butanol (n-Butyl Alcohol)	3.34
377. 2-Butanol (s-Butyl Alcohol)	1.60
378. t-Butyl Alcohol	0.45
379. Cyclopentanol	1.96
380. 2-Pentanol	1.74
381. 3-Pentanol	1.73
382. n-Pentanol (Amyl Alcohol)	3.35
383. Isoamyl Alcohol (3-Methyl-1-Butanol)	2.73
384. 2-Methyl-1-Butanol	2.60
385. Cyclohexanol	2.25
386. 1-Hexanol	2.74
387. 2-Hexanol	2.46
388. 4-Methyl-2-Pentanol (Methyl Isobutyl Carbinol)	2.89
389. 1-Heptanol	2.21
390. Dimethylpentanol (2,3-Dimethyl-1-Pentanol)	2.51
391. 1-Octanol	2.01
392. 2-Ethyl-1-Hexanol (Ethyl Hexyl Alcohol)	2.20
393. 2-Octanol	2.16
394. 3-Octanol	2.57
395. 4-Octanol	3.07
396. 5-Methyl-1-Heptanol	1.95
397. Trimethylcyclohexanol	2.17

398. Dimethylheptanol (2,6 Dimethyl 2 Heptanol)	1.07
399. 2,6 Dimethyl 4 Heptanol	2.37
400. Menthol	1.70
401. Isodecyl Alcohol (8 Methyl 1 Nonanol)	1.23
402. 1-Decanol	1.22
403. 3,7 Dimethyl 1 Octanol	1.42
404. Trimethylnonanolthreoerythro; 2,6,8 Trimethyl 4 Nonanol	1.55
405. Ethylene Glycol	3.36
406. Propylene Glycol	2.75
407. 1,2 Butanediol	2.21
408. Glycerol (1,2,3 Propanetriol)	3.27
409. 1,4 Butanediol	3.22
410. Pentaerythritol	2.42
411. 1,2 Dihydroxy Hexane	2.75
412. 2 Methyl 2,4 Pentanediol	1.04
413. 2 Ethyl 1,3 Hexanediol	2.62
414. Dimethyl Ether	0.93
415. Trimethylene Oxide	5.22
416. 1,3-Dioxolane	5.47
417. Dimethoxymethane	1.04
418. Tetrahydrofuran	4.95
419. Diethyl Ether	4.01
420. 1,4 Dioxane	2.71
421. Alpha Methyltetrahydrofuran	4.62
422. Tetrahydropyran	3.81
423. Ethyl Isopropyl Ether	3.86
424. Methyl n Butyl Ether	3.66
425. Methyl t Butyl Ether	0.78
426. 2,2 Dimethoxypropane	0.52
427. Di n Propyl Ether	3.24
428. Ethyl n Butyl Ether	3.86
429. Ethyl t Butyl Ether	2.11
430. Methyl t Amyl Ether	2.14
431. Di isopropyl Ether	3.56
432. Ethylene Glycol Diethyl Ether; 1,2 Diethoxyethane	2.84
433. Acetal (1,1 Diethoxyethane)	3.68
434. 4,4 Dimethyl 3 Oxahexane	2.03
435. 2-Butyl Tetrahydrofuran	2.53
436. Di Isobutyl Ether	1.29
437. Di n butyl Ether	3.17
438. 2 Methoxy 1 (2 Methoxy 1 Methylethoxy) Propane	2.09
439. Di n Pentyl Ether	2.64
440. Ethylene Glycol Monomethyl Ether (2-Methoxyethanol)	2.98
441. Propylene Glycol Monomethyl Ether (1-Methoxy-2-Propanol)	2.62
442. 2 Ethoxyethanol	3.78
443. 2 Methoxy 1 Propanol	3.01

444.	3-Methoxy-1-Propanol	4.01
445.	Diethylene Glycol	3.55
446.	Tetrahydro-2-Furanmethanol	3.54
447.	Propylene Glycol Monoethyl Ether (1-Ethoxy-2-Propanol)	3.25
448.	Ethylene Glycol Monopropyl Ether (2-Propoxyethanol)	3.52
449.	3-Ethoxy-1-Propanol	4.24
450.	3-Methoxy-1-Butanol	0.97
451.	Diethylene Glycol Methyl Ether [2-(2-Methoxyethoxy) Ethanol]	2.90
452.	Propylene Glycol Monopropyl Ether (1-Propoxy-2-Propanol)	2.86
453.	Ethylene Glycol Monobutyl Ether [2-Butoxyethanol]	2.90
454.	3-Methoxy-3-Methyl-Butanol	1.74
455.	n-Propoxypropanol	3.84
456.	2-(2-Ethoxyethoxy) Ethanol	3.19
457.	Dipropylene Glycol	2.48
458.	Triethylene Glycol	3.41
459.	Propylene Glycol t-Butyl Ether (1-tert-Butoxy-2-Propanol)	1.71
460.	2-tert-Butoxy-1-Propanol	1.81
461.	n-Butoxy-2-Propanol	2.70
462.	Dipropylene Glycol Methyl Ether Isomer (1-Methoxy-2-[2-Hydroxypropoxy]-Propane)	2.21
463.	Dipropylene Glycol Methyl Ether Isomer (2-[2-Methoxypropoxy]-1-Propanol)	2.70
464.	2-Hexyloxyethanol	2.45
465.	2-(2-Propoxyethoxy)	3.00
466.	2,2,4-Trimethyl-1,3-Pentanediol	1.74
467.	2-(2-Butoxyethoxy) Ethanol	2.87
468.	2-[2-(2-Methoxyethoxy) Ethoxy] Ethanol	2.62
469.	Dipropylene Glycol Ethyl Ether	2.75
470.	Ethylene Glycol 2-Ethylhexyl Ether [2-(2-Ethylhexyloxy) Ethanol]	1.71
471.	2-[2-(2-Ethoxyethoxy) Ethoxy] Ethanol	2.66
472.	Tetraethylene Glycol	2.84
473.	1-(Butoxyethoxy)-2-Propanol	2.08
474.	2-(2-Hexyloxyethoxy) Ethanol	2.03
475.	Glycol Ether dpnb (1-(2-Butoxy-1-Methylethoxy)-2-Propanol)	1.96
476.	2-[2-(2-Propoxyethoxy) Ethoxy] Ethanol	2.46
477.	2-[2-(2-Butoxyethoxy) Ethoxy] Ethanol	2.24
478.	Tripropylene Glycol Monomethyl Ether	1.90
479.	2,5,8,11-Tetraoxatridecan-13-ol	2.15
480.	3,6,9,12-Tetraoxahexadecan-1-ol	1.90
481.	Cumene Hydroperoxide (1-Methyl-1-Phenylethylhydroperoxide)*	12.61
482.	Methyl Formate	0.06
483.	Ethyl Formate	0.52
484.	Methyl Acetate	0.07
485.	gamma-Butyrolactone	1.15
486.	Ethyl Acetate	0.64
487.	Methyl Propionate	0.71

488. n Propyl Formate	0.93
489. Isopropyl Formate	0.42
490. Ethyl Propionate	0.79
491. Isopropyl Acetate	1.12
492. Methyl Butyrate	1.18
493. Methyl Isobutyrate	0.70
494. n Butyl Formate	0.95
495. Propyl Acetate	0.87
496. Ethyl Butyrate	1.25
497. Isobutyl Acetate	0.67
498. Methyl Pivalate (2,2 Dimethyl Propanoic Acid Methyl Ester)	0.39
499. n Butyl Acetate	0.89
500. n Propyl Propionate	0.93
501. s Butyl Acetate	1.43
502. t Butyl Acetate	0.20
503. Butyl Propionate	0.89
504. Amyl Acetate	0.96
505. n Propyl Butyrate	1.17
506. Isoamyl Acetate (3 Methylbutyl Acetate)	1.18
507. 2 Methyl 1 Butyl Acetate	1.17
508. EEP Solvent (Ethyl 3 Ethoxy Propionate)	3.61
509. 2,3 Dimethylbutyl Acetate	0.84
510. 2 Methylpentyl Acetate	1.11
511. 3 Methylpentyl Acetate	1.31
512. 4 Methylpentyl Acetate	0.92
513. Isobutyl Isobutyrate	0.61
514. n Butyl Butyrate	1.12
515. n Hexyl Acetate (Hexyl Acetate)	0.87
516. Methyl Amyl Acetate (4 Methyl 2 Pentanol Acetate)	1.46
517. n Pentyl Propionate	0.79
518. 2,4 Dimethylpentyl Acetate	0.98
519. 2 Methylhexyl Acetate	0.89
520. 3 Ethylpentyl Acetate	1.24
521. 3 Methylhexyl Acetate	1.01
522. 4 Methylhexyl Acetate	0.91
523. 5 Methylhexyl Acetate	0.79
524. Isoamyl Isobutyrate	0.89
525. n Heptyl Acetate (Heptyl Acetate)	0.73
526. 2,4 Dimethylhexyl Acetate	0.93
527. 2 Ethyl Hexyl Acetate	0.79
528. 3,4 Dimethylhexyl Acetate	1.16
529. 3,5 Dimethylhexyl Acetate	1.09
530. 3 Ethylhexyl Acetate	1.03
531. 3 Methylheptyl Acetate	0.76
532. 4,5 Dimethylhexyl Acetate	0.86
533. 4 Methylheptyl Acetate	0.72

534. 5 Methylheptyl Acetate	0.73
535. n Octyl Acetate	0.64
536. 2,3,5 Trimethylhexyl Acetate	0.86
537. 2,3 Dimethylheptyl Acetate	0.84
538. 2,4 Dimethylheptyl Acetate	0.88
539. 2,5 Dimethylheptyl Acetate	0.86
540. 2 Methyloctyl Acetate	0.63
541. 3,5 Dimethylheptyl Acetate	1.01
542. 3,6 Dimethylheptyl Acetate	0.87
543. 3 Ethylheptyl Acetate	0.71
544. 4,5 Dimethylheptyl Acetate	0.96
545. 4,6 Dimethylheptyl Acetate	0.83
546. 4 Methyloctyl Acetate	0.68
547. 5 Methyloctyl Acetate	0.67
548. n Nonyl Acetate	0.58
549. 3,6 Dimethyloctyl Acetate	0.88
550. 3 Isopropylheptyl Acetate	0.71
551. 4,6 Dimethyloctyl Acetate	0.85
552. 3,5,7 Trimethyloctyl Acetate	0.83
553. 3 Ethyl 6 Methyloctyl Acetate	0.80
554. 4,7 Dimethylnonyl Acetate	0.64
555. Methyl Dodecanoate (Methyl Laurate)	0.53
556. 2,3,5,7 Tetramethyloctyl Acetate	0.74
557. 3,5,7 Trimethylnonyl Acetate	0.76
558. 3,6,8 Trimethylnonyl Acetate	0.72
559. 2,4,6,8 Tetramethylnonyl Acetate	0.63
560. 3 Ethyl 6,7 Dimethylnonyl Acetate	0.76
561. 4,7,9 Trimethyldecyl Acetate	0.55
562. Methyl Myristate (Methyl Tetradecanoate)	0.47
563. 2,3,5,6,8 Pentaamethylnonyl Acetate	0.74
564. 3,5,7,9 Tetramethyldecyl Acetate	0.58
565. 5 Ethyl 3,6,8 Trimethylnonyl Acetate	0.77
566. Dimethyl Carbonate	0.06
567. Propylene Carbonate (4 Methyl 1,3 Dioxolan 2 one)	0.25
568. Methyl Lactate	2.75
569. 2 Methoxyethyl Acetate	1.18
570. Ethyl Lactate	2.71
571. Methyl Isopropyl Carbonate	0.69
572. Propylene Glycol Monomethyl Ether Acetate (1 Methoxy 2 Propyl Acetate)	1.71
573. 2 Ethoxyethyl Acetate	1.90
574. 2 Methoxy 1 Propyl Acetate	1.12
575. Methoxypropanol Acetate	1.97
576. Dimethyl Succinate	0.23
577. Ethylene Glycol Diacetate	0.72
578. 1,2 Propylene Glycol Diacetate	0.94

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*** * * * * Errata Sheet and PC #3 * * * * ***

579. Diisopropyl Carbonate	1.04
580. Dimethyl Glutarate	0.51
581. Ethylene Glycol Monobutyl Ether Acetate (2-Butoxyethyl Acetate)	1.67
582. Dimethyl Adipate	1.95
583. 2-(2-Ethoxyethoxy) Ethyl Acetate	1.50
584. Dipropylene Glycol n-Propyl Ether Isomer #1	2.13
585. Dipropylene Glycol Methyl Ether Acetate Isomer #1	1.41
586. Dipropylene Glycol Methyl Ether Acetate Isomer #2	1.58
587. Dipropylene Glycol Methyl Ether Acetate	1.49
588. Glyceryl Triacetate	0.57
589. 2-(2-Butoxyethoxy) Ethyl Acetate	1.38
590. Substituted C7 Ester (C12)	0.92
591. 1-Hydroxy-2,2,4-Trimethylpentyl-3-Isobutyrate	0.92
592. 3-Hydroxy-2,2,4-Trimethylpentyl-1-Isobutyrate	0.88
593. Hydroxy-2,2,4-Trimethylpentyl-Isobutyrate Isomers (2,2,4-Trimethyl-1,3-Pentanediol Monoisobutyrate)	0.89
594. Substituted C9 Ester (C12)	0.89
595. Dimethyl Sebacate	0.48
596. Diisopropyl Adipate	1.42
597. Ethylene Oxide	0.04
598. Propylene Oxide	0.32
599. 1,2-Epoxybutane (Ethyl Oxirane)	1.02
600. Formic Acid	0.08
601. Acetic Acid	0.50
602. Glycolic Acid (Hydroxyacetic Acid)	2.67
603. Peracetic Acid (Peroxyacetic Acid)*	12.62
604. Acrylic Acid	11.66
605. Propionic Acid	0.79
606. Methacrylic Acid	18.78
607. Isobutyric Acid	1.22
608. Butanoic Acid	1.78
609. Malic Acid	7.51
610. 3-Methylbutanoic Acid	4.26
611. Adipic Acid	3.37
612. 2-Ethyl Hexanoic Acid	3.49
613. Methyl Acrylate	12.24
614. Vinyl Acetate	3.26
615. 2-Methyl-2-Butene-3-ol (1,2-Dimethylpropyl-1-en-1-ol)	5.12
616. Ethyl Acrylate	8.78
617. Methyl Methacrylate	15.84
618. Hydroxypropyl Acrylate	5.56
619. n-Butyl Acrylate	5.52
620. n-Butyl Acrylate	5.52
621. Isobutyl Acrylate	5.05
622. Butyl Methacrylate	9.09
623. Isobutyl Methacrylate	8.99

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624. Isobornyl Methacrylate*	8.64
625. a Terpeneol	5.16
626. 2-Ethyl-Hexyl Acrylate	2.42
627. Furan	16.54
628. Formaldehyde	8.97
629. Acetaldehyde	6.84
630. Propionaldehyde	7.89
631. 2-Methylpropanal	5.87
632. Butanal	6.74
633. C4 Aldehydes	6.74
634. 2,2-Dimethylpropanal (Pivaldehyde)	5.40
635. 3-Methylbutanal (Isovaleraldehyde)	5.52
636. Pentanal (Valeraldehyde)	5.76
637. C5 Aldehydes	5.76
638. Glutaraldehyde	4.79
639. Hexanal	4.98
640. C6 Aldehydes	4.98
641. Heptanal	4.23
642. C7 Aldehydes	4.23
643. 2-Methyl-Hexanal	3.97
644. Octanal	3.65
645. C8 Aldehydes	3.65
646. Glyoxal	14.22
647. Methyl Glyoxal	16.21
648. Acrolein	7.60
649. Crotonaldehyde	10.07
650. Methacrolein	6.23
651. Hydroxy Methacrolein	6.61
652. Benzaldehyde	0.00
653. Toluualdehyde	0.00
654. Acetone	0.43
655. Cyclobutanone	0.68
656. Methyl Ethyl Ketone (2-Butanone)	1.49
657. Cyclopentanone	1.43
658. C5 Cyclic Ketones	1.43
659. Methyl Propyl Ketone (2-Pentanone)	3.07
660. 3-Pentanone	1.45
661. C5 Ketones	3.07
662. Methyl Isopropyl Ketone	1.64
663. 2,4-Pentanedione	1.02
664. Cyclohexanone	1.61
665. C6 Cyclic Ketones	1.61
666. Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	4.31
667. Methyl n-Butyl Ketone (2-Hexanone)	3.55
668. Methyl t-Butyl Ketone	0.78
669. C6 Ketones	3.55

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670. C7 Cyclic Ketones	1.41
671. Methyl Amyl Ketone (2 Heptanone)	2.80
672. 2 Methyl 3 Hexanone	1.79
673. Di Isopropyl Ketone	1.63
674. C7 Ketones	2.80
675. 3 Methyl 2 Hexanone	2.81
676. Methyl Isoamyl Ketone (5 Methyl 2 Hexanone)	2.10
677. C8 Cyclic Ketones	1.25
678. 2-Octanone	1.66
679. C8 Ketones	1.66
680. C9 Cyclic Ketones	1.13
681. 2 Propyl Cyclohexanone	1.71
682. 4 Propyl Cyclohexanone	2.08
683. 2-Nonanone	1.30
684. Di Isobutyl Ketone (2,6 Dimethyl 4 Heptanone)	2.94
685. C9 Ketones	1.30
686. C10 Cyclic Ketones	1.02
687. 2-Decanone	1.06
688. C10 Ketones	1.06
689. 2,6,8 Trimethyl 4 Nonanone; Isobutyl Heptyl Ketone	1.86
690. Biacetyl	20.73
691. Methylvinyl ketone	8.73
692. Mesityl Oxide (2 Methyl 2 Penten 4 one)	17.37
693. Isophorone (3,5,5 Trimethyl 2 Cyclohexenone)	10.58
694. 1-Nonene 4 one	3.39
695. Hydroxy Acetone	3.08
696. Dihydroxyacetone	4.02
697. Methoxy Acetone	2.14
698. Diacetone Alcohol (4 Hydroxy 4 Methyl 2 Pentanone)	0.68
699. Phenol	1.82
700. C7 Alkyl Phenols	2.34
701. m Cresol	2.34
702. p-Cresol	2.34
703. o-Cresol	2.34
704. C8 Alkyl Phenols	2.07
705. C9 Alkyl Phenols	1.86
706. C10 Alkyl Phenols	1.68
707. C11 Alkyl Phenols	1.54
708. C12 Alkyl Phenols	1.42
709. 2 Phenoxyethanol; Ethylene Glycol Phenyl Ether	3.61
710. 1 Phenoxy 2 Propanol	1.73
711. Nitrobenzene	0.07
712. Para Toluene Isoocyanate	0.93
713. Toluene Diisocyanate (Mixed Isomers)	0.00
714. Methylene Diphenylene Diisocyanate	0.79
715. N Methyl Acetamide*	19.70

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716. Dimethyl Amine	9.37
717. Ethyl Amine	7.80
718. Trimethyl Amine	7.06
719. Triethyl Amine*	16.60
720. Diethylenetriamine*	13.03
721. Ethanolamine	5.97
722. Dimethylaminoethanol	4.76
723. Monoisopropanol Amine (1 Amino 2 Propanol)*	13.42
724. 2-Amino-2-Methyl-1-Propanol*	15.08
725. Diethanol Amine	4.05
726. Triethanolamine	2.76
727. Methyl Pyrrolidone (N Methyl 2 Pyrrolidone)	2.56
728. Morpholine*	15.43
729. Nitroethane*	12.79
730. Nitromethane*	7.86
731. 1-Nitropropane*	16.16
732. 2-Nitropropane*	16.16
733. Dexpantenol (Pantothenyol)*	9.35
734. Methyl Ethyl Ketoxime (Ethyl Methyl Ketone Oxime)*	22.04
735. Hydroxyethylethylene Urea*	14.75
736. Methyl Chloride	0.03
737. Methylene Chloride (Dichloromethane)	0.07
738. Methyl Bromide	0.02
739. Chloroform	0.03
740. Carbon Tetrachloride	0.00
741. Methylene Bromide	0.00
742. Vinyl Chloride	2.92
743. Ethyl Chloride	0.25
744. 1,1-Dichloroethane	0.10
745. 1,2-Dichloroethane	0.10
746. Ethyl Bromide	0.11
747. 1,1,1-Trichloroethane	0.00
748. 1,1,2-Trichloroethane	0.06
749. 1,2-Dibromoethane	0.05
750. n-Propyl Bromide	0.35
751. n-Butyl Bromide	0.60
752. trans-1,2-Dichloroethene	0.81
753. Trichloroethylene	0.60
754. Perchloroethylene	0.04
755. 2-(Chloro-Methyl)-3-Chloro-Propene	1.13
756. Monochlorobenzene	0.36
757. p-Dichlorobenzene	0.20
758. Benzotrifluoride	0.26
759. PCBTF (p-Trifluoromethyl-CI-Benzene)	0.11
760. HFC 134a (1,1,1,2-Tetrafluoroethane)*	0.00
761. HFC 152a (1,1-Difluoroethane)*	0.00

762. Dimethyl Sulfoxide	6.90
763. Unspeciated C6 Alkanes	1.48
764. Unspeciated C7 Alkanes	1.79
765. Unspeciated C8 Alkanes	1.64
766. Unspeciated C9 Alkanes	2.13
767. Unspeciated C10 Alkanes	1.16
768. Unspeciated C11 Alkanes	0.90
769. Unspeciated C12 Alkanes	0.81
770. Unspeciated C13 Alkanes	0.73
771. Unspeciated C14 Alkanes	0.67
772. Unspeciated C15 Alkanes	0.61
773. Unspeciated C16 Alkanes	0.55
774. Unspeciated C17 Alkanes	0.52
775. Unspeciated C18 Alkanes	0.49
776. Unspeciated C10 Aromatics	5.48
777. Unspeciated C11 Aromatics	4.96
778. Unspeciated C12 Aromatics	4.53
779. Base ROG Mixture	3.71
780. Alkane, Mixed— Predominantly (Minimally 94%) C13-14	0.67
781. Oxo-Hexyl Acetate	1.03
782. Oxo-Heptyl Acetate	0.97
783. Oxo-Octyl Acetate	0.96
784. Oxo-Nonyl Acetate	0.85
785. Oxo-Decyl Acetate	0.83
786. Oxo-Dodecyl Acetate	0.72
787. Oxo-Tridecyl Acetate	0.67

*——ULMIR (as defined in Section 94521(a)(71), title 17, California Code of Regulations):

15. *Strike the whole of Appendix B from the rule, including references in the index to the Appendix. The USEPA has promulgated an identical rule concerning “Aerosol Coatings” thus mooted the proposed Subpart D and related appendices.*

~~APPENDIX B——MIR VALUES FOR HYDROCARBON SOLVENTS~~

~~APPENDIX B——MIR VALUES FOR HYDROCARBON SOLVENTS~~

~~(a) Aliphatic Hydrocarbon Solvents~~

Bin	Average Boiling	Criteria	MIR Value
	Boiling Point***		
	(degrees F)		

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1	80-205	Alkanes (< 2% Aromatics)	2.08
2	80-205	N- & Iso-Alkanes ($\geq 90\%$ and < 2% Aromatics)	1.59
3	80-205	Cyclo-Alkanes ($\geq 90\%$ and < 2% Aromatics)	2.52
4	80-205	Alkanes (2 to < 8% Aromatics)	2.24
5	80-205	Alkanes (8 to 22% Aromatics)	2.56
6	>205-340	Alkanes (< 2% Aromatics)	1.41
7	>205-340	N- & Iso-Alkanes ($\geq 90\%$ and < 2% Aromatics)	1.17
8	>205-340	Cyclo-Alkanes ($\geq 90\%$ and < 2% Aromatics)	1.65
9	>205-340	Alkanes (2 to < 8% Aromatics)	1.62
10	>205-340	Alkanes (8 to 22% Aromatics)	2.03
11	>340-460	Alkanes (< 2% Aromatics)	0.91
12	>340-460	N- & Iso-Alkanes ($\geq 90\%$ and < 2% Aromatics)	0.81
13	>340-460	Cyclo-Alkanes ($\geq 90\%$ and < 2% Aromatics)	1.01
14	>340-460	Alkanes (2 to < 8% Aromatics)	1.21
15	>340-460	Alkanes (8 to 22% Aromatics)	1.82
16	>460-580	Alkanes (< 2% Aromatics)	0.57
17	>460-580	N- & Iso-Alkanes ($\geq 90\%$ and < 2% Aromatics)	0.51
18	>460-580	Cyclo-Alkanes ($\geq 90\%$ and < 2% Aromatics)	0.63
19	>460-580	Alkanes (2 to < 8% Aromatics)	0.88

20 >460-580 Alkanes (8 to 22% Aromatics) 1.49

*** Average Boiling Point = (Initial Boiling Point + Dry Point) / 2

(b) Aromatic Hydrocarbon Solvents

Bin	Boiling Range (degrees F)	Criteria	MIR Value
21	280-290	Aromatic Content (≥98%)	7.37
22	320-350	Aromatic Content (≥98%)	7.51
23	355-420	Aromatic Content (≥98%)	8.07
24	450-535	Aromatic Content (≥98%)	5.00

* ULMIR (as defined in Section 94521(a)(71), title 17, California Code of Regulations).

16. To correct point 14 on the Illinois EPA's Second Errata Sheet, which states:

14. Amend Section ~~223.255~~ ~~223.320~~, to clarify that companies only have to submit date codes to the Illinois EPA upon request. It was not intended that companies should be required to provide this information without a request from the Illinois EPA.

- a) If a manufacturer uses a code other than specified in 223.250(b) indicating the date of manufacture for any consumer product subject to Section 223.205(a), an explanation of the date portion of the code must be filed with the Agency upon request. ~~no later than 12 months prior to the effective date of the applicable standard specified in Section 223.205.~~

Respectfully submitted,

ILLINOIS ENVIRONMENTAL
PROTECTION AGENCY

Charles E. Matoesian
Assistant Counsel

DATED: _____
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276
(217) 782-5544

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:)
)
PROPOSED NEW 35 ILL. ADM. CODE)
PART 223 STANDARDS AND) **R08 - 017**
LIMITATIONS FOR ORGANIC) **(Rulemaking – Air)**
MATERIAL EMISSIONS FOR AREA)
SOURCES)
)

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY’S POST-HEARING
COMMENTS TO THE JUNE 4, 2008 HEARING ON THE PROPOSAL FOR THE
ADDITION OF 35 ILL. ADM. CODE 223

NOW COMES the ILLINOIS ENVIRONMENTAL PROTECTION AGENCY (“Illinois EPA”), by one of its attorneys, and hereby submits its post-hearing comments in the above rulemaking proceeding. The Illinois EPA has reviewed the transcript of the June 4, 2008, hearing and responds to the information requests as follows:

1. To the information request on Transcript page 9, line 12:

The reductions anticipated to come from the proposed regulation were indeed included in the recent attainment demonstration for Illinois.

2. To the information request on Transcript page 11, line 6:

The Agency filed the proposed regulation as soon as was possible given the staff resources, and the combination of the Consumer Products rule with AIM Coatings rule and the now withdrawn Aerosol Coatings rule. An extensive amount of consultation with affected industry groups to ensure the rules were consistent and acceptable to stakeholders was an additional factor in the timing of the Agency's filing of the proposed regulations.

3. To the information request on Transcript page 14, line 18:

In the interest of providing a clear and complete record, all questions to which the Agency committed to respond in writing are included here. However, the requested document at the above citation in the transcript was submitted by Ms. Hodge as Exhibit 3, and was admitted as such at page 21 of the transcript, line 7. It should be noted, as it was a number of times at the public hearing, that the proposed regulation was not in fact

based on the 2001 OTC Model Rule. The 2006 OTC Model Rule was used as a resource, in addition to input from affected industries, and the omission of the document from the documents relied upon submitted to the Board was inadvertent.

4. To the information request on Transcript page 17, line 2:

The Agency will be submitting the most recent white paper for consumer products that LADCO has made available. The updated version is dated March 10, 2006, and is essentially unchanged in any way pertaining to the questions posed at hearings. The estimated reductions for the OTC model rule for consumer products remain 14.2% beyond existing federal rules, and include the additional categories in the 2006 OTC model rule. It should be noted, as it was a number of times at the public hearing, that the proposed regulation was not in fact based on the 2001 OTC Model Rule.

5. To the information request on Transcript page 19, line 12:

See response to question 3. The document requested at this point in the hearing was submitted as Exhibit 3, and the document is highlighted to reflect the changes from the 2001 and 2006 versions of the OTC Model Rule for Consumer Products.

6. To the information request on Transcript page 28, line 8:

As stated in response 4, the most recent white paper and up to date research conducted by LADCO and Mactec does indeed include the additional categories mentioned at the hearing. The overall percent reduction likely was not changed as a result of the new categories due to several factors: (1) the amount of reductions from the additional categories relative to the total amount of reduction from the regulation was insufficient to change the overall total percentage; (2) the percent reduction from the additional categories was comparable to the percent reduction from the existing categories, thus not affecting the overall percentage; and (3) as stated in the hearing, some of the additional categories were already included in the existing categories, but were given more specific categories and limits.

7. To the information request on Transcript page 30, line 6:

In response to the question by Ms. Hodge in the above transcript citation, one can refer to the response to question 6, the question being whether emission reductions were considered to come from the additional categories in question. Indeed these categories were included in the estimated 14.2% emission reduction, therefore further independent research by the Agency regarding the additional categories will not be necessary.

8. To the information request on Transcript page 31, line 17:

See response 8. Since the additional categories were considered in the LADCO/Mactec white papers, a case by case determination for emission reductions from the additional categories would not be necessary.

9. To the information request on Transcript page 36, line 24:

The table referred to in the transcript from the OTC Model Rule was removed from the Illinois rule because the compounds listed were ozone depleting compounds. It is the position of the Agency that these compounds are regulated for other purposes in Illinois and federally and so should not be included in an area source VOM regulation.

10. To the information request on Transcript page 39, line 21:

Questions 10-12 concern additional support for a few additional categories not included in the Table 2.2.1 in the Technical Support Document. The categories in question have in fact been researched by CARB for similar rulemakings, and this support was the basis for their inclusion in the OTC Model Rule. These support documents can be found on the CARB website at:

<http://www.arb.ca.gov/regact/conprod/conprod.htm>

This site contains a total record of a rulemaking to consider amendments to CARB consumer products rules, and includes technical support and economic analysis for the toilet and urinal care products category. The Agency did not include analyses from each of the amendment phases of the California rulemakings as the documentation to be submitted would have been voluminous. The aforementioned (response 4) white paper was relied upon as an overall analysis of economic impact and cost effectiveness. These documents can be formally submitted if the Board so orders.

11. To the information request on Transcript page 40, line 10:

In response to a follow up question to 10, "...will the agency go forth and do it's own analysis to support those additional categories?," the Agency will not be doing such analyses. The support documents described above were produced by CARB for a similar rulemaking, as were the technical and economic analyses provided to the Board for this Illinois rulemaking. As was previously stated in response 4, the addition of the categories in question did not significantly impact the overall percentage reduction or economic impact of the proposed regulation.

12. To the information request on Transcript page 40, line 18:

It is the Agency's position that the Board should move forward with adoption of the proposed rule given that appropriate technical and economic analyses have been performed for all affected categories.

13. To the information request on Transcript page 58, line 1:

The word "beret" is the appropriate term and refers to a structure for reducing soil erosion.

14. To the information request on Transcript page 58, line 12:

The word "fetal" was an error in the OTC AIM Model Rule and should be changed to "final." This has been addressed in the errata.

15. To the information request on Transcript page 53, line 5:

Per Mr. Fox's request, the addresses of the South Coast Air Quality Management District, Bay Area Air Quality Management District, and CARB:

South Coast Air Quality Management District
21865 Copley Dr.
Diamond Bar CA 91765

Bay Area Air Quality Management
District Office
939 Ellis Street
San Francisco, CA 94109

California Air Resources Board
1001 I Street
P.O. Box 2815
Sacramento, CA 95812

Attachments:

ASTM D86-07b
Updated White Paper 3/10/06
CA Code of Regulations, Section 94509

Respectfully submitted,

**ILLINOIS ENVIRONMENTAL
PROTECTION AGENCY**

Charles E. Matoesian
Assistant Counsel

DATED: _____
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Source Category: Consumer and Commercial Products

INTRODUCTION

The purpose of this document is to provide a forum for public review and comment on the evaluation of candidate control measures that may be considered by the States in the Midwest Regional Planning Organization (MRPO) to develop strategies for ozone, PM_{2.5}, and regional haze State Implementation Plans (SIPs). Additional emission reductions beyond those due to mandatory controls required by the Clean Air Act may be necessary to meet SIP requirements and to demonstrate attainment. This document provides background information on the mandatory control programs and on possible additional control measures.

The candidate control measures identified in this document represent an initial set of possible measures. The MRPO States have not yet determined which measures will be necessary to meet the requirements of the Clean Air Act. As such, the inclusion of a particular measure here should not be interpreted as a commitment or decision by any State to adopt that measure. Other measures will be examined in the near future. Subsequent versions of this document will likely be prepared for evaluation of additional potential control measures.

The evaluation of candidate control measures is presented in a series of "Interim White Papers." Each paper includes a title, summary table, description of the source category, brief regulatory history, discussion of candidate control measures, expected emission reductions, cost effectiveness and basis, timing for implementation, rule development issues, other issues, and a list of supporting references. Table 1 summarizes this information for the consumer and commercial products category.

SOURCE CATEGORY DESCRIPTION

Consumer and commercial products are those items sold to retail customers for personal, household, or automotive use, along with the products marketed by wholesale distributors for use in commercial or institutional settings such as beauty shops, schools, and hospitals. Volatile organic compound (VOC) emissions from these products are the result of the evaporation of propellant and organic solvents during use. Consumer and commercial products include hundreds of individual products, including personal care products, household products, automotive aftermarket products, adhesives and sealants, FIFRA-related insecticides, coatings and related products (except architectural and maintenance coatings), and other miscellaneous products. Consumer and commercial products were estimated to account for about 5.9 percent of the total anthropogenic VOC emissions in the MRPO region in 2002.

REGULATORY HISTORY

The U.S. Environmental Protection Agency (EPA) published the consumer and commercial products rule on September 11, 1998 (40 CFR Part 59 Subpart D) under authority of Section 183(e) of the Clean Air Act. This rule limits the VOC content of 24 product categories representing 48 percent of the consumer and commercial products inventory nationwide. According to EPA, VOC emissions from those 24 product categories are reduced by 20 percent. But since over half of the inventory is unaffected by the rule, the Federal rule is estimated to yield VOC reductions of 9.7 percent from uncontrolled levels for the

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**TABLE 1 – CONTROL MEASURE SUMMARY FOR
CONSUMER AND COMMERCIAL PRODUCTS**

Control Measure Summary	VOC Emissions (tons/year) in 5-State MRPO Region	
<p>2002 existing measure: Federal Consumer and Commercial Products rules 40CFR Part 59 <i>Emission Reductions:</i> Overall 8.0% from uncontrolled levels (20% reduction for products covered by rule, only 40% of all products are covered by the rule) <i>Control Cost:</i> \$237 per ton <i>Timing of Implementation:</i> Compliance required by December 1998 <i>Implementation Area:</i> Nationwide</p>	<p>Uncontrolled: 180,168 2002 Reduction: <u>-14,339</u> 2002 Base: 165,829</p>	
<p>Candidate measure: Adopt OTC Model Rule with additional product coverage and more stringent VOC limits <i>Measure ID:</i> SOLV2A <i>Emission Reductions:</i> 14.2% beyond Federal Part 59 rule (for a total reduction of 21.0% from uncontrolled emissions) <i>Control Cost:</i> \$800 per ton <i>Timing of Implementation:</i> Assuming 2007 effective date of rule and 2-year sell-through period, emission reductions are achieved in 2009 <i>Implementation Area:</i> 5-state MRPO region</p>	<p>2002 Base: 165,829 2009 Reduction: <u>-23,548</u> 2009 Remaining: 142,281</p>	
<p>Candidate measure: Adopt CARB 2003 SIP requirements with additional products and more stringent VOC limits (in addition to OTC Model Rule) <i>Measure ID:</i> SOLV2B <i>Emission Reductions:</i> 12.5% beyond OTC Model Rule (for a total reduction of 30.9% from uncontrolled emissions) <i>Control Cost:</i> \$4,800 per ton <i>Timing of Implementation:</i> Assuming 2007 effective date of rule and 2-year sell-through period, emission reductions are achieved in 2009 <i>Implementation Area:</i> 5-state MRPO region</p>	<p>2002 Base: 165,829 2009 Reduction: <u>-41,333</u> 2009 Remaining: 124,496</p>	

Notes: 2002 emission reductions shown are reductions from uncontrolled levels.
 2009 emission reductions shown are reductions for 2002 base emissions.
 2009 emissions are not growth-adjusted.

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entire consumer and commercial production category. All products listed in Part 59 and manufactured after December 10, 1998, must meet the VOC content limits.

The California Air Resources Board (CARB) has been regulating consumer and commercial products since 1989, when it adopted a regulation to reduce VOC emissions from antiperspirants and deodorants. In the early 1990s, amendments to the consumer products rule (referred to as the Phase I and Phase II amendments) required emission reductions for 26 additional consumer products. In 1995, CARB adopted an aerosol coatings regulation, which required emissions reductions from 35 categories of aerosol paints and related coatings products. In 1997 and 2000, the regulations were amended again to include so-called "mid-term" measures, so that the current regulations contain nearly 200 emission limits affecting 82 categories of consumer products, plus limits for 35 categories of aerosol coatings.

Also prior to passage of the Federal consumer and commercial rule, several other state and local agencies adopted rules to regulate various consumer and commercial products. For example, New York adopted rules for consumer insecticides, air fresheners, and disinfectants in 1988, and later adopted a regulation to limit the VOC content of antiperspirants, deodorants, and hair sprays. Seven other states also adopted some form of consumer product rules prior to the Federal rule.

Since over half of the inventory is unregulated by the Federal Part 59 rule, the Ozone Transport Commission (OTC) developed a model rule for consumer and commercial products in 2000 to regulate additional consumer product categories and have more stringent VOC content limits than the Federal rule. The VOC content limits in the OTC Model Rule are similar to the CARB's mid-term limits. The OTC Model Rule regulates approximately 80 consumer product categories and includes technologically feasible VOC content limits. According to Reference 3, the emission reductions for the OTC Model Rule are estimated to be 14.2 percent of the total consumer product inventory beyond the national rule reduction. Several states in the Ozone Transport Region are in the process of adopting the OTC Model Rule. All products manufactured for sale or use within an OTC State after January 1, 2005 would need to comply with the VOC content limits in the OTC Model Rule. The OTC Model Rule also includes regulatory flexibility provisions for innovative products and alternative control plans.

On October 23, 2003, CARB adopted a statewide SIP strategy to further reduce emissions from consumer products. The CARB committed to developing a measure to be implemented by 2006 that would achieve about a two percent reduction from consumer products. These rules were adopted on July 20, 2005. The CARB also committed to develop new consumer product category limits, with implementation between 2008 and 2010, which would achieve an additional 8-14 percent reduction from consumer productions by 2010. These rules, expected to be adopted by the end of 2006, will achieve reductions by setting mass-based and possibly reactivity-based standards.

None of the five Midwest RPO States have rules specifically regulating consumer and commercial products beyond the requirements of the Federal Part 59 rule.

CANDIDATE CONTROL MEASURES

In general, VOC emission reductions can be obtained through product reformulation - modifying the current formulation of the coating to obtain a lower VOC content. The product reformulation options vary with each product category, and can involve one or more of the following approaches:

- Replacing VOC solvents with a water-based formulation;
- Replacing VOC solvents with acetone or another exempt solvent

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- Increasing the solids content of the product;
- Formulating a non-VOC propellant; and,
- Changing the valve, container, or delivery system to reduce VOC content.

The regulatory approach for reducing emissions is to establish VOC content limits for specific coatings that manufacturers are required to meet either through reformulating products or substituting products with compliant products. Two specific candidate control measures are discussed below.

Measure SOLV2A – Adopt OTC Model Rule for Consumer Products. This measure regulates more consumer products, establishes more stringent VOC limits than the Federal Part 59 rule, and achieves VOC emission reductions through the use of product reformulation and product substitution. The OTC limits are based primarily on the CARB mid-term limits adopted in 1997 and 2000. The emission reductions for the OTC Model Rule are estimated to be 14.2 percent beyond the reductions obtained from the Federal Part 59 rule.

Measure SOLV2B – Adopt CARB 2003 SIP Requirements for Additional Products and VOC Limits (in addition to OTC Model Rule). CARB has identified two strategies to further reduce VOC emissions from consumer and commercial products. CARB Measure CONS-1 (adopted July 20, 2005) sets or revises VOC limits for about 13 categories that must be complied with by December 31, 2006. This measure will achieve about a 2 percent reduction in VOC emissions over projected 2010 levels. CARB Measure CONS-2 is a commitment to develop rules between 2006 and 2008 to adopt new limits for consumer products (either mass-based or reactivity-based) as well as to set limits for previously unregulated categories. The combined emission reductions from implementation of both CONS-1 and CONS-2 are estimated to be between 9.7 and 15.5 percent in 2009.

EXPECTED EMISSION REDUCTIONS

We calculated the approximate emission reductions expected from adoption of the OTC Model Rule and the CARB 2003 SIP commitments in the following manner:

- Obtained 2002 actual emissions from the MRPO's 2002 inventory (Note: these estimates account for the estimated 20% reduction from products covered by the Federal Part 59 rule; since only 40 percent of the total inventory is covered under the Federal rule, the overall reduction from the Federal rule is about 8.0%; see References 3 and 7);
- Assumed that the OTC Model Rule is adopted in 2007 by all five MRPO states and that full implementation will be achieved by 2009, resulting in a 14.2% reduction beyond the reduction provided by the Federal Part 59 rule; and,
- Assumed that the CARB 2003 SIP limits, in addition to the OTC Model Rule, is adopted in 2007 by all five MRPO states and that full implementation will occur by 2009, resulting in 12.5% reduction beyond the reduction provided by the OTC Model Rule and Federal Part 59 rule.

Current emissions and the expected emission reductions from candidate control measures are summarized in Table 2. If the MRPO States adopt the OTC Model Rule, the incremental reduction of 14.2 percent beyond the Federal Part 59 requirements would result in a reduction of 23,548 tpy of VOC in 2009 across the 5-state region. The CARB estimates that VOC emissions can be further reduced by an additional 9.7-15.5 percent beyond that obtained from their existing regulations (which are similar to the OTC Model Rule. If this measure is adopted by the MRPO States, the average incremental reduction of 12.5 percent (mid-point of estimated 9.7-15.5 percent reduction estimated by CARB) beyond the OTC Model Rule would result in an additional reduction of 17,785 tons/year of VOC.

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TABLE 2 -- COMPARISON OF 2002, OTC MODEL RULE, AND CARB 2003 SIP EMISSION SCENARIOS

SCC	SCC Description	Includes 8.0% overall reduction from Federal Part 59 Rule	VOC Emissions (tons/year)			
			With OTC Model Rule 14.2% beyond Federal Rule		With CARB 2003 SIP limits and OTC Model Rule 12.5% beyond OTC Rule	
			Incremental Emissions Reduction	2009 Emissions Remaining	Incremental Emissions Reduction	2009 Emissions Remaining
IL 2460xxxxxx	Consumer and Commercial Products	2002 Actual 45,444	6,453	38,991	4,874	34,117
IN 2460xxxxxx	Consumer and Commercial Products	22,213	3,154	19,059	2,382	16,676
OH 2465000000	Consumer and Commercial Products	36,684	5,209	31,475	3,934	27,541
MI 2460xxxxxx	Consumer and Commercial Products	41,688	5,920	35,768	4,471	31,297
WI 2460xxxxxx	Consumer and Commercial Products	19,800	2,812	16,988	2,124	14,865
MRPO 5-State Total		165,829	23,548	142,281	17,785	124,496

Note:

1. The 2009 emission estimates presented here are not growth-adjusted.

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TIMING OF IMPLEMENTATION

The Federal Part 59 rule was promulgated on September 11, 1998, and required all regulated products manufactured after December 10, 1998 to meet the VOC content limits specified in the rule.

The OTC Model Rule set a compliance date of January 1, 2005, which was consistent with the date the CARB mid-term measures amendments will become effective. The January 1, 2005 compliance date would allow the limits for most products to take effect in California before becoming effective in the OTR. Although the CARB rule contained a sell-through provision (allows a window during which manufacturers and distributors may continue to sell products that were produced before a set deadline even if they do not meet the more stringent VOC limits), the OTC Model Rule did not. The sell-through period is simply a safeguard to prevent compliance action for occasional older products remaining on retail shelves. It should be noted, however, that many manufacturers are currently manufacturing products that meet the California and OTC limits. In addition, product inventories turn over quickly. Thus, it seems reasonable that a two-year window creates time for manufacturers to reformulate while continuing to sell their existing products in the MRPO region. As a result, a sell-through period is not necessary and it is anticipated that the full emission reduction potential achieved by adoption of the OTC Model Rule could be realized within two years of adoption of the rule (i.e., 2009).

The CARB 2003 SIP commits to establishing additional emissions limits that would become effective between 2006 and 2010, depending on the product category and allowing for a 3-year sell-through period. If the MRPO states adopted similar requirements, it is unlikely that the majority of emission reductions achieved by adoption of the CARB requirements would be realized by 2009.

COST EFFECTIVENESS AND BASIS

The CARB has estimated the cost of their mid-term measures rule to be \$800 per ton. Since the OTC Model Rule emission limits are based on California's, this value should approximate costs that would be incurred to meet the same limits in the OTC rules.

The CARB calculated the cost effectiveness of CARB Measure CONS-1 (adopted July 20, 2005) to be \$4,800 per ton. The CARB has not yet estimated cost effectiveness for CARB Measure CONS-2 (compliance date of 2010). EPA's AirControlNET database estimates the incremental cost of CARB long-term limits to be \$4,680 per ton.

CONTROL EFFICIENCY, RULE PENETRATION, AND RULE EFFECTIVENESS

Table 2 shows the control factors that will be applied to simulate the effects of the adoption of the OTC Model Rule or the OTC Model Rule plus CARB 2003 SIP limits. We have assumed that rules will be adopted in 2007 and that the rules will allow a 2-year "sell-through" period, with full compliance occurring in 2009. For 2002, the overall emission reduction percentage was obtained from Reference 7 for the seven product categories. The control efficiency (CE) is assumed to be 20 percent for each regulated product. Because emissions will be controlled via reformulations, the EIIP guidance recommends that the rule effectiveness (RE) can be assumed to be 100 percent for all coating types affected by the rule. Since not all products are regulated, the rule penetration (RP) accounts for the percentage of the overall inventory covered by the Federal regulation. Thus, the RP was back-calculated using the overall emission reductions and the CE/RE values.

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For the OTC Model Rule and OTC Model Rule plus CARB 2003 SIP limits control measures, additional subcategories of products will be regulated which will increase the rule penetration. More stringent limits will also apply to already regulated products, which will increase the control efficiency. Only the total emission reduction percentages are readily available for the OTC Model Rule and OTC Model Rule plus CARB 2003 SIP limits. For this reason, we have not assigned specific values for CE and RP for the candidate control measures, but rather will use the overall emission reduction percentage when creating the control factor files in RPO data exchange format.

TABLE 2 – CONTROL FACTORS BY YEAR AND CONTROL MEASURE

Year	Control Measure	CE	RP	RE	Emission Reduction % from Uncontrolled
2002 (Base) and 2003-2008	Federal Part 59 rule:				
	Personal Care Products	20	60.6	100	12.11
	Household Products	20	54.7	100	10.94
	Auto Aftermarket Products	20	44.8	100	8.97
	Adhesives and Sealants	20	41.5	100	8.30
	FIFRA-regulated Products	20	25.4	100	5.08
	Coatings and Related Products	20	0.0	100	0.00
	Misc. Products	20	0.0	100	0.00
	All Products	20	40.0	100	7.96
2009-2018	Federal Part 59 rule plus OTC Model Rule: All Products	Not known	Not known	100	21.0
2009-2018	Federal Part 59 rule plus OTC Model Rule plus CARB 2003 SIP limits: All Products	Not known	Not known	100	30.9

RULE DEVELOPMENT ISSUES

The Federal Part 59 rule in no way prevents states from adopting more stringent VOC content limits. In California, more stringent regulations have been in place since 2000. Many of the OTC states have or will soon adopt the OTC Model Rule. The MRPO states could use the OTC Model Rule as a framework for developing state-specific regulations.

GEOGRAPHIC APPLICABILITY

In an effort to maintain consistency and uniformity for the manufacturers of consumer products, it is preferable that any rules specifying more stringent VOC limits (whether the OTC Model Rule or the CARB 2003 SIP commitments) be implemented across the MRPO region. Thus, emission reductions would be realized in both ozone attainment and nonattainment counties.

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TEMPORAL APPLICABILITY

Emission reductions would be realized throughout the year.

AFFECTED SCCs

24-60-000-000	All Consumer and Commercial Products
24-60-100-000	All Personal Care Products
24-60-200-000	All Household Products
24-60-400-000	All Automotive Aftermarket Products
24-60-500-000	All Coatings and Related Products
24-60-600-000	All Adhesives and Sealants
24-60-800-000	All FIFRA Related Products
24-60-900-000	Miscellaneous Products (Not Otherwise Covered)
24-65-000-000	All Products/Processes

OTHER IMPACTS

CARB examined the potential effect of consumer product regulations on global warming, stratospheric ozone protection, use of toxic air contaminants, water quality, and solid waste disposal. No significant adverse environmental impacts have been identified.

REFERENCES

1. STAPPA/ALAPCO. *Meeting the 15-Percent Rate-of-Progress Requirement Under the Clean Air Act: A Menu of Options*. September 1993.
2. California Air Resources Board. *Proposed 2003 State and Federal Strategy for the California State Implementation Plan, Section III: Consumer Products, Vapor Recovery, and Pesticides*. August 25, 2003.
3. E.H. Pechan & Associates, Inc. *Control Measure Development Support Analysis of Ozone Transport Commission Model Rules*. March 31, 2001.
4. E.H. Pechan & Associates, Inc. *AirControlNET Version 3.2, Documentation Report*. September 2003.
5. California Air Resources Board. *Initial Statement of Reasons for the Proposed Amendments to the California Aerosol Coating Products, Antiperspirants and Deodorants, and Consumer Product Regulations*. May 7, 2004.
6. Eastern Research Group. *Emission Inventory Improvement Program, Consumer and Commercial Solvent Use, Volume III, Chapter 5*. August 1996.
7. E.H. Pechan & Associates, Inc. *Development of Growth and Control Factors for Lake Michigan Air Directors Consortium*. December 14, 2004.

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Designation: D 86 – 07b

An American National Standard

Standard Test Method for Distillation of Petroleum Products at Atmospheric Pressure¹

This standard is issued under the fixed designation D 86; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This test method covers the atmospheric distillation of petroleum products using a laboratory batch distillation unit to determine quantitatively the boiling range characteristics of such products as light and middle distillates, automotive spark-ignition engine fuels, automotive spark-ignition engine fuels containing up to 10 % ethanol, aviation gasolines, aviation turbine fuels, 1-D and 2-D diesel fuels, biodiesel blends up to 20 %, marine fuels, special petroleum spirits, naphthas, white spirits, kerosines, and Grades 1 and 2 burner fuels.

1.2 The test method is designed for the analysis of distillate fuels; it is not applicable to products containing appreciable quantities of residual material.

1.3 This test method covers both manual and automated instruments.

1.4 Unless otherwise noted, the values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information only.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 All standards are subject to revision, and parties to agreement on this test method are to apply the most recent edition of the standards indicated below, unless otherwise specified, such as in contractual agreements or regulatory rules where earlier versions of the method(s) identified may be required.

2.2 ASTM Standards:²

- D 97 Test Method for Pour Point of Petroleum Products
- D 323 Test Method for Vapor Pressure of Petroleum Products (Reid Method)
- D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products
- D 4177 Practice for Automatic Sampling of Petroleum and Petroleum Products
- D 4953 Test Method for Vapor Pressure of Gasoline and Gasoline-Oxygenate Blends (Dry Method)
- D 5190 Test Method for Vapor Pressure of Petroleum Products (Automatic Method)
- D 5191 Test Method for Vapor Pressure of Petroleum Products (Mini Method)
- D 5842 Practice for Sampling and Handling of Fuels for Volatility Measurement
- D 5949 Test Method for Pour Point of Petroleum Products (Automatic Pressure Pulsing Method)
- D 5950 Test Method for Pour Point of Petroleum Products (Automatic Tilt Method)
- D 5985 Test Method for Pour Point of Petroleum Products (Rotational Method)
- D 6300 Practice for Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products and Lubricants
- E 1 Specification for ASTM Liquid-in-Glass Thermometers
- E 77 Test Method for Inspection and Verification of Thermometers
- E 1272 Specification for Laboratory Glass Graduated Cylinders
- E 1405 Specification for Laboratory Glass Distillation Flasks

2.3 Energy Institute Standards:³

- IP 69 Determination of Vapour Pressure—Reid Method

¹ This test method is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.08 on Volatility.

In the IP, the equivalent test method is published under the designation IP 123. It is under the jurisdiction of the Standardization Committee.

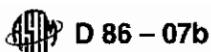
Current edition approved Nov. 15, 2007. Published January 2008. Originally approved in 1921. Last previous edition approved in 2007 as D 86-07a.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from Energy Institute, 61 New Cavendish St., London, W1G 7AR, U.K., <http://www.energyinst.org.uk>.

*A Summary of Changes section appears at the end of this standard.

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D 86 - 07b

TABLE 1 Preparation of Apparatus

	Group 1	Group 2	Group 3	Group 4
Flask, mL	125	125	125	125
ASTM distillation thermometer	7C (7F)	7C (7F)	7C (7F)	8C (8F)
IP distillation thermometer range	low	low	low	high
Flask support board	B	B	C	C
diameter of hole, mm	38	38	50	50
Temperature at start of test				
Flask °C	13–18	13–18	13–18	not above
°F	55–65	55–65	55–65	ambient
Flask support and shield	not above	not above	not above	
	ambient	ambient	ambient	
Receiving cylinder and sample				
°C	13–18	13–18	13–18 ^A	13–ambient ^A
°F	55–65	55–65	55–65 ^A	55–ambient ^A

^A See 10.3.1.1 for exceptions.

IP 123 Petroleum Products—Determination of Distillation Characteristics

IP 394 Determination of Air Saturated Vapour Pressure

IP Standard Methods for Analysis and Testing of Petroleum and Related Products 1996—Appendix A

3. Terminology

3.1 Definitions:

3.1.1 *charge volume, n*—the volume of the specimen, 100 mL, charged to the distillation flask at the temperature specified in Table 1.

3.1.2 *decomposition, n*—of a hydrocarbon, the pyrolysis or cracking of a molecule yielding smaller molecules with lower boiling points than the original molecule.

3.1.2.1 *Discussion*—Characteristic indications of thermal decomposition are evolution of fumes and erratic temperature readings that usually decrease after any attempt is made to adjust the heat.

3.1.3 *decomposition point, n*—the corrected thermometer reading that coincides with the first indications of thermal decomposition of the liquid in the flask.

3.1.3.1 *Discussion*—The decomposition point, as determined under the conditions of this test method, does not necessarily correspond to the decomposition temperature in other applications.

3.1.4 *dry point, n*—the corrected thermometer reading that is observed at the instant the last drop of liquid (exclusive of any drops or film of liquid on the side of the flask or on the temperature sensor), evaporates from the lowest point in the distillation flask.

3.1.4.1 *Discussion*—The end point (final boiling point), rather than the dry point, is intended for general use. The dry point can be reported in connection with special purpose naphthas, such as those used in the paint industry. Also, it is substituted for the end point (final boiling point) whenever the sample is of such a nature that the precision of the end point (final boiling point) cannot consistently meet the requirements given in the precision section.

3.1.5 *dynamic holdup, n*—the amount of material present in the neck of the flask, in the sidearm of the flask, and in the condenser tube during the distillation.

3.1.6 *emergent stem effect, n*—the offset in temperature reading caused by the use of total immersion mercury-in-glass thermometers in the partial immersion mode.

3.1.6.1 *Discussion*—In the partial immersion mode, a portion of the mercury thread, that is, the emergent portion, is at a lower temperature than the immersed portion, resulting in a shrinkage of the mercury thread and a lower temperature reading.

3.1.7 *end point (EP) or final boiling point (FBP), n*—the maximum corrected thermometer reading obtained during the test.

3.1.7.1 *Discussion*—This usually occurs after the evaporation of all liquid from the bottom of the flask. The term maximum temperature is a frequently used synonym.

3.1.8 *front end loss, n*—loss due to evaporation during transfer from receiving cylinder to distillation flask, vapor loss during the distillation, and uncondensed vapor in the flask at the end of the distillation.

3.1.9 *initial boiling point (IBP), n*—the corrected thermometer reading that is observed at the instant the first drop of condensate falls from the lower end of the condenser tube.

3.1.10 *percent evaporated, n*—the sum of the percent recovered and the percent loss.

3.1.11 *percent loss (or observed loss), n*—one hundred minus the percent total recovery.

3.1.11.1 *corrected loss, n*—percent loss corrected for barometric pressure.

3.1.12 *percent recovered, n*—the volume of condensate observed in the receiving cylinder, expressed as a percentage of the charge volume, associated with a simultaneous temperature reading.

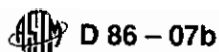
3.1.13 *percent recovery, n*—the maximum percent recovered, as observed in accordance with 10.18.

3.1.13.1 *corrected percent recovery, n*—the percent recovery, adjusted for the difference between the observed loss and the corrected loss, as described in Eq 8.

3.1.13.2 *percent total recovery, n*—the combined percent recovery and residue in the flask, as determined in accordance with 11.1.

3.1.14 *percent residue, n*—the volume of residue in the flask, measured in accordance with 10.19, and expressed as a percentage of the charge volume.

3.1.15 *rate of change (or slope), n*—the change in temperature reading per percent evaporated or recovered, as described in 13.2.



3.1.16 *temperature lag, n*—the offset between the temperature reading obtained by a temperature sensing device and the true temperature at that time.

3.1.17 *temperature measurement device, n*—a thermometer, as described in 6.3.1, or a temperature sensor, as described in 6.3.2.

3.1.18 *temperature reading, n*—the temperature obtained by a temperature measuring device or system that is equal to the thermometer reading described in 3.1.19.

3.1.18.1 *corrected temperature reading, n*—the temperature reading, as described in 3.1.18, corrected for barometric pressure.

3.1.19 *thermometer reading (or thermometer result), n*—the temperature of the saturated vapor measured in the neck of the flask below the vapor tube, as determined by the prescribed thermometer under the conditions of the test.

3.1.19.1 *corrected thermometer reading, n*—the thermometer reading, as described in 3.1.19, corrected for barometric pressure.

4. Summary of Test Method

4.1 Based on its composition, vapor pressure, expected IBP or expected EP, or combination thereof, the sample is placed in one of four groups. Apparatus arrangement, condenser temperature, and other operational variables are defined by the group in which the sample falls.

4.2 A 100-mL specimen of the sample is distilled under prescribed conditions for the group in which the sample falls. The distillation is performed in a laboratory batch distillation unit at ambient pressure under conditions that are designed to provide approximately one theoretical plate fractionation. Systematic observations of temperature readings and volumes of condensate are made, depending on the needs of the user of the data. The volume of the residue and the losses are also recorded.

4.3 At the conclusion of the distillation, the observed vapor temperatures can be corrected for barometric pressure and the data are examined for conformance to procedural requirements, such as distillation rates. The test is repeated if any specified condition has not been met.

4.4 Test results are commonly expressed as percent evaporated or percent recovered versus corresponding temperature, either in a table or graphically, as a plot of the distillation curve.

5. Significance and Use

5.1 The basic test method of determining the boiling range of a petroleum product by performing a simple batch distillation has been in use as long as the petroleum industry has existed. It is one of the oldest test methods under the jurisdiction of ASTM Committee D02, dating from the time when it was still referred to as the Engler distillation. Since the test method has been in use for such an extended period, a tremendous number of historical data bases exist for estimating end-use sensitivity on products and processes.

5.2 The distillation (volatility) characteristics of hydrocarbons have an important effect on their safety and performance, especially in the case of fuels and solvents. The boiling range gives information on the composition, the properties, and the

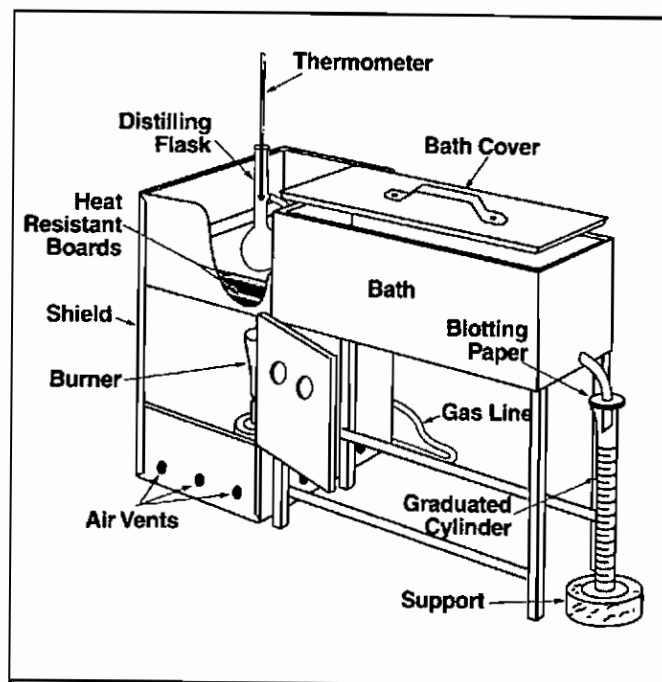


FIG. 1 Apparatus Assembly Using Gas Burner

behavior of the fuel during storage and use. Volatility is the major determinant of the tendency of a hydrocarbon mixture to produce potentially explosive vapors.

5.3 The distillation characteristics are critically important for both automotive and aviation gasolines, affecting starting, warm-up, and tendency to vapor lock at high operating temperature or at high altitude, or both. The presence of high boiling point components in these and other fuels can significantly affect the degree of formation of solid combustion deposits.

5.4 Volatility, as it affects rate of evaporation, is an important factor in the application of many solvents, particularly those used in paints.

5.5 Distillation limits are often included in petroleum product specifications, in commercial contract agreements, process refinery/control applications, and for compliance to regulatory rules.

6. Apparatus

6.1 Basic Components of the Apparatus:

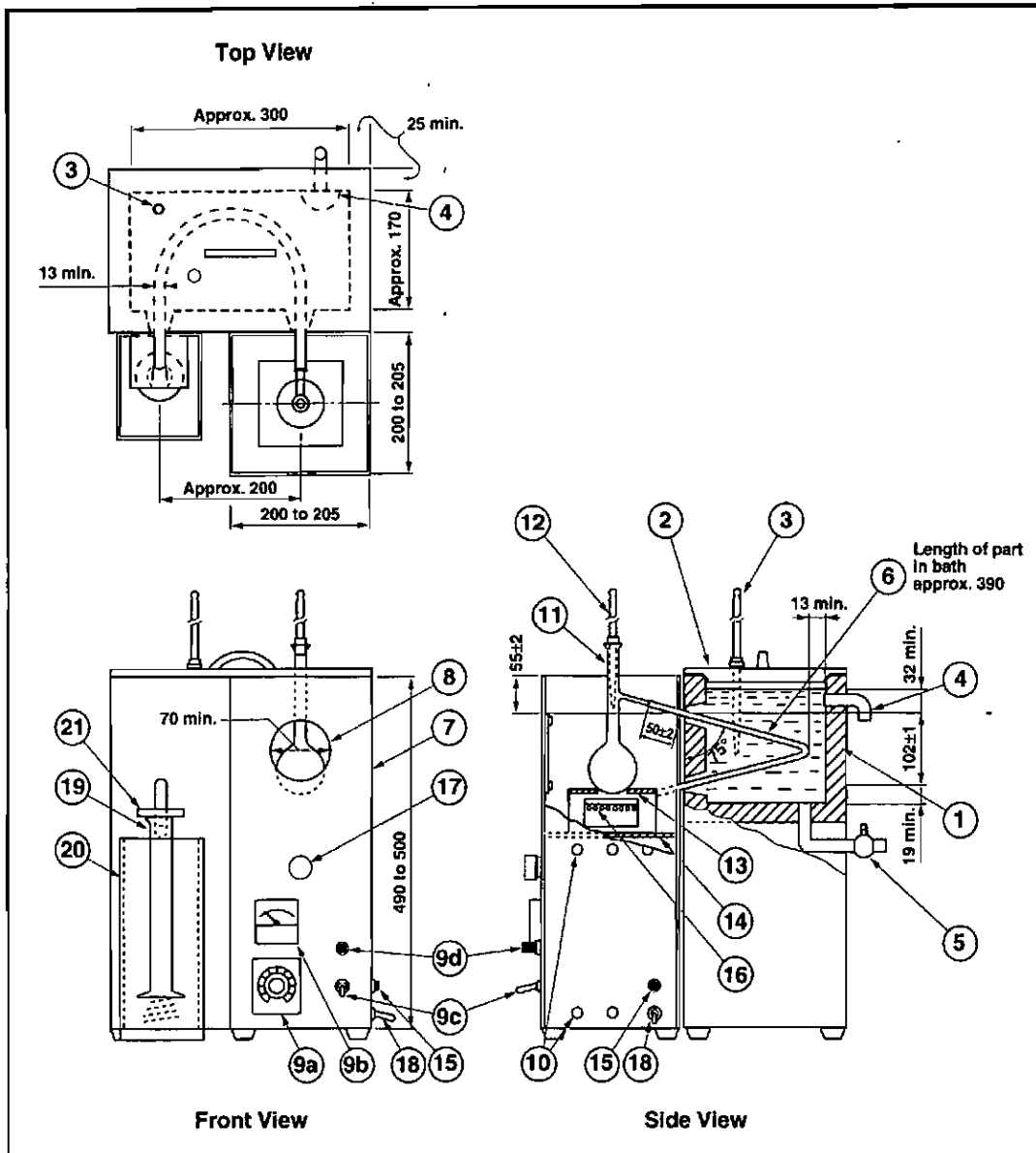
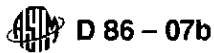
6.1.1 The basic components of the distillation unit are the distillation flask, the condenser and associated cooling bath, a metal shield or enclosure for the distillation flask, the heat source, the flask support, the temperature measuring device, and the receiving cylinder to collect the distillate.

6.1.2 Figs. 1 and 2 are examples of manual distillation units.

6.1.3 In addition to the basic components described in 6.1.1, automated units also are equipped with a system to measure and automatically record the temperature and the associated recovered volume in the receiving cylinder.

6.2 A detailed description of the apparatus is given in Annex A2.

6.3 Temperature Measuring Device:



- | | |
|---------------------------|---|
| 1-Condenser bath | 11-Distillation flask |
| 2-Bath cover | 12-Temperature sensor |
| 3-Bath temperature sensor | 13-Flask support board |
| 4-Bath overflow | 14-Flask support platform |
| 5-Bath drain | 15-Ground connection |
| 6-Condenser tube | 16-Electric heater |
| 7-Shield | 17-Knob for adjusting level of support platform |
| 8-Viewing window | 18-Power source cord |
| 9a-Voltage regulator | 19-Receiver cylinder |
| 9b-Voltmeter or ammeter | 20-Receiver cooling bath |
| 9c-Power switch | 21-Receiver cover |
| 9d-Power light indicator | |
| 10-Vent | |

FIG. 2 Apparatus Assembly Using Electric Heater

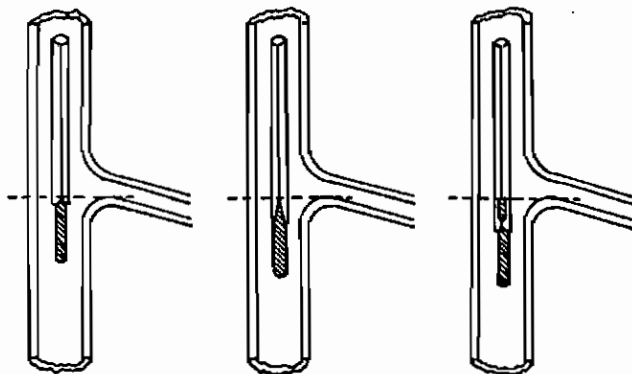
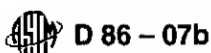


FIG. 5 Position of Thermometer in Distillation Flask

TABLE 2 Group Characteristics

	Group 1	Group 2	Group 3	Group 4
Sample characteristics				
Distillate type				
Vapor pressure at 37.8°C, kPa	≥65.5	<65.5	<65.5	<65.5
100°F, psi	≥9.5	<9.5	<9.5	<9.5
(Test Methods D 323, D 4953, D 5190, D 5191, D 5482, IP 69 or IP 394)				
Distillation, IBP °C			≤100	>100
°F			≤212	>212
EP °C	≤250	≤250	>250	>250
°F	≤482	≤482	>482	>482

temperature, the sample shall be drawn into a bottle prechilled to below 10°C, in such a manner that agitation is kept at a minimum. Close the bottle immediately with a tight-fitting closure. (**Warning**—Do not completely fill and tightly seal a cold bottle of sample because of the likelihood of breakage on warming.)

7.2.1.2 *Groups 2, 3, and 4*—Collect the sample at ambient temperature. After sampling, close the sample bottle immediately with a tight-fitting closure.

7.2.1.3 If the sample received by the testing laboratory has been sampled by others and it is not known whether sampling has been performed as described in 7.2, the sample shall be assumed to have been so sampled.

7.3 *Sample Storage:*

7.3.1 If testing is not to start immediately after collection, store the samples as indicated in 7.3.2, 7.3.3, and Table 3. All samples shall be stored away from direct sunlight or sources of direct heat.

7.3.2 *Group 1*—Store the sample at a temperature below 10°C.

NOTE 6—If there are no, or inadequate, facilities for storage below 10°C, the sample may also be stored at a temperature below 20°C, provided the operator ensures that the sample container is tightly closed and leak-free.

7.3.3 *Group 2*—Store the sample at a temperature below 10°C.

NOTE 7—If there are no, or inadequate, facilities for storage below 10°C, the sample may also be stored at a temperature below 20°C, provided the operator ensures that the sample container is tightly closed and leak-free.

7.3.4 *Groups 3 and 4*—Store the sample at ambient or lower temperature.

7.4 *Sample Conditioning Prior to Analysis:*

7.4.1 Samples shall be conditioned to the temperature shown in Table 3 before opening the sample container.

7.4.1.1 *Groups 1 and 2*—Samples shall be conditioned to a temperature of less than 10°C (50°F) before opening the sample container.

7.4.1.2 *Groups 3 and 4*—If the sample is not fluid at ambient temperature, it is to be heated to a temperature of 9 to 21°C above its pour point (Test Method D 97, D 5949, or D 5985) prior to analysis. If the sample has partially or completely solidified during storage, it shall be vigorously shaken after melting prior to opening the sample container to ensure homogeneity.

7.4.1.3 If the sample is not fluid at room temperature, the temperature ranges shown in Table 3 for the flask and for the sample do not apply.

7.5 *Wet Samples:*

7.5.1 Samples of materials that visibly contain water are not suitable for testing. If the sample is not dry, obtain another sample that is free from suspended water.

7.5.2 *Groups 1 and 2*—If such a sample cannot be obtained, the suspended water can be removed by maintaining the sample at 0 to 10°C, adding approximately 10 g of anhydrous sodium sulfate per 100 mL of sample, shaking the mixture for approximately 2 min, and then allowing the mixture to settle for approximately 15 min. Once the sample shows no visible signs of water, use a decanted portion of the sample, maintained between 1 and 10°C, for the analysis. Note in the report that the sample has been dried by the addition of a desiccant.

NOTE 8—Suspended water in hazy samples in Groups 1 and 2 can be removed by the addition of anhydrous sodium sulfate and separating the liquid sample from the drying agent by decanting without statistically affecting the results of the test.⁴

7.5.3 *Groups 3 and 4*—In cases in which a water-free sample is not practical, the suspended water can be removed by shaking the sample with anhydrous sodium sulfate or other suitable drying agent and separating it from the drying agent by decanting. Note in the report that the sample has been dried by the addition of a desiccant.

8. *Preparation of Apparatus*

8.1 Refer to Table 1 and prepare the apparatus by choosing the appropriate distillation flask, temperature measuring device, and flask support board, as directed for the indicated group. Bring the temperature of the receiving cylinder, the flask, and the condenser bath to the indicated temperature.

8.2 Make any necessary provisions so that the temperature of the condenser bath and the receiving cylinder will be maintained at the required temperatures. The receiving cylinder shall be in a bath such that either the liquid level is at least as high as the 100-mL mark or the entire receiving cylinder is surrounded by an air circulation chamber.

⁴ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D02-1455.

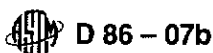


TABLE 3 Sampling, Storage, and Sample Conditioning

		Group 1	Group 2	Group 3	Group 4
Temperature of sample bottle	°C	<10			
	°F	<50			
Temperature of stored sample	°C	<10 ^A	<10	ambient	ambient
	°F	<50 ^A	<50	ambient	ambient
Temperature of sample after conditioning prior to analysis	°C	<10	<10	Ambient or 9 to 21°C above pour point ^B	Ambient or Ambient or
	°F	<50	<50	Ambient or 48 to 70°F above pour point ^D	Ambient or Ambient or
If sample is wet		resample	resample		
If resample is still wet ^C		dry in accordance with 7.5.2			dry in accordance with 7.5.3

^A Under certain circumstances, samples can also be stored at temperatures below 20°C (68°F). See also 7.3.2 and 7.3.3.

^B If sample is (semi)-solid at ambient temperature, see also 10.3.1.1.

^C If sample is known to be wet, resampling may be omitted. Dry sample in accordance with 7.5.2 and 7.5.3.

8.2.1 *Groups 1, 2, and 3*—Suitable media for low temperature baths include, but are not limited to, chopped ice and water, refrigerated brine, and refrigerated ethylene glycol.

8.2.2 *Group 4*—Suitable media for ambient and higher bath temperatures include, but are not limited to, cold water, hot water, and heated ethylene glycol.

8.3 Remove any residual liquid in the condenser tube by swabbing with a piece of soft, lint-free cloth attached to a cord or wire.

9. Calibration and Standardization

9.1 *Temperature Measurement System*—Temperature measurement systems using other than the specified mercury-in-glass thermometers shall exhibit the same temperature lag, emergent stem effect, and accuracy as the equivalent mercury-in-glass thermometer. Confirmation of the calibration of these temperature measuring systems shall be made at intervals of not more than six months, and after the system has been replaced or repaired.

9.1.1 The accuracy and the calibration of the electronic circuitry or computer algorithms, or both, shall be verified by the use of a standard precision resistance bench. When performing this verification, no algorithms shall be used to correct the temperature for lag and the emergent stem effect (see manufacturer's instructions).

9.1.2 Verification of the calibration of temperature measuring devices shall be conducted by distilling toluene in accordance with Group 1 of this test method and comparing the 50 % recovered temperature with that shown in Table 4.⁵

9.1.2.1 If the temperature reading is not within the values shown in Table 4 for the respective apparatus being used (see Note 10 and Table 4), the temperature measurement system shall be considered defective and shall not be used for the test.

NOTE 9—Toluene is used as a verification fluid for calibration; it will yield almost no information on how well an electronic measurement system simulates the temperature lag of a liquid-in-glass thermometer.

9.1.2.2 Reagent grade toluene and hexadecane (cetane), conforming to the specifications of the Committee on Analyti-

cal Reagents of the American Chemical Society,⁶ shall be used. However, other grades may also be used, provided it is first ascertained that the reagent is of sufficient purity to permit its use without lessening the accuracy of the determination.

NOTE 10—At 101.3 kPa, toluene is shown in reference manuals as boiling at 110.6°C when measured using a partial immersion thermometer. Because this test method uses thermometers calibrated for total immersion, the results typically will be lower and, depending on the thermometer and the situation, may be different for each thermometer. At 101.3 kPa, hexadecane is shown in reference manuals as boiling at 287.0°C when measured using a partial immersion thermometer. Because this test method uses thermometers calibrated for total immersion, the results typically will be lower, and, depending on the thermometer and the situation, may be different for each thermometer.

9.1.3 A procedure to determine the magnitude of the temperature lag is described in Annex A3.

9.1.4 A procedure to emulate the emergent stem effect is described in Appendix X4.

9.1.5 To verify the calibration of the temperature measurement system at elevated temperatures, use hexadecane. The temperature measurement system shall indicate, at 50% recovered, a temperature comparable to that shown in Table 4 for the respective apparatus under Group 4 distillation conditions.

NOTE 11—Because of the high melting point of hexadecane, Group 4 verification distillations will have to be carried out with condenser temperatures >20°C.

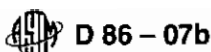
9.2 *Automated Method:*

9.2.1 *Level Follower*—For an automated distillation apparatus, the level follower/recording mechanism of the apparatus shall have a resolution of 0.1 mL or better with a maximum error of 0.3 mL between the 5 and 100 mL points. The calibration of the assembly shall be verified in accordance with manufacturer's instructions at intervals of not more than three months and after the system has been replaced or repaired.

NOTE 12—The typical calibration procedure involves verifying the output with the receiver containing 5 and 100 mL of material respectively.

⁶ *Reagent Chemicals, American Chemical Society Specifications*, American Chemical Society, Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see *Analar Standards for Laboratory Chemicals*, BDH Ltd., Poole, Dorset, U.K., and the *United States Pharmacopeia and National Formulary*, U.S. Pharmacopeial Convention, Inc. (USPC), Rockville, MD.

⁵ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D02-1580.



D 86 - 07b

TABLE 4 True and Min and Max D 86 50 % Recovered Boiling Points (°C)⁴

	ASTM/IP true boiling point	Manual		Automated	
		Distillation conditions min D 86 50 % boiling point	Distillation conditions max D 86 50 % boiling point	Distillation conditions min D 86 50 % boiling point	Distillation conditions max D 86 50 % boiling point
Toluene	110.6	Group 1, 2, and 3	Group 1, 2, and 3	Group 1, 2, and 3	Group 1, 2, and 3
		105.9	111.8	108.5	109.7
Hexadecane	ASTM/IP true boiling point	Group 4	Group 4	Group 4	Group 4
	287.0	272.2	283.1	277.0	280.0

⁴ The manual and automated temperatures show in this table are the values for the 95 % tolerance interval for the 99 % population coverage. The proposed tolerance is approximately $3 \times \sigma$. Information on the values in this table can be found in RR:D02-1580.

9.2.2 *Barometric Pressure*—At intervals of not more than six months, and after the system has been replaced or repaired, the barometric reading of the instrument shall be verified against a barometer, as described in 6.6.

10. Procedure

10.1 Record the prevailing barometric pressure.

10.2 *Groups 1 and 2*—Fit a low range thermometer provided with a snug-fitting cork or stopper of silicone rubber, or equivalent polymeric material, tightly into the neck of the sample container and bring the temperature of the sample to the temperature indicated in Table 1.

10.3 *Groups 1, 2, 3, and 4*—Check that the temperature of the sample is as shown in Table 1. Pour the specimen precisely to the 100-mL mark of the receiving cylinder, and transfer the contents of the receiving cylinder as completely as practical into the distillation flask, ensuring that none of the liquid flows into the vapor tube.

NOTE 13—It is important that the difference between the temperature of the specimen and the temperature of the bath around the receiving cylinder is as small as practically possible. A difference of 5°C can make a difference of 0.7 mL.

10.3.1 *Groups 3 and 4*—If the sample is not fluid at ambient temperature, it is to be heated to a temperature between 9 and 21°C above its pour point (Test Methods D 97, D 5949, D 5950, or D 5985) prior to analysis. If the sample has partially or completely solidified in the intervening period, it shall be vigorously shaken after melting, and prior to sampling, to ensure homogeneity.

10.3.1.1 If the sample is not fluid at ambient temperatures, disregard the temperature range shown in Table 1 for the receiving cylinder and sample. Prior to analysis, heat the receiving cylinder to approximately the same temperature as the sample. Pour the heated specimen precisely to the 100-mL mark of the receiving cylinder, and transfer the contents of the receiving cylinder as completely as practical into the distillation flask, ensuring that none of the liquid flows into the vapor tube.

NOTE 14—Any material that evaporates during the transfer will contribute to the loss; any material that remains in the receiving cylinder will contribute to the observed recovery volume at the time of the IBP.

10.4 If the sample can be expected to demonstrate irregular boiling behavior, that is, bumping, add a few boiling chips to the specimen. The addition of a few boiling chips is acceptable for any distillation.

10.5 Fit the temperature sensor through a snug-fitting device, as described in 6.4, to mechanically center the sensor in the neck of the flask. In the case of a thermometer, the bulb is centered in the neck and the lower end of the capillary is level with the highest point on the bottom of the inner wall of the vapor tube (see Fig. 5). In the case of a thermocouple or resistance thermometer, follow the manufacturer's instructions as to placement (see Fig. 6).

NOTE 15—If vacuum grease is used on the mating surface of the centering device, use the minimum amount of grease that is practical.

10.6 Fit the flask vapor tube, provided with a snug-fitting cork or rubber stopper of silicone, or equivalent polymeric material, tightly into the condenser tube. Adjust the flask in a vertical position so that the vapor tube extends into the condenser tube for a distance from 25 to 50 mm. Raise and adjust the flask support board to fit it snugly against the bottom of the flask.

10.7 Place the receiving cylinder that was used to measure the specimen, without drying the inside of the cylinder, into its temperature-controlled bath under the lower end of the condenser tube. The end of the condenser tube shall be centered in the receiving cylinder and shall extend therein for a distance of at least 25 mm, but not below the 100-mL mark.

10.8 Initial Boiling Point:

10.8.1 *Manual Method*—To reduce evaporation loss of the distillate, cover the receiving cylinder with a piece of blotting paper, or similar material, that has been cut to fit the condenser tube snugly. If a receiver deflector is being used, start the distillation with the tip of the deflector just touching the wall of the receiving cylinder. If a receiver deflector is not used, keep the drip tip of the condenser away from the wall of the receiving cylinder. Note the start time. Observe and record the IBP to the nearest 0.5°C (1.0°F). If a receiver deflector is not being used, immediately move the receiving cylinder so that the tip of the condenser touches its inner wall.

10.8.2 *Automated Method*—To reduce evaporation loss of the distillate, use the device provided by the instrument

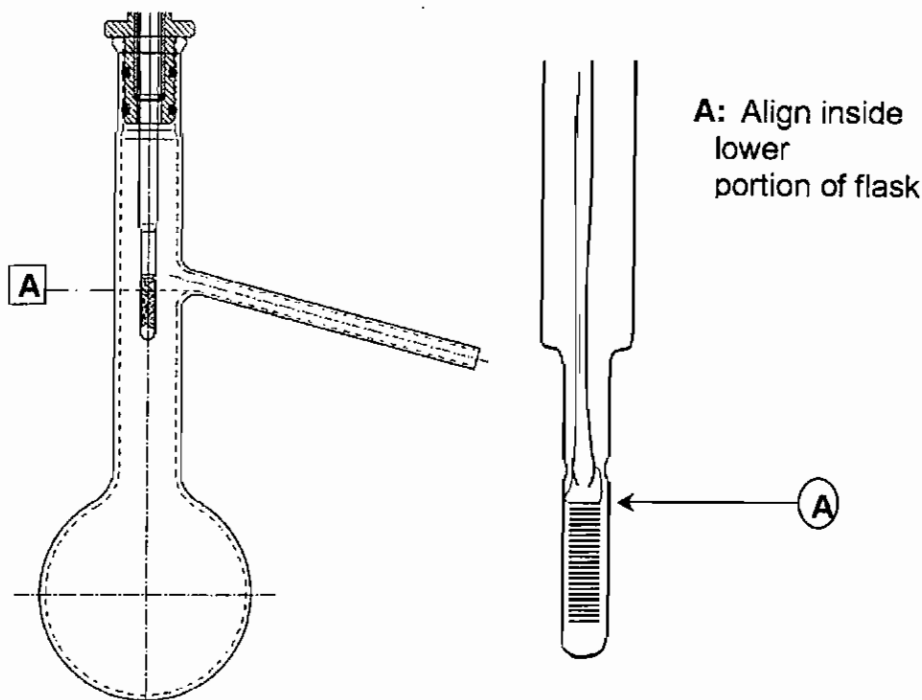
 D 86 - 07b


FIG. 6 Example of One Manufacturer's Recommended Placement of Pt-100 Probe Relative to Distillation Flask Sidearm for Automated D 86 Distillation Instrument

manufacturer for this purpose. Apply heat to the distillation flask and contents with the tip of the receiver deflector just touching the wall of the receiving cylinder. Note the start time. Record the IBP to the nearest 0.1°C (0.2°F).

10.9 Regulate the heating so that the time interval between the first application of heat and the IBP is as specified in Table 5.

10.10 Regulate the heating so that the time from IBP to 5 or 10 % recovered is as indicated in Table 5.

10.11 Continue to regulate the heating so that the uniform average rate of condensation from 5 or 10 % recovered to 5 mL residue in the flask is 4 to 5 mL per min. (**Warning**—Due to the configuration of the boiling flask and the conditions of the test, the vapor and liquid around the temperature sensor are not in thermodynamic equilibrium. The distillation rate will consequently have an effect on the measured vapor temperature. The distillation rate shall, therefore, be kept as constant as possible throughout the test.)

NOTE 16—When testing gasoline samples, it is not uncommon to see the condensate suddenly form non-miscible liquid phases and bead up on the temperature measuring device and in the neck of the boiling flask at a vapor temperature of around 160°C. This may be accompanied by a sharp (about 3°C) dip in the vapor temperature and a drop in the recovery rate. The phenomenon, which may be due to the presence of trace water in the sample, may last for 10 to 30 s before the temperature recovers and the condensate starts flowing smoothly again. This point is sometimes colloquially referred to as the Hesitation Point.

10.12 Repeat any distillation that did not meet the requirements described in 10.9, 10.10, and 10.11.

10.13 If a decomposition point, as described in 3.1.3, is observed, discontinue the heating and proceed as directed in 10.17.

10.14 In the interval between the IBP and the end of the distillation, observe and record data necessary for the calculation and reporting of the results of the test as required by the specification involved, or as previously established for the sample under test. These observed data can include temperature readings at prescribed percentages recovered or percentages recovered at prescribed temperature readings, or both.

10.14.1 *Manual Method*—Record all volumes in the graduated cylinder to the nearest 0.5 mL, and all temperature readings to the nearest 0.5°C (1.0°F).

10.14.2 *Automated Method*—Record all volumes in the receiving cylinder to the nearest 0.1 mL, and all temperature readings to the nearest 0.1°C (0.2°F).

10.14.3 *Group 1, 2, 3, and 4*—In cases in which no specific data requirements have been indicated, record the IBP and the EP (FBP) or the dry point, or both, and temperature readings at 5, 15, 85, and 95 % recovered, and at each 10 % multiple of volume recovered from 10 to 90, inclusive.

10.14.3.1 *Group 4*—When a high range thermometer is used in testing aviation turbine fuels and similar products, pertinent thermometer readings can be obscured by the centering device. If these readings are required, perform a second distillation in accordance with Group 3. In such cases, reading from a low range thermometer can be reported in place of the obscured high range thermometer readings, and the test report



D 86 - 07b

TABLE 5 Conditions During Test Procedure

		Group 1	Group 2	Group 3	Group 4
Temperature of cooling bath ^A	°C	0-1	0-5	0-5	0-60
	°F	32-34	32-40	32-40	32-140
Temperature of bath around receiving cylinder	°C	13-18	13-18	13-18	±3
	°F	55-65	55-65	55-65	±5 of charge temperature
Time from first application of heat to initial boiling point, min		5-10	5-10	5-10	5-15
Time from initial boiling point to 5 % recovered, s		60-100	60-100		
Time from initial boiling point to 10 % recovered, min					
Uniform average rate of condensation from 5 % recovered to 5 mL in flask, mL/min		4-5	4-5	4-5	4-5
Time recorded from 5 mL residue to end point, min		5 max	5 max	5 max	5 max

^A the proper condenser bath temperature will depend upon the wax content of the sample and of its distillation fractions. The test is generally performed using one single condenser temperature. Wax formation in the condenser can be deduced from (a) the presence of wax particles in the distillate coming off the drip tip, (b) a higher distillation loss than what would be expected based on the initial boiling point of the specimen, (c) an erratic recovery rate and (d) the presence of wax particles during the removal of residual liquid by swabbing with a lint-free cloth (see 8.3). The minimum temperature that permits satisfactory operation shall be used. In general, a bath temperature in the 0 to 4°C range is suitable for kerosene, Grade No. 1 fuel oil and Grade No. 1-D diesel fuel oil. In some cases involving Grade No. 2 fuel oil, Grade No. 2-D diesel fuel oil, gas oils and similar distillates, it may be necessary to hold the condenser bath temperature in the 38 to 60°C range.

shall so indicate. If, by agreement, the obscured readings are waived, the test report shall so indicate.

10.14.4 When it is required to report the temperature reading at a prescribed percent evaporated or recovered for a sample that has a rapidly changing slope of the distillation curve in the region of the prescribed percent evaporated or recovered reading, record temperature readings at every 1 % recovered. The slope is considered rapidly changing if the change in slope (C) of the data points described in 10.14.2 in that particular area is greater than 0.6 (change of slope (F) is greater than 1.0) as calculated by Eq 1 (Eq 2).

$$\text{Change of Slope (C)} = \frac{(C_2 - C_1)(V_2 - V_1) - (C_3 - C_2)(V_3 - V_2)}{(V_2 - V_1) - (V_3 - V_2)} \quad (1)$$

$$\text{Change of Slope (F)} = \frac{(F_2 - F_1)(V_2 - V_1) - (F_3 - F_2)(V_3 - V_2)}{(V_2 - V_1) - (V_3 - V_2)} \quad (2)$$

where:

- C₁ = temperature at the volume % recorded one reading prior to the volume % in question, °C,
- C₂ = temperature at the volume % recorded in question, °C,
- C₃ = temperature at the volume % recorded following the volume % in question, °C,
- F₁ = temperature at the volume % recorded one reading prior to the volume % in question, °F,
- F₂ = temperature at the volume % recorded in question, °F,
- F₃ = temperature at the volume % recorded following the volume % in question, °F,
- V₁ = volume % recorded one reading prior to the volume % in question,
- V₂ = volume % recorded at the volume % in question, and
- V₃ = volume % recorded following the volume % in question.

10.15 When the residual liquid in the flask is approximately 5 mL, make a final adjustment of the heat. The time from the 5 mL of liquid residue in the flask to the EP (FBP) shall be

within the limits prescribed in Table 5. If this condition is not satisfied, repeat the test with appropriate modification of the final heat adjustment.

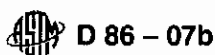
NOTE 17—Since it is difficult to determine when there is 5 mL of boiling liquid left in the flask, this time is determined by observing the amount of liquid recovered in the receiving cylinder. The dynamic holdup has been determined to be approximately 1.5 mL at this point. If there are no front end losses, the amount of 5 mL in the flask can be assumed to correspond with an amount of 93.5 mL in the receiving cylinder. This amount has to be adjusted for the estimated amount of front end loss.

10.15.1 If the actual front end loss differs more than 2 mL from the estimated value, the test shall be rerun.

10.16 Observe and record the EP (FBP) or the dry point, or both, as required, and discontinue the heating.

NOTE 18—Groups 1 and 2, once the final heat adjustment is made, the vapor temperature/thermometer reading will continue to increase. As the distillation nears the end point (final boiling point) the distillation typically achieves dry point first. After the dry point has been achieved the vapor temperature/thermometer reading should continue to increase. The bottom of the flask will be dry but the sides and neck of the flask and the temperature sensor will still have vapor condensate present. The vapor condensate may have the appearance of a white cloud of fumes. This vapor condensate/cloud of fumes should totally engulf the temperature-measuring sensor before the vapor temperature starts to decrease. If these observations do not occur, the end point may not have been reached. It would be advisable to repeat the test adding additional heat to the final heat adjustment. Typically the vapor temperature will continue to rise as the dry point is reached and the vapor cloud engulfs the temperature-measuring sensor. When the end point is near, the rate of temperature increase will slow and level off. Once the endpoint is reached the vapor temperature will start and continue to decrease. If the vapor temperature starts to decrease but then increases and repeats this cycle while the vapor temperature continues to increase you have added too much heat to the final heat adjustment. If this is the case, it would be advisable to repeat the test lowering final heat setting.

Groups 3 and 4, many Group 3 and 4 samples will have the same distillation characteristics in regards to dry point and endpoint as Groups 1 and 2. With samples that contain higher temperature boiling materials it may not be possible to detect a dry point or an end point before the decomposition point occurs.



10.17 Allow the distillate to drain into the receiving cylinder, after heating has been discontinued.

10.17.1 *Manual Method*—While the condenser tube continues to drain into the graduated cylinder, observe and note the volume of condensate to the nearest 0.5 mL at 2 min intervals until two successive observations agree. Measure the volume in the receiving cylinder accurately, and record it to the nearest 0.5 mL.

10.17.2 *Automated Method*—The apparatus shall continually monitor the recovered volume until this volume changes by no more than 0.1 mL in 2 min. Record the volume in the receiving cylinder accurately to the nearest 0.1 mL.

10.18 Record the volume in the receiving cylinder as percent recovery. If the distillation was previously discontinued under the conditions of a decomposition point, deduct the percent recovered from 100, report this difference as the sum of percent residue and percent loss, and omit the procedure given in 10.19.

10.19 After the flask has cooled and no more vapor is observed, disconnect the flask from the condenser, pour its contents into a 5-mL graduated cylinder, and with the flask suspended over the cylinder, allow the flask to drain until no appreciable increase in the volume of liquid in the cylinder is observed. Measure the volume in the graduated cylinder to the nearest 0.1 mL, and record as percent residue.

10.19.1 If the 5-mL graduated cylinder does not have graduations below 1 mL and the volume of liquid is less than 1 mL, refill the cylinder with 1 mL of a heavy oil to allow a better estimate of the volume of the material recovered.

10.19.1.1 If a residue greater than expected is obtained, and the distillation was not purposely terminated before the EP, check whether adequate heat was applied towards the end of the distillation and whether conditions during the test conformed to those specified in Table 5. If not, repeat test.

NOTE 19—The distillation residues of this test method for gasoline, kerosene, and distillate diesel are typically 0.9–1.2, 0.9–1.3, and 1.0–1.4 volume %, respectively.

NOTE 20—The test method is not designed for the analysis of distillate fuels containing appreciable quantities of residual material (see 1.2).

10.19.2 *Groups 1, 2, 3, and 4*—Record the volume in the 5-mL graduated cylinder, to the nearest 0.1 mL, as percent residue.

10.20 If the intent of the distillation is to determine the percent evaporated or percent recovered at a predetermined corrected temperature reading, modify the procedure to conform to the instructions described in Annex A4.

10.21 Examine the condenser tube and the side arm of the flask for waxy or solid deposits. If found, repeat the test after making adjustments described in Footnote A of Table 5.

11. Calculations

11.1 The percent total recovery is the sum of the percent recovery (see 10.18) and the percent residue (see 10.19). Deduct the percent total recovery from 100 to obtain the percent loss.

11.2 Do not correct the barometric pressure for meniscus depression, and do not adjust the pressure to what it would be at sea level.

TABLE 6 Approximate Thermometer Reading Correction

Temperature Range		Correction ^A per 1.3 kPa (10 mm Hg) Difference in Pressure	
°C	°F	°C	°F
10–30	50–86	0.35	0.63
30–50	86–122	0.38	0.68
50–70	122–158	0.40	0.72
70–90	158–194	0.42	0.76
90–110	194–230	0.45	0.81
110–130	230–266	0.47	0.85
130–150	266–302	0.50	0.89
150–170	302–338	0.52	0.94
170–190	338–374	0.54	0.98
190–210	374–410	0.57	1.02
210–230	410–446	0.59	1.07
230–250	446–482	0.62	1.11
250–270	482–518	0.64	1.15
270–290	518–554	0.66	1.20
290–310	554–590	0.69	1.24
310–330	590–626	0.71	1.28
330–350	626–662	0.74	1.33
350–370	662–698	0.76	1.37
370–390	698–734	0.78	1.41
390–410	734–770	0.81	1.46

^A Values to be added when barometric pressure is below 101.3 kPa (760 mm Hg) and to be subtracted when barometric pressure is above 101.3 kPa.

NOTE 21—The observed barometric reading does not have to be corrected to a standard temperature and to standard gravity. Even without performing these corrections, the corrected temperature readings for the same sample between laboratories at two different locations in the world will, in general, differ less than 0.1°C at 100°C. Almost all data obtained earlier have been reported at barometric pressures that have not been corrected to standard temperature and to standard gravity.

11.3 Correct temperature readings to 101.3 kPa (760 mm Hg) pressure. Obtain the correction to be applied to each temperature reading by means of the Sydney Young equation as given in Eq 3, Eq 4, or Eq 5, as appropriate, or by the use of Table 6. For Celsius temperatures:

$$C_c = 0.0009 (101.3 - P_k) (273 + t_c) \quad (3)$$

$$C_c = 0.00012 (760 - P) (273 + t_c) \quad (4)$$

For Fahrenheit temperatures:

$$C_f = 0.00012 (760 - P) (460 + t_f) \quad (5)$$

where:

- t_c = the observed temperature reading in °C,
- t_f = the observed temperature reading in °F,
- C_c and C_f = corrections to be added algebraically to the observed temperature readings,
- P_k = barometric pressure, prevailing at the time and location of the test, kPa, and
- P = barometric pressure, prevailing at the time and location of the test, mm Hg.

After applying the corrections and rounding each result to the nearest 0.5°C (1.0°F) or 0.1°C (0.2°F), as appropriate to the apparatus being used, use the corrected temperature readings in all further calculations and reporting.

NOTE 22—Temperature readings are not corrected to 101.3 kPa (760 mm Hg) when product definitions, specifications, or agreements between the parties involved indicate, specifically, that such correction is not required or that correction shall be made to some other base pressure.



11.4 Correct the actual loss to 101.3 kPa (760 mm Hg) pressure when temperature readings are corrected to 101.3 kPa pressure. The corrected loss, L_c , is calculated from Eq 6 or Eq 7, as appropriate, or can be read from the tables presented as Fig. X3.1 or Fig. X3.2.

$$L_c = 0.5 + (L - 0.5) / \{1 + (101.3 - P_k) / 8.00\} \quad (6)$$

$$L_c = 0.5 + (L - 0.5) / \{1 + (760 - P) / 60.0\} \quad (7)$$

where:

- L = observed loss,
- L_c = corrected loss,
- P_k = pressure, kPa, and
- P = pressure, mm Hg.

NOTE 23—Eq 6 and 7 above have been derived from the data in Table A4.1 and Eqs 5 and 6 in Test Method D 86 - 95 and earlier versions. It is probable that Eq 6 and 7 shown were the original empirical equations from which the table and equations in the Test Method D 86 - 95 and earlier versions were derived.

11.4.1 Calculate the corresponding corrected percent recovery in accordance with the following equation:

$$R_c = R + (L - L_c) \quad (8)$$

where:

- L = percent loss or observed loss,
- L_c = corrected loss,
- R = percent recovery, and
- R_c = corrected percent recovery.

11.5 To obtain the percent evaporated at a prescribed temperature reading, add the percent loss to each of the observed percent recovered at the prescribed temperature readings, and report these results as the respective percent evaporated, that is:

$$P_e = P_r + L \quad (9)$$

where:

- L = observed loss,
- P_e = percent evaporated, and
- P_r = percent recovered.

11.6 To obtain temperature readings at prescribed percent evaporated, and if no recorded temperature data is available within 0.1 volume % of the prescribed percent evaporated, use either of the two following procedures, and indicate on the report whether the arithmetical procedure or the graphical procedure has been used.

11.6.1 *Arithmetical Procedure*—Deduct the observed loss from each prescribed percent evaporated to obtain the corresponding percent recovered. Calculate each required temperature reading as follows:

$$T = T_L + (T_H - T_L) (R - R_L) / (R_H - R_L) \quad (10)$$

where:

- R = percent recovered corresponding to the prescribed percent evaporated,
- R_H = percent recovered adjacent to, and higher than R ,

- R_L = percent recovered adjacent to, and lower than R ,
- T = temperature reading at the prescribed percent evaporated,
- T_H = temperature reading recorded at R_H , and
- T_L = temperature reading recorded at R_L .

Values obtained by the arithmetical procedure are affected by the extent to which the distillation graphs are nonlinear. Intervals between successive data points can, at any stage of the test, be no wider than the intervals indicated in 10.18. In no case shall a calculation be made that involves extrapolation.

11.6.2 *Graphical Procedure*—Using graph paper with uniform subdivisions, plot each temperature reading corrected for barometric pressure, if required (see 11.3), against its corresponding percent recovered. Plot the IBP at 0% recovered. Draw a smooth curve connecting the points. For each prescribed percent evaporated, deduct the distillation loss to obtain the corresponding percent recovered and take from the graph the temperature reading that this percent recovered indicates. Values obtained by graphical interpolation procedures are affected by the care with which the plot is made.

NOTE 24—See Appendix X1 for numerical examples illustrating the arithmetical procedure.

11.6.3 In most automated instruments, temperature-volume data are collected at 0.1 volume % intervals or less and stored in memory. To report a temperature reading at a prescribed percent evaporated, neither of the procedures described in 11.6.1 and 11.6.2 have to be used. Obtain the desired temperature directly from the database as the temperature closest to and within 0.1 volume % of the prescribed percent evaporated.

12. Report

12.1 Report the following information (see Appendix X5 for examples of reports):

12.2 Report the barometric pressure to the nearest 0.1 kPa (1 mm Hg).

12.3 Report all volumetric readings in percentages.

12.3.1 *Manual Method*—Report volumetric readings to the nearest 0.5, and all temperature readings to the nearest 0.5°C (1.0°F).

12.3.2 *Automated Method*—Report volumetric readings to the nearest 0.1, and all temperature readings to the nearest one tenth degree.

12.4 After barometric corrections of the temperature readings have been made, the following data require no further calculation prior to reporting: IBP, dry point, EP (FBP), decomposition point, and all pairs of corresponding values involving percent recovered and temperature readings.

12.4.1 The report shall state if the temperature readings have not been corrected for barometric pressure.

12.5 When the temperature readings have not been corrected to 101.3 kPa (760 mm Hg) pressure, report the percent residue and percent loss as *observed* in accordance with 10.19 and 11.1, respectively.

12.6 Do not use the corrected loss in the calculation of percent evaporated.

12.7 It is advisable to base the report on relationships between temperature readings and percent evaporated when the sample is a gasoline, or any other product classified under



D 86 – 07b

Group 1, or in which the percent loss is greater than 2.0. Otherwise, the report can be based on relationships between temperature readings and percent evaporated or percent recovered. Every report must indicate clearly which basis has been used.

12.7.1 In the manual method, if results are given in percent evaporated versus temperature readings, report if the arithmetical or the graphical procedure was used (see 11.6).

12.8 Report if a drying agent, as described in 7.5.2 or 7.5.3, was used.

12.9 Fig. X1.1 is an example of a tabular report. It shows the percent recovered versus the corresponding temperature reading and versus the corrected temperature reading. It also shows the percent loss, the corrected loss, and the percent evaporated versus the corrected temperature reading.

13. Precision and Bias

13.1 *Precision*—The precision of this test method, as determined by the statistical examination of the interlaboratory test results,⁷ is as follows:

NOTE 25—The precision and bias have been derived according to the group number in the following fashion. Group 1, 2, and 3 samples are labeled as NOT4, and Group 4 samples are labeled GRP4.

NOTE 26—The precision was derived from data produced by automated D 86 apparatus. Typical examples of precision for manual apparatus can be calculated from the information contained in Annex A4 (see A4.9).

13.1.1 *Repeatability*—The difference between successive test results, obtained by the same operator using the same apparatus under constant operating conditions on identical test material, would in the long run, in the normal and correct operation of this test method, exceed the following only in one case in twenty.

NOT4: Refer to Annex A1 for tables of calculated repeatability.
 IBP: $r = 0.0295(E + 51.19)$ valid range: 20 – 70°C
 E10: $r = 1.33$ valid range: 35 – 95°C
 E50: $r = 0.74$ valid range: 65 – 220°C
 E90: $r = 0.00755(E + 59.77)$ valid range: 110 – 245°C
 FBP: $r = 3.33$ valid range: 135 – 260°C

GRP4: Refer to Annex A1 for tables of calculated repeatability.
 IBP: $r = 0.018T$ valid range: 145 – 220°C
 T10: $r = 0.0094T$ valid range: 160 – 265°C
 T50: $r = 0.94$ valid range: 170 – 295°C
 T90: $r = 0.0041T$ valid range: 180 – 340°C
 FBP: $r = 2.2$ valid range: 195 – 365°C

where:

E = evaporated temperature within valid range prescribed, and

T = recovered temperature within valid range prescribed.

NOTE 27—For naphthas, solvents and other similar materials where percent recovered are reported and the percent loss is typically less than one percent, the percent recovered temperatures can be considered

identical to the percent evaporated temperatures and precision can be calculated as shown for NOT4.

13.1.2 *Reproducibility*—The difference between two single and independent test results, obtained by different operators working in different laboratories on identical test material, would in the long run, in normal and correct operation of this test method, exceed the following only in one case in twenty.

NOT4: Refer to Annex A1 for tables of calculated reproducibility.
 IBP: $R = 0.0595(E + 51.19)$ valid range: 20 – 70°C
 E10: $R = 3.20$ valid range: 35 – 95°C
 E50: $R = 1.88$ valid range: 65 – 220°C
 E90: $R = 0.019(E + 59.77)$ valid range: 110 – 245°C
 FBP: $R = 6.78$ valid range: 135 – 260°C

GRP4: Refer to Annex A1 for tables of calculated reproducibility.
 IBP: $R = 0.055T$ valid range: 145 – 220°C
 T10: $R = 0.022T$ valid range: 160 – 265°C
 T50: $R = 2.97$ valid range: 170 – 295°C
 T90: $R = 0.015T$ valid range: 180 – 340°C
 FBP: $R = 7.1$ valid range: 195 – 365°C

where:

E = evaporated temperature within valid range prescribed, and

T = recovered temperature within valid range prescribed.

NOTE 28—For naphthas, solvents and other similar materials where percent recovered are reported and the percent loss is typically less than one percent, the percent recovered temperatures can be considered identical to the percent evaporated temperatures and precision can be calculated as shown for NOT4.

13.2 The precision statements were derived according to Practice D 6300 from a 2005 interlaboratory cooperative test program.⁷ Sixteen laboratories participated and analyzed thirty three sample sets comprised of; specification grade gasolines, some containing up to 10 % ethanol, specification grade diesel, with a B5 and B20 biodiesel, specification grade heating oil, aviation turbine fuels, aviation gasolines, marine fuels, mineral spirits and toluene. The temperature range covered was 23 to 365°C. Information on the type of samples and their average boiling points are in the research report.

NOTE 29—The precision was not determined for one sample of gasoline with high vapor pressure which exhibited high loss, and one sample of aviation turbine fuel doped with gasoline, which is atypical.

13.3 Bias:

13.3.1 *Bias*—Since there is no accepted reference material suitable for determining the bias for the procedure in these test methods, bias has not been determined.

13.3.2 *Relative Bias between Manual and Automated Apparatus*—An interlaboratory study⁵ conducted in 2003 using manual and automated apparatus has concluded that there is no statistical evidence to suggest that there is a bias between manual and automated results.

14. Keywords

14.1 batch distillation; distillates; distillation; laboratory distillation; petroleum products

⁷ Supporting data (results of the 2005 Interlaboratory Cooperative Test Program) have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D02-1621.



ANNEXES

(Mandatory Information)

A1. PRECISION TABLES FOR REPEATABILITY (r) AND REPRODUCIBILITY (R)

A1.1 Tables:

Evaporated IBP Temperature (°C)	r_D86auto	IBP_NOT4 R_D86auto	255	240	5.61
20	2.10	4.24	260	2.44	5.72
25	2.25	4.53	265	2.49	5.83
30	2.40	4.83	Evaporated 50 % Temperature (°C) 65-220	r_D86auto 0.74	E50_NOT4 R_D86auto 1.88
35	2.54	5.13	Recovered 50 % Temperature (°C) 170-295	r_D86auto 0.94	T50_GRP4 R_D86auto 2.97
40	2.69	5.43	Evaporated 90% Temperature (°C) 110	r_D86auto 1.28	E90_NOT4 R_D86auto 3.23
45	2.84	5.72	115	1.32	3.32
50	2.99	6.02	120	1.36	3.42
55	3.13	6.32	125	1.40	3.51
60	3.28	6.62	130	1.43	3.61
65	3.43	6.91	135	1.47	3.70
70	3.58	7.21	140	1.51	3.80
Recovered IBP Temperature (°C)	r_D86auto	IBP_GRP4 R_D86auto	145	1.55	3.89
145	2.61	7.98	150	1.58	3.99
150	2.70	8.25	155	1.62	4.08
155	2.79	8.53	160	1.66	4.18
160	2.88	8.80	165	1.70	4.27
165	2.97	9.08	170	1.73	4.37
170	3.06	9.35	175	1.77	4.46
175	3.15	9.63	180	1.81	4.56
180	3.24	9.90	185	1.85	4.65
185	3.33	10.18	190	1.89	4.75
190	3.42	10.45	195	1.92	4.84
195	3.51	10.73	200	1.96	4.94
200	3.60	11.00	205	2.00	5.03
205	3.69	11.28	210	2.04	5.13
210	3.78	11.55	215	2.07	5.22
215	3.87	11.83	220	2.11	5.32
220	3.96	12.10	225	2.15	5.41
Evaporated 10 % Temperature (°C)	r_D86auto	E10_NOT4 R_D86auto	230	2.19	5.51
35	1.33	3.20	235	2.23	5.60
40	1.33	3.20	240	2.26	5.70
45	1.33	3.20	245	2.30	5.79
50	1.33	3.20	Recovered 90 % Temperature (°C)	r_D86auto	T90_GRP4 R_D86auto
55	1.33	3.20	180	0.74	2.70
60	1.33	3.20	185	0.76	2.78
65	1.33	3.20	190	0.78	2.85
70	1.33	3.20	195	0.80	2.93
75	1.33	3.20	200	0.82	3.00
80	1.33	3.20	205	0.84	3.08
85	1.33	3.20	210	0.86	3.15
90	1.33	3.20	215	0.88	3.23
95	1.33	3.20	220	0.90	3.30
Recovered 10 % Temperature (°C)	r_D86auto	T10_GRP4 R_D86auto	225	0.92	3.38
160	1.50	3.52	230	0.94	3.45
165	1.55	3.63	235	0.96	3.53
170	1.60	3.74	240	0.98	3.60
175	1.65	3.85	245	1.00	3.68
180	1.69	3.96	250	1.03	3.75
185	1.74	4.07	255	1.05	3.83
190	1.79	4.18	260	1.07	3.90
195	1.83	4.29	265	1.09	3.98
200	1.88	4.40	270	1.11	4.05
205	1.93	4.51	275	1.13	4.13
210	1.97	4.62	280	1.15	4.20
215	2.02	4.73	285	1.17	4.28
220	2.07	4.84	290	1.19	4.35
225	2.12	4.95	295	1.21	4.43
230	2.16	5.06	300	1.23	4.50
235	2.21	5.17	305	1.25	4.58
240	2.26	5.28	310	1.27	4.65
245	2.30	5.39			
250	2.35	5.50			



D 86 - 07b

315	1.29	4.73	Evaporated FBP	FBP_NOT4	
320	1.31	4.80	Temperature (°C)	r_D86auto	R_D86auto
325	1.33	4.88	135-260	3.33	6.78
330	1.35	4.95	Recovered FBP	FBP_GRP4	
335	1.37	5.03	Temperature (°C)	r_D86auto	R_D86auto
340	1.39	5.10	195-365	2.2	7.1

A2. DETAILED DESCRIPTION OF APPARATUS

A2.1 Distillation Flasks—Flasks shall be of heat resistant glass, constructed to the dimensions and tolerances shown in Fig. A2.1 and shall otherwise comply with the requirements of Specification E 1405. Flask A (100 mL) may also be constructed with a ground glass joint, in which case the diameter of the neck shall be the same as the 125-mL flask.

NOTE A2.1—For tests specifying dry point, specially selected flasks with bottoms and walls of uniform thickness are desirable.

A2.2 Condenser and Condenser Bath—Typical types of condenser and condenser baths are illustrated in Figs. 1 and 2.

A2.2.1 The condenser shall be made of seamless noncorrosive metal tubing, 560 ± 5 mm in length, with an outside diameter of 14 mm and a wall thickness of 0.8 to 0.9 mm.

NOTE A2.2—Brass or stainless steel has been found to be a suitable material for this purpose.

A2.2.2 The condenser shall be set so that 393 ± 3 mm of the tube is in contact with the cooling medium, with 50 ± 3 mm outside the cooling bath at the upper end, and with 114 ± 3 mm outside at the lower end. The portion of the tube projecting at the upper end shall be set at an angle of $75 \pm 3^\circ$ with the vertical. The portion of the tube inside the condenser bath shall be either straight or bent in any suitable continuous smooth curve. The average gradient shall be $15 \pm 1^\circ$ with respect to the horizontal, with no 10-cm section having a gradient outside of the $15 \pm 3^\circ$ range. The projecting lower portion of the condenser tube shall be curved downward for a length of 76 mm and the lower end shall be cut off at an acute angle. Provisions shall be made to enable the flow of the distillate to run down the side of the receiving cylinder. This can be accomplished by using a drip-deflector, which is attached to the outlet of the tube. Alternatively, the lower portion of the condenser tube can be curved slightly backward to ensure contact with the wall of the receiving cylinder at a point 25 to 32 mm below the top of the receiving cylinder. Fig. A2.3 is a drawing of an acceptable configuration of the lower end of the condenser tube.

A2.2.3 The volume and the design of the bath will depend on the cooling medium employed. The cooling capacity of the bath shall be adequate to maintain the required temperature for the desired condenser performance. A single condenser bath may be used for several condenser tubes.

A2.3 Metal Shield or Enclosure for Flask. (Manual units only).

A2.3.1 Shield for Gas Burner (see Fig. 1)—The purpose of this shield is to provide protection for the operator and yet allow easy access to the burner and to the distillation flask

during operation. A typical shield would be 480-mm high, 280-mm long and 200-mm wide, made of sheet metal of 0.8-mm thickness (22 gauge). The shield shall be provided with at least one window to observe the dry point at the end of the distillation.

A2.3.2 Shield for Electric Heater (see Fig. 2)—A typical shield would be 440-mm high, 200-mm long, and 200-mm wide, made of sheet metal of approximately 0.8-mm thickness (22 gauge) and with a window in the front side. The shield shall be provided with at least one window to observe the dry point at the end of the distillation.

A2.4 Heat Source

A2.4.1 Gas Burner (see Fig. 1), capable of bringing over the first drop from a cold start within the time specified and of continuing the distillation at the specified rate. A sensitive manual control valve and gas pressure regulator to give complete control of heating shall be provided.

A2.4.2 Electric Heater (see Fig. 2), of low heat retention.

NOTE A2.3—Heaters, adjustable from 0 to 1000 W, have been found to be suitable for this purpose.

A2.5 Flask Support

A2.5.1 Type 1—Use a Type 1 flask support with a gas burner (see Fig. 1). This support consists of either a ring support of the ordinary laboratory type, 100 mm or larger in diameter, supported on a stand inside the shield, or a platform adjustable from the outside of the shield. On this ring or platform is mounted a hard board made of ceramic or other heat-resistant material, 3 to 6 mm in thickness, with a central opening 76 to 100 mm in diameter, and outside line dimensions slightly smaller than the inside boundaries of the shield.

A2.5.2 Type 2—Use a Type 2 flask support assembly with electric heating (see Fig. 2 as one example). The assembly consists of an adjustable system onto which the electric heater is mounted with provision for placement of a flask support board (see A2.6) above the electric heater. The whole assembly is adjustable from the outside of the shield.

A2.6 Flask Support Board—The flask support board shall be constructed of ceramic or other heat-resistant material, 3 to 6 mm in thickness. Flask support boards are classified as A, B, or C, based on the size of the centrally located opening, the dimension of which is shown in Table 1. The flask support board shall be of sufficient dimension to ensure that thermal heat to the flask only comes from the central opening and that extraneous heat to the flask other than through the central



opening is minimized. (Warning—Asbestos-containing materials shall not be used in the construction of the flask support board.)

A2.7 The flask support board can be moved slightly in different directions on the horizontal plane to position the distillation flask so that direct heat is applied to the flask only through the opening in this board. Usually, the position of the flask is set by adjusting the length of the side-arm inserted into the condenser.

A2.8 Provision shall be made for moving the flask support assembly vertically so that the flask support board is in direct contact with the bottom of the distillation flask during the distillation. The assembly is moved down to allow for easy mounting and removal of the distillation flask from the unit.

A2.9 Receiving Cylinders—The receiving cylinder shall have a capacity to measure and collect 100 mL. The shape of the base shall be such that the receiver does not topple when placed empty on a surface inclined at an angle of 13° from the horizontal.

A2.9.1 Manual Method—The cylinder shall be graduated at intervals of 1 mL and have a graduation at the 100-mL mark. Construction details and tolerances for the graduated cylinder are shown in Fig. A2.4.

A2.9.2 Automated Method—The cylinder shall conform to the physical specifications described in Fig. A2.4, except that graduations below the 100-mL mark are permitted, as long as they do not interfere with the operation of the level follower. Receiving cylinders for use in automated units may also have a metal base.

A2.9.3 If required, the receiving cylinder shall be immersed during the distillation to above the 100-mL graduation line in a cooling liquid contained in a cooling bath, such as a tall-form beaker of clear glass or transparent plastic. Alternatively, the receiving cylinder may be placed in a thermostated bath air circulation chamber.

A2.10 Residue Cylinder—The graduated cylinder shall have a capacity of 5 or 10 mL, with graduations into 0.1 mL subdivisions, beginning at 0.1 mL. The top of the cylinder may be flared, the other properties shall conform to Specification E 1272.

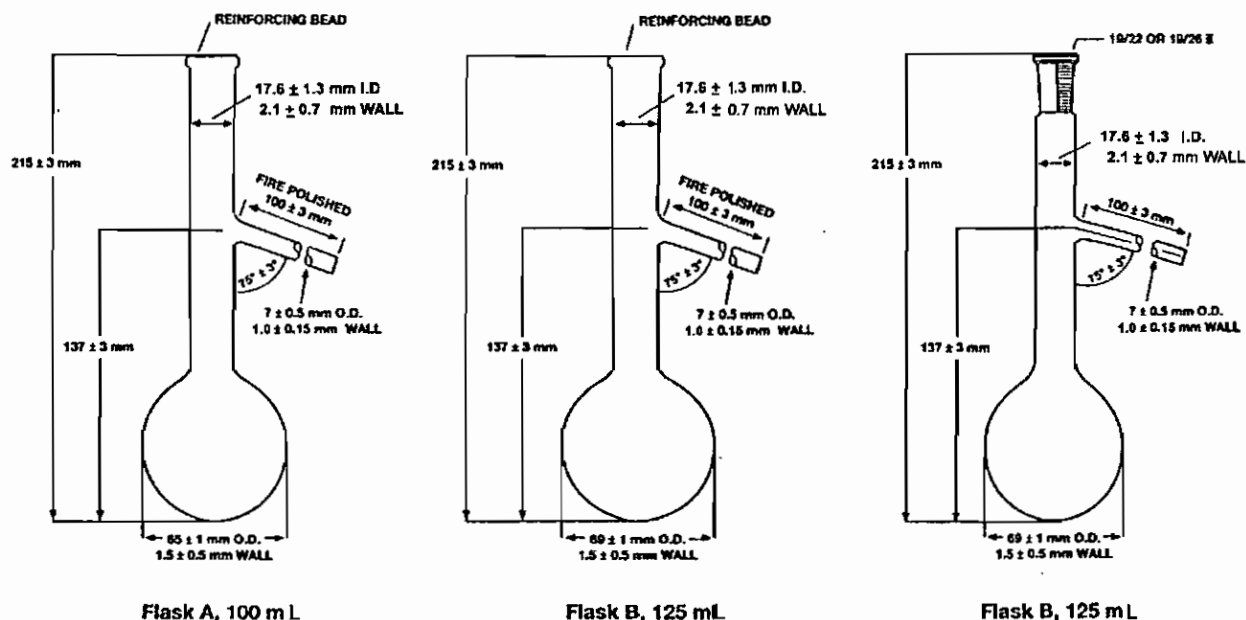


FIG. A2.1 Flask A, 100 mL, Flask B, 125 mL, and Flask B with Ground Glass Joint, 125 mL

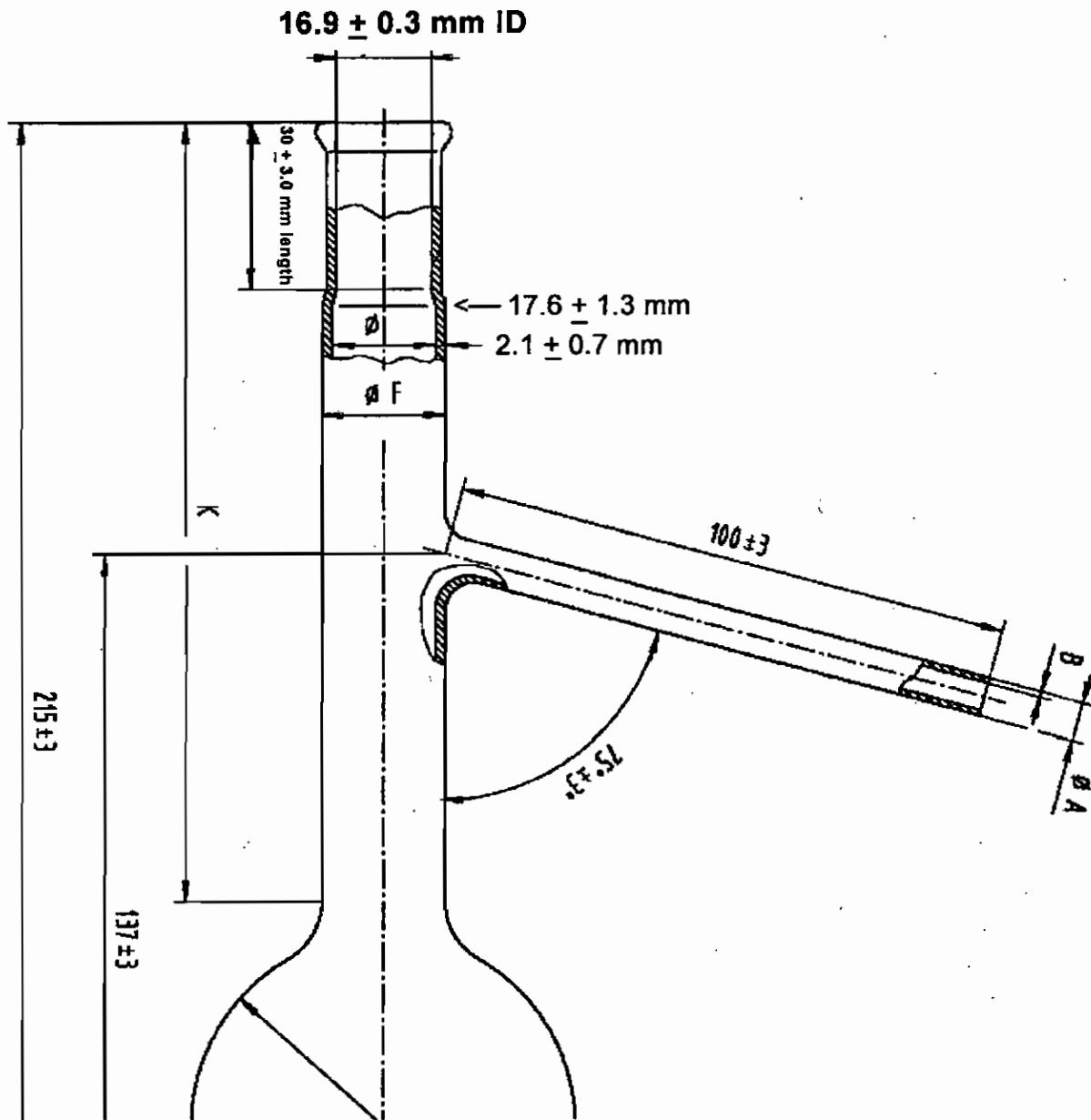
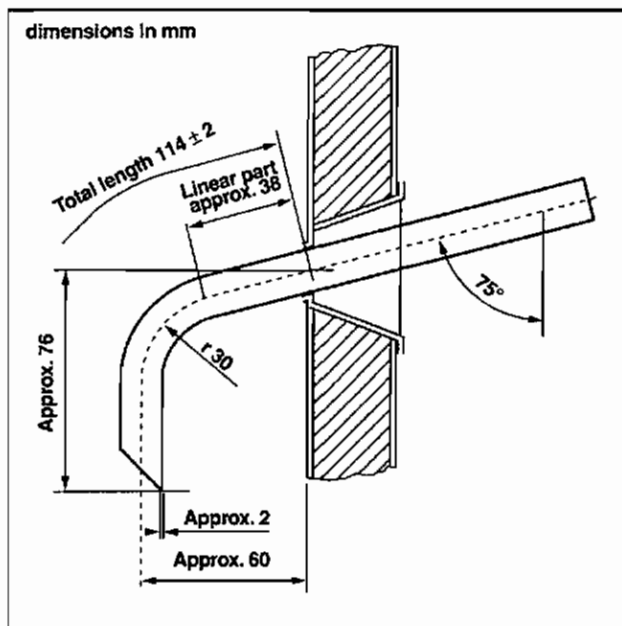
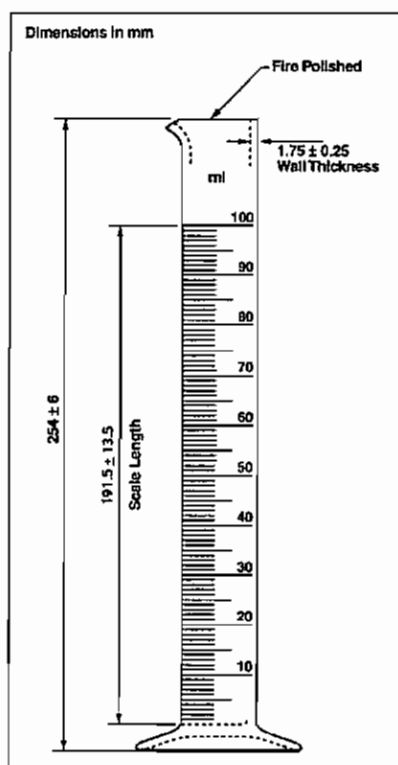


FIG. A2.2 Detail of Upper Neck Section

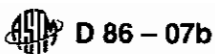
D 86 - 07b



Lower End of Condenser Tube
 FIG. A2.3 Lower End of Condenser Tube



Note—1 to 100 mL in 1 mL graduations; tolerance ± 1.0 mL.
 FIG. A2.4 100 mL Graduated Cylinder



D 86 – 07b

A3. DETERMINATION OF THE DIFFERENCE IN LAG TIME BETWEEN AN ELECTRONIC TEMPERATURE MEASUREMENT SYSTEM AND A MERCURY-IN-GLASS THERMOMETER

A3.1 The response time of an electronic temperature measuring device is inherently more rapid than that of a mercury-in-glass thermometer. The temperature measuring device assembly in general use, consisting of the sensor and its casing, or an electronic system and its associated software, or both, is so designed that the temperature measuring system will simulate the temperature lag of the mercury-in-glass thermometer.

A3.2 To determine the difference in lag time between such a temperature measuring system and a mercury-in-glass thermometer, analyze a sample such as gasoline, kerosene, jet fuel, or light diesel fuel with the electronic temperature measurement system in place and in accordance with the procedures described in this test method. In most cases this is the standard distillation step performed with an automated unit.

A3.2.1 Do not use a single pure compound, a very narrow boiling range product, or a synthetic blend of less than six compounds for this test.

A3.2.2 Best results are obtained with a sample that is typical of the sample load of the laboratory. Alternatively, use a full-range mixture with a 5 to 95 % boiling range of at least 100°C.

A3.3 Replace the electronic temperature measuring device with a low range or a high range mercury-in-glass thermometer, depending on the boiling range of the sample.

A3.4 Repeat the distillation with this thermometer, and manually record the temperature at the various percent recovered as described in 10.14.

A3.5 Calculate the values for the repeatability for the observed slope ($\Delta T/\Delta V$) for the different readings in the test.

A3.6 Compare the test data obtained using these two temperature measuring devices. The difference at any point shall be equal to, or less than, the repeatability of the method at that point. If this difference is larger, replace the electronic temperature measuring device or adjust the electronics involved, or both.

A4. PROCEDURE TO DETERMINE THE PERCENT EVAPORATED OR PERCENT RECOVERED AT A PRESCRIBED TEMPERATURE READING

A4.1 Many specifications require specific percentages evaporated or recovered at prescribed temperature readings, either as maxima, minima, or ranges. The procedures to determine these values are frequently designated by the terms Exxx or Rxxx, where xxx is the desired temperature.

NOTE A4.1—Regulatory standards on the certification of reformulated gasoline under the complex model procedure require the determination of E 200 and E 300, defined as the percent evaporated fuel at 93.3°C (200°F) and 148.9°C (300°F), respectively. E 158, the percent evaporated at a distillation temperature of 70°C (158°F), is also used in describing fuel volatility characteristics. Other typical temperatures are R 200 for kerosenes and R 250 and R 350 for gas oils, where R 200, R 250, and R 350 are the percent recovered fuel at 200°C, 250°C, and 350°C, respectively.

A4.2 Determine the barometric pressure, and calculate the correction to the desired temperature reading using Eq 3, Eq 4, or Eq 5 for $t = xxx^\circ\text{C}$ (or $t_f = xxx^\circ\text{F}$).

A4.2.1 *Manual Method*—Determine this correction to 0.5°C (1°F).

A4.2.2 *Automated Method*—Determine this correction to 0.1°C (0.2°F).

A4.3 Determine the expected temperature reading to yield $xxx^\circ\text{C}$ (or $xxx^\circ\text{F}$) after the barometric correction. To obtain the expected value, add the absolute value of the calculated correction to the desired temperature if the barometric pressure is above 101.3 kPa. If the barometric pressure is below 101.3 kPa, subtract the absolute value of the calculated correction from the desired temperature.

A4.4 Perform the distillation, as described in Section 10,

while taking into account A4.5 and A4.6.

A4.5 Manual Distillation

A4.5.1 In the region between about 10°C below and 10°C above the desired expected temperature reading determined in A4.3 record the temperature reading in intervals of 1 volume %.

A4.5.2 If the intent of the distillation is to solely determine the value of Exxx or Rxxx, discontinue the distillation after at least another 2 mL of distillate have been collected. Otherwise, continue the distillation, as described in Section 10, and determine the observed loss, as described in 11.1.

A4.5.2.1 If the intent of the distillation is to determine the value of Exxx and the distillation was terminated after about 2 mL of distillate was collected beyond the desired temperature, allow the distillate to drain into the receiving graduate. Allow the contents of the flask to cool to below approximately 40°C and then drain its contents into the receiving graduate. Note the volume of product in the receiving graduate to the nearest 0.5 mL at 2 min intervals until two successive observations agree.

A4.5.2.2 The amount recovered in the receiving graduate is the percent recovery. Determine the amount of observed loss by subtracting the percent recovery from 100.0.

A4.6 Automated Distillation

A4.6.1 In the region between about 10°C below and 10°C above the desired expected temperature reading determined in A4.3, collect temperature-volume data at 0.1 volume % intervals or less.



TABLE A4.1 Data Points for Determining Slope, S_C or S_F

Slope at %	IBP	5	10	20	30	40	50	60	70	80	90	95	EP
T_U at %	0	0	0	10	20	30	40	50	60	70	80	90	95
T_L at %	5	10	20	30	40	50	60	70	80	90	90	95	V_{EP}
$V_U - V_L$	5	10	20	20	20	20	20	20	20	20	10	5	$V_{EP} - 95$

A4.6.2 Continue the distillation, as described in Section 10, and determine the percent loss, as described in 11.1.

A4.7 Calculations

A4.7.1 *Manual Method*—If a volume % recovered reading is not available at the exact temperature calculated in A4.3, determine the percent recovered by interpolation between the two adjacent readings. Either the linear, as described in 11.6.1, or the graphical procedure, as described in 11.6.2, is permitted. The percent recovered is equal to R_{xxx} .

A4.7.2 *Automated Method*—Report the observed volume to 0.1 volume % corresponding to the temperature closest to the expected temperature reading. This is the percent recovered, or R_{xxx} .

A4.7.3 *Manual and Automated Methods*—To determine the value of E_{xxx} , add the observed loss to the percent recovered, R_{xxx} , as determined in A4.7.1 or A4.7.2 and as described in Eq 9.

A4.7.3.1 As prescribed in 12.6, do not use the corrected loss.

Precision

A4.8 The statistical determination of the precision of the volume % evaporated or recovered at a prescribed temperature has not been directly measured in an interlaboratory program. It can be shown that the precision of the volume % evaporated or recovered at a prescribed temperature is equivalent to the precision of the temperature measurement at that point divided by the rate of change of temperature versus volume % evaporated or recovered. The estimation of precision becomes less precise at high slope values.

A4.9 Calculate the slope or rate of change in temperature reading, S_C (or S_F), as described in A4.9.1 and Eq A4.1 and using temperature values bracketing the desired temperature.

A4.9.1 *Slope or Rate of Change of Temperature:*

A4.9.1.1 To determine the precision of a result, it is generally necessary to determine the slope or rate of change of the temperature at that particular point. This variable, denoted as S_C or S_F , is equal to the change in temperature, either in °C or in °F, respectively, per percent recovered or evaporated.

A4.9.1.2 The precision of the IBP and EP does not require any slope calculation.

A4.9.1.3 With the exception stated in A4.9.1.2, the slope at any point during the distillation is calculated from the following equations, using the values shown in Table A4.1:

$$S_C \text{ (or } S_F) = (T_U - T_L) / (V_U - V_L) \quad (A4.1)$$

where:

S_C = the slope, °C/volume %,

S_F = the slope, °F/volume %,

T_U = the upper temperature, °C (or °F),

T_L = the lower temperature, °C (or °F),

V_U = the volume % recovered or evaporated corresponding to T_U ,

V_L = the volume % recovered or evaporated corresponding to T_L , and

V_{EP} = the volume % recovered or evaporated corresponding to the end point.

A4.9.1.4 In the event that the distillation end point occurs prior to the 95 % point, the slope at the end point is calculated as follows:

$$S_C \text{ (or } S_F) = (T_{EP} - T_{HR}) / (V_{EP} - V_{HR}) \quad (A4.2)$$

where:

T_{EP} or T_{HR} = the temperature, in °C or °F, at the percent volume recovered indicated by the subscript, and

V_{EP} or V_{HR} = the volume % recovered.

Subscript EP = end point, and

Subscript HR = highest reading, either 80 % or 90 %, prior to the end point.

A4.9.1.5 For points between 10 to 85 % recovered that are not shown in Table A4.1, the slope is calculated as follows:

$$S_C \text{ (or } S_F) = 0.05 (T_{(v+10)} - T_{(v-10)}) \quad (A4.3)$$

A4.9.2 Calculate the repeatability, r , or the reproducibility, R , from the slope, S_C (or S_F) and the data in Tables A4.2-A4.4.

A4.9.3 Determine the repeatability or reproducibility, or both, of the volume % evaporated or recovered at a prescribed temperature from the following formulas:

$$r_{\text{volume \%}} = r / S_C (S_F) \quad (A4.4)$$

$$R_{\text{volume \%}} = R / S_C (S_F) \quad (A4.5)$$

where:

$r_{\text{volume \%}}$ = repeatability of the volume % evaporated or recovered,

$R_{\text{volume \%}}$ = reproducibility of the volume % evaporated or recovered,

r = repeatability of the temperature at the prescribed temperature at the observed percent distilled,

R = reproducibility of the temperature at the prescribed temperature at the observed percent distilled, and

$S_C (S_F)$ = rate of change in temperature reading in °C (°F) per the volume % evaporated or recovered.

A4.9.4 Examples on how to calculate the repeatability and the reproducibility are shown in Appendix X2.

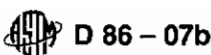


TABLE A4.2 Repeatability and Reproducibility for Group 1

Evaporated Point, %	Manual Repeatability ^A		Manual Reproducibility ^A		Automated Repeatability ^A		Automated Reproducibility ^A	
	°C	°F	°C	°F	°C	°F	°C	°F
IBP	3.3	6	5.6	10	3.9	7	7.2	13
5	1.9+0.86S _C	3.4+0.86S _F	3.1+1.74S _C	5.6+1.74S _F	2.1+0.67S _C	3.8+0.67S _F	4.4+2.0S _C	7.9+2.0S _F
10	1.2+0.86S _C	2.2+0.86S _F	2.0+1.74S _C	3.6+1.74S _F	1.7+0.67S _C	3.0+0.67S _F	3.3+2.0S _C	6.0+2.0S _F
20	1.2+0.86S _C	2.2+0.86S _F	2.0+1.74S _C	3.6+1.74S _F	1.1+0.67S _C	2.0+0.67S _F	3.3+2.0S _C	6.0+2.0S _F
30-70	1.2+0.86S _C	2.2+0.86S _F	2.0+1.74S _C	3.6+1.74S _F	1.1+0.67S _C	2.0+0.67S _F	2.6+2.0S _C	4.7+2.0S _F
80	1.2+0.86S _C	2.2+0.86S _F	2.0+1.74S _C	3.6+1.74S _F	1.1+0.67S _C	2.0+0.67S _F	1.7+2.0S _C	3.0+2.0S _F
90	1.2+0.86S _C	2.2+0.86S _F	0.8+1.74S _C	1.4+1.74S _F	1.1+0.67S _C	2.0+0.67S _F	0.7+2.0S _C	1.2+2.0S _F
95	1.2+0.86S _C	2.2+0.86S _F	1.1+1.74S _C	1.9+1.74S _F	2.5+0.67S _C	4.5+0.67S _F	2.6+2.0S _C	4.7+2.0S _F
FBP	3.9	7	7.2	13	4.4	8	8.9	16

^A S_C or S_F is the average slope (or rate of change) calculated in accordance with A4.9.1. Table A4.2 precision data obtained from RR study on both manual and automated D 86 units by North American and IP laboratories.

TABLE A4.3 Repeatability and Reproducibility for Groups 2, 3 and 4 (Manual Method)

	Repeatability ^A		Reproducibility ^A	
	°C	°F	°C	°F
IBP	1.0+0.35S _C	1.9+0.35S _F	2.8+0.93S _C	5.0+0.93S _F
5-95 %	1.0+0.41S _C	1.8+0.41S _F	1.8+1.33S _C	3.3+1.33S _F
FBP	0.7+0.36S _C	1.3+0.36S _F	3.1+0.42S _C	5.7+0.42S _F
% volume at temperature reading	0.7+0.92/S _C	0.7+1.66/S _F	1.5+1.78/S _C	1.53+3.20/S _F

^A S_C or S_F is the average slope (or rate of change) calculated in accordance with A4.9.1. Table A4.3 has been derived from the monographs in Figs. 6 and 7 in D 86-97.

TABLE A4.4 Repeatability and Reproducibility for Groups 2, 3 and 4 (Automated)

Collected, %	Repeatability ^A		Reproducibility ^A	
	°C	°F	°C	°F
IBP	3.5	6.3	8.5	15.3
2 %	3.5	6.3	2.6 + 1.92S _C	4.7 + 1.92S _F
5 %	1.1 + 1.08S _C	2.0 + 1.08S _F	2.0 + 2.53S _C	3.6 + 2.53S _F
10 %	1.2 + 1.42S _C	2.2 + 1.42S _F	3.0 + 2.64S _C	5.4 + 2.64S _F
20-70 %	1.2 + 1.42S _C	2.2 + 1.42S _F	2.9 + 3.97S _C	5.2 + 3.97S _F
80 %	1.2 + 1.42S _C	2.2 + 1.42S _F	3.0 + 2.64S _C	5.4 + 2.64S _F
90-95 %	1.1 + 1.08S _C	2.0 + 1.08S _F	2.0 + 2.53S _C	3.6 + 2.53S _F
FBP	3.5	6.3	10.5	18.9

^A S_C or S_F is the average slope (or rate of change) calculated in accordance with A4.9.1. Table A4.4 precision data obtained from RR study on both manual and automated D 86 units by North American and IP laboratories.

APPENDIXES

(Nonmandatory Information)

X1. EXAMPLES ILLUSTRATING CALCULATIONS FOR REPORTING OF DATA

X1.1 The observed distillation data used for the calculation of the examples below are shown in the first three columns of Fig. X1.1.

X1.1.1 Temperature readings corrected to 101.3 kPa (760 mm Hg) pressure (see 11.3) are as follows:

$$\text{correction (}^\circ\text{C)} = 0.0009 (101.3 - 98.6) (273 + t_r) \quad (\text{X1.1})$$

$$\text{correction (}^\circ\text{F)} = 0.00012 (760 - 740) (460 + t_r) \quad (\text{X1.2})$$

X1.1.2 Loss correction to 101.3 kPa (see 11.4) are as follows. The data for the examples are taken from Fig. X1.1.

$$\text{corrected loss} = (0.5 + (4.7 - 0.5)) \quad (\text{X1.3})$$

$$[1 + (101.3 - 98.6)/8.0] = 3.6$$

X1.1.3 Recovery correction to 101.3 kPa (see 11.4.1) are as follows:

$$\text{corrected recovery} = 94.2 + (4.7 - 3.6) = 95.3 \quad (\text{X1.4})$$

X1.2 Temperature Readings at Prescribed Percent Evaporated

X1.2.1 Temperature reading at 10 % evaporated (4.7 % observed loss = 5.3 % recovered) (see 11.6.1) are as follows:

$$T_{10E} (^\circ\text{C}) = 33.7 + [(40.3 - 33.7) \quad (\text{X1.5})$$

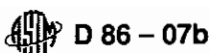
$$(5.3 - 5)/(10 - 5)] = 34.1^\circ\text{C}$$

$$T_{10E} (^\circ\text{F}) = 92.7 + [(104.5 - 92.7) \quad (\text{X1.6})$$

$$(5.3 - 5)/(10 - 5)] = 93.1^\circ\text{F}$$

X1.2.2 Temperature reading at 50 % evaporated (45.3 % recovered) (see 11.6.1) are as follows:

$$T_{50E} (^\circ\text{C}) = 93.9 + [(108.9 - 93.9) \quad (\text{X1.7})$$



$$(45.3 - 40)/(50 - 40) = 101.9^{\circ}\text{C}$$

$$T_{90E} (^{\circ}\text{F}) = 201 + [(228 - 201)] \quad (\text{X1.8})$$

$$(45.3 - 40)/(50 - 40) = 215.3^{\circ}\text{F}$$

X1.2.3 Temperature reading at 90 % evaporated (85.3 % recovered) (see 11.6.1) are as follows:

$$T_{90E} (^{\circ}\text{C}) = 181.6 + [(201.6 - 181.6)] \quad (\text{X1.9})$$

$$(85.3 - 85)/(90 - 85) = 182.8^{\circ}\text{C}$$

$$T_{90E} (^{\circ}\text{F}) = 358.9 + [(394.8 - 358.9)] \quad (\text{X1.10})$$

$$(85.3 - 85)/(90 - 85) = 361.0^{\circ}\text{F}$$

X1.2.4 Temperature reading at 90 % evaporated (85.3 % recovered) not corrected to 101.3 kPa pressure (see 11.6.1) are as follows:

$$T_{90E} (^{\circ}\text{C}) = 180.5 + [(200.4 - 180.5)] \quad (\text{X1.11})$$

$$(85.3 - 85)/(90 - 85) = 181.7^{\circ}\text{C}$$

$$T_{90E} (^{\circ}\text{F}) = 357 + [(392 - 357)] \quad (\text{X1.12})$$

$$(85.3 - 85)/(90 - 85) = 359.1^{\circ}\text{F}$$

NOTE X1.1—Results calculated from °C data may not correspond exactly to results calculated from °F data because of errors in rounding.

Sample ID:
Date analyzed:
Equipment No:
Remarks:
Barometric pressure: 98.6 kPa
Analyst:

X recovered	Barometric pressure observed 98.6 kPa 740 mm Hg		Barometric pressure corrected 101.3 kPa 760 mm Hg		procedure arithmetical/geophysical	
	°C	°F	°C	°F	X evaporated	T _{evap} °C °F
18P	25.5	78	26.2	79.2	5	26.7 80.0
5	33.0	91	33.7	92.7	10	34.1 93.4
10	39.5	103	40.3	104.5	15	40.7 105.2
15	46.0	115	46.8	116.2	20	47.3 117.1
20	54.5	130	55.3	131.5	30	65.7 150.2
30	74.0	165	74.8	166.7	40	84.9 184.9
40	93.0	199	93.9	201.0	50	101.9 215.3
50	108.0	226	108.9	228.0	60	116.9 242.4
60	123.0	253	124.0	255.1	70	134.1 273.3
70	142.0	288	143.0	289.4	80	156.0 312.8
80	166.5	332	167.6	333.6	85	168.4 335.1
85	180.5	357	181.6	358.9	90	182.8 361.0
90	200.4	393	201.6	394.8	95	202.4 396.3
EP	215.0	419	216.2	421.1		
recovered, X	94.2		95.3			
residue, X	1.1		1.1			
loss, X	4.7		3.6			

FIG. X1.1 Example of Test Report

X2. EXAMPLES OF CALCULATION OF REPEATABILITY AND REPRODUCIBILITY OF VOLUME % (RECOVERED OR EVAPORATED) AT A PRESCRIBED TEMPERATURE READING

X2.1 Some specifications require the reporting of the volume % evaporated or recovered at a prescribed temperature. Table X2.1 shows the distillation data of a Group 1 sample as obtained by an automated unit.

X2.2 Example Calculation

X2.2.1 For a Group 1 sample exhibiting distillation characteristics as per Table X2.1, as determined by an automated unit, the reproducibility of the volume evaporated, R_{volume %}, at 93.3°C (200°F) is determined as follows:

X2.2.1.1 Determine first the slope at the desired temperature:

$$S_C \% = 0.1 (T_{(20)} - T_{(10)}) \quad (\text{X2.1})$$

$$= 0.1 (94 - 83)$$

$$= 1.1$$

$$S_F \% = 0.1 (T_{(20)} - T_{(10)})$$

$$= 0.1 (201 - 182)$$

$$= 1.9$$

X2.2.2 From Table A4.3, determine the value of R, the reproducibility at the observed percentage distilled. In this case, the observed percentage distilled is 18 % and

$$R = 3.3 + 2.0 (S_C) \quad (\text{X2.2})$$

$$= 3.3 + 2.0 \times 1.1$$

$$= 5.5$$

$$R = 6.0 + 2.0 (S_F)$$

$$= 6.0 + 2.0 \times 1.9$$

$$= 9.8$$

X2.2.3 From the calculated value of R, determine the value of volume, as described in A4.9.

$$R \text{ volume \%} = R/(S_C) \quad (\text{X2.3})$$

$$= 5.5/1.1$$

$$= 5.0$$

$$R \text{ volume \%} = R/(S_F)$$

$$= 9.8/1.9$$

$$= 5.1$$

TABLE X2.1 Distillation Data from a Group 1 Sample Automated Distillation

Distillation Point Recovered, mL	Temperature °C	Temperature °F	Volume (mL) Recovered at 93.3°C (200°F)
10	84	183	18.0
20	94	202	
30	103	217	
40	112	233	
Distillation Point Evaporated, mL	Temperature °C	Temperature °F	Volume (mL) Evaporated at 93.3°C (200°F)
10	83	182	18.4
20	94	201	
30	103	217	
40	111	232	



X3. TABLES OF CORRECTED LOSS FROM MEASURED LOSS AND BAROMETRIC PRESSURE

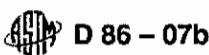
X3.1 The table presented as Fig. X3.1 can be used to determine the corrected loss from the measured loss and the barometric pressure in kPa.

X3.2 The table presented as Fig. X3.2 can be used to determine the corrected loss from the measured loss and the barometric pressure in mm Hg.

Barometric Pressure, kPa

from through	78.1 80.8	80.9 84.4	84.5 87.2	87.3 89.5	89.6 91.4	91.5 93.0	93.1 94.0	94.1 95.4	95.5 96.3	96.4 97.1	97.2 97.8	97.9 98.3	98.4 98.8	98.9 99.4	99.5 99.9	100.0 100.3	100.4 100.7	100.8 101.1	101.2 101.4	101.5 101.9	102.0 102.3	102.4 102.7	102.8 103.1	103.2 103.5
Observed Loss	/--- Corrected Loss ----->																							
Units																								
0	0.37	0.35	0.33	0.31	0.29	0.27	0.25	0.23	0.20	0.18	0.16	0.14	0.13	0.11	0.09	0.06	0.04	0.02	-0.00	-0.02	-0.06	-0.09	-0.13	-0.17
1	0.63	0.65	0.67	0.69	0.71	0.73	0.75	0.78	0.80	0.82	0.84	0.86	0.87	0.89	0.92	0.94	0.96	0.98	1.00	1.03	1.06	1.09	1.13	1.17
2	0.89	0.95	1.01	1.08	1.14	1.20	1.26	1.33	1.40	1.46	1.52	1.57	1.62	1.68	1.75	1.81	1.87	1.94	2.00	2.08	2.17	2.27	2.38	2.51
3	1.15	1.25	1.36	1.46	1.57	1.67	1.77	1.88	1.99	2.09	2.19	2.28	2.37	2.47	2.58	2.69	2.79	2.90	3.00	3.13	3.29	3.45	3.63	3.84
4	1.41	1.56	1.70	1.84	1.99	2.14	2.28	2.43	2.59	2.73	2.87	3.00	3.12	3.26	3.41	3.56	3.70	3.85	4.00	4.18	4.40	4.63	4.89	5.16
5	1.68	1.86	2.04	2.23	2.42	2.61	2.79	2.98	3.19	3.37	3.55	3.71	3.87	4.05	4.25	4.44	4.62	4.81	5.00	5.23	5.51	5.81	6.14	6.52
6	1.94	2.16	2.39	2.61	2.84	3.06	3.30	3.53	3.78	4.01	4.23	4.42	4.62	4.84	5.08	5.31	5.53	5.77	6.00	6.28	6.63	6.99	7.40	7.86
7	2.20	2.46	2.73	3.00	3.27	3.55	3.80	4.08	4.36	4.65	4.90	5.14	5.37	5.63	5.91	6.18	6.44	6.73	7.00	7.33	7.74	8.17	8.65	9.20
8	2.46	2.76	3.07	3.38	3.70	4.02	4.31	4.63	4.96	5.28	5.58	5.85	6.12	6.41	6.74	7.06	7.36	7.69	8.00	8.38	8.86	9.35	9.90	10.53
9	2.72	3.07	3.41	3.76	4.12	4.49	4.82	5.18	5.57	5.92	6.26	6.56	6.87	7.20	7.57	7.93	8.27	8.65	9.00	9.43	9.97	10.53	11.16	11.87
10	2.98	3.37	3.76	4.15	4.55	4.96	5.33	5.73	6.17	6.56	6.94	7.28	7.62	7.99	8.41	8.81	9.19	9.60	10.00	10.48	11.06	11.71	12.41	13.21
11	3.24	3.67	4.10	4.53	4.97	5.43	5.84	6.26	6.77	7.20	7.61	7.99	8.37	8.78	9.24	9.68	10.10	10.56	11.00	11.53	12.20	12.89	13.67	14.55
12	3.50	3.97	4.44	4.92	5.40	5.90	6.35	6.83	7.36	7.84	8.29	8.71	9.12	9.57	10.07	10.56	11.02	11.52	12.00	12.59	13.31	14.07	14.92	15.89
13	3.76	4.27	4.78	5.30	5.83	6.36	6.86	7.39	7.96	8.47	8.97	9.42	9.88	10.36	10.90	11.43	11.93	12.48	13.00	13.64	14.43	15.25	16.17	17.22
14	4.03	4.58	5.13	5.69	6.25	6.83	7.36	7.94	8.56	9.11	9.64	10.13	10.61	11.15	11.74	12.31	12.85	13.44	14.00	14.69	15.54	16.43	17.43	18.56
15	4.29	4.88	5.47	6.07	6.68	7.30	7.87	8.49	9.15	9.75	10.32	10.85	11.36	11.93	12.57	13.18	13.76	14.40	15.00	15.74	16.66	17.61	18.68	19.90
16	4.55	5.18	5.81	6.45	7.10	7.77	8.38	9.04	9.75	10.39	11.00	11.58	12.11	12.72	13.40	14.06	14.68	15.36	16.00	16.79	17.77	18.79	19.94	21.24
17	4.81	5.48	6.16	6.84	7.53	8.24	8.89	9.59	10.33	11.03	11.68	12.27	12.86	13.51	14.23	14.93	15.59	16.31	17.00	17.84	18.88	19.97	21.19	22.58
18	5.07	5.78	6.50	7.22	7.96	8.71	9.40	10.14	10.84	11.66	12.35	12.99	13.61	14.30	15.07	15.80	16.50	17.27	18.00	18.89	20.00	21.15	22.44	23.91
19	5.33	6.08	6.84	7.61	8.38	9.18	9.91	10.69	11.54	12.30	13.03	13.70	14.36	15.09	15.90	16.68	17.42	18.23	19.00	19.94	21.11	22.35	23.70	25.25
20	5.59	6.39	7.18	7.99	8.81	9.65	10.41	11.24	12.14	12.94	13.71	14.41	15.11	15.88	16.73	17.55	18.33	19.19	20.00	20.99	22.23	23.51	24.95	26.59
Tenths	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.1	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.13	0.13
0.2	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.11	0.12	0.13	0.14	0.14	0.15	0.16	0.17	0.18	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.27
0.3	0.06	0.09	0.10	0.12	0.13	0.14	0.15	0.17	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.26	0.27	0.29	0.30	0.32	0.33	0.35	0.38	0.40
0.4	0.10	0.12	0.14	0.15	0.17	0.19	0.20	0.22	0.24	0.26	0.27	0.29	0.30	0.32	0.33	0.35	0.37	0.38	0.40	0.42	0.45	0.47	0.50	0.54
0.5	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.28	0.30	0.32	0.34	0.36	0.37	0.39	0.42	0.44	0.46	0.48	0.50	0.53	0.56	0.59	0.63	0.67
0.6	0.16	0.18	0.21	0.23	0.26	0.28	0.31	0.33	0.36	0.38	0.41	0.43	0.45	0.47	0.50	0.52	0.55	0.58	0.60	0.63	0.67	0.71	0.75	0.80
0.7	0.18	0.21	0.24	0.27	0.30	0.33	0.36	0.39	0.42	0.45	0.47	0.50	0.52	0.55	0.58	0.61	0.64	0.67	0.70	0.74	0.78	0.83	0.88	0.94
0.8	0.21	0.24	0.27	0.31	0.34	0.38	0.41	0.44	0.48	0.51	0.54	0.57	0.60	0.63	0.67	0.70	0.73	0.77	0.80	0.84	0.89	0.94	1.00	1.07
0.9	0.24	0.27	0.31	0.35	0.38	0.42	0.46	0.50	0.54	0.57	0.61	0.64	0.67	0.71	0.75	0.79	0.82	0.86	0.90	0.95	1.00	1.06	1.13	1.20

FIG. X3.1 Corrected Loss from Observed Loss and Barometric Pressure kPa



Barometric Pressure, mm Hg.

from through	571 606	607 633	634 654	655 671	672 685	686 697	698 705	706 715	716 722	723 728	729 733	734 737	738 741	742 745	746 749	750 752	753 755	756 758	759 761	762 764	765 767	768 770	771 773	774 776	
Observed Loss	/ - - Corrected Loss - - - - - >																								
Units	0	0.37	0.35	0.33	0.31	0.29	0.27	0.25	0.23	0.20	0.16	0.14	0.13	0.11	0.09	0.07	0.05	0.02	-0.00	-0.03	-0.06	-0.09	-0.13	-0.17	
	1	0.63	0.65	0.67	0.69	0.71	0.73	0.75	0.77	0.80	0.82	0.84	0.86	0.87	0.89	0.91	0.93	0.95	0.98	1.00	1.03	1.06	1.09	1.13	1.17
	2	0.89	0.95	1.01	1.07	1.14	1.20	1.26	1.32	1.39	1.45	1.51	1.57	1.62	1.68	1.74	1.80	1.86	1.93	2.00	2.06	2.17	2.27	2.38	2.50
	3	1.15	1.25	1.36	1.46	1.56	1.67	1.77	1.87	1.99	2.09	2.19	2.28	2.36	2.46	2.57	2.67	2.77	2.88	3.00	3.13	3.28	3.44	3.63	3.83
	4	1.41	1.55	1.70	1.84	1.99	2.14	2.27	2.42	2.58	2.72	2.86	2.99	3.11	3.25	3.40	3.54	3.68	3.83	4.00	4.19	4.39	4.62	4.88	5.17
	5	1.67	1.86	2.04	2.22	2.41	2.61	2.78	2.97	3.18	3.36	3.54	3.70	3.86	4.03	4.23	4.41	4.59	4.79	5.00	5.24	5.50	5.80	6.13	6.50
	6	1.93	2.16	2.38	2.61	2.84	3.07	3.29	3.52	3.77	3.99	4.21	4.41	4.60	4.82	5.05	5.28	5.50	5.74	6.00	6.29	6.61	6.97	7.38	7.84
	7	2.19	2.46	2.72	2.99	3.26	3.54	3.79	4.07	4.36	4.63	4.88	5.12	5.35	5.60	5.88	6.15	6.41	6.69	7.00	7.34	7.72	8.15	8.63	9.17
	8	2.46	2.76	3.07	3.37	3.69	4.01	4.30	4.62	4.96	5.27	5.56	5.83	6.09	6.38	6.71	7.02	7.32	7.64	8.00	8.40	8.84	9.33	9.88	10.50
	9	2.72	3.06	3.41	3.76	4.11	4.48	4.81	5.17	5.56	5.90	6.23	6.54	6.84	7.17	7.54	7.89	8.23	8.60	9.00	9.45	9.95	10.50	11.13	11.84
	10	2.98	3.36	3.75	4.14	4.54	4.94	5.31	5.71	6.15	6.54	6.91	7.25	7.58	7.95	8.37	8.78	9.14	9.55	10.00	10.50	11.06	11.68	12.38	13.17
	11	3.24	3.66	4.09	4.52	4.96	5.41	5.82	6.28	6.74	7.17	7.58	7.96	8.33	8.74	9.19	9.63	10.05	10.50	11.00	11.56	12.17	12.86	13.63	14.51
	12	3.50	3.96	4.43	4.91	5.39	5.88	6.33	6.81	7.34	7.81	8.26	8.67	9.07	9.52	10.02	10.50	10.96	11.46	12.00	12.61	13.28	14.03	14.88	15.84
	13	3.76	4.27	4.78	5.29	5.81	6.35	6.83	7.36	7.93	8.44	8.93	9.38	9.82	10.31	10.85	11.37	11.87	12.41	13.00	13.66	14.39	15.21	16.13	17.17
	14	4.02	4.57	5.12	5.67	6.24	6.82	7.34	7.91	8.53	9.08	9.61	10.09	10.57	11.09	11.68	12.24	12.78	13.36	14.00	14.71	15.51	16.39	17.38	18.51
	15	4.28	4.87	5.46	6.06	6.66	7.28	7.85	8.46	9.12	9.71	10.28	10.80	11.31	11.88	12.51	13.11	13.68	14.31	15.00	15.77	16.62	17.57	18.63	19.84
	16	4.54	5.17	5.80	6.44	7.09	7.75	8.35	9.01	9.72	10.35	10.95	11.51	12.06	12.66	13.33	13.98	14.59	15.27	16.00	16.82	17.73	18.74	19.88	21.18
	17	4.80	5.47	6.14	6.82	7.51	8.22	8.86	9.56	10.31	10.98	11.63	12.22	12.80	13.45	14.16	14.85	15.50	16.22	17.00	17.87	18.84	19.92	21.13	22.51
	18	5.06	5.77	6.49	7.21	7.94	8.69	9.37	10.11	10.91	11.62	12.30	12.93	13.55	14.23	14.99	15.72	16.41	17.17	18.00	18.93	19.95	21.10	22.38	23.84
	19	5.32	6.07	6.83	7.59	8.36	9.15	9.88	10.65	11.50	12.25	12.88	13.54	14.29	15.02	15.82	16.59	17.32	18.12	19.01	19.98	21.06	22.27	23.64	25.18
	20	5.58	6.37	7.17	7.97	8.79	9.62	10.38	11.20	12.09	12.89	13.65	14.35	15.04	15.80	16.64	17.46	18.23	19.08	20.01	21.03	22.17	23.45	24.89	26.51
Tenths	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.1	0.03	0.03	0.03	0.04	0.04	0.05	0.05	0.05	0.06	0.06	0.07	0.07	0.07	0.08	0.08	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.13	0.13
	0.2	0.05	0.06	0.07	0.08	0.08	0.09	0.10	0.11	0.12	0.13	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.27	0.27
	0.3	0.08	0.09	0.10	0.11	0.13	0.14	0.15	0.16	0.18	0.19	0.20	0.21	0.22	0.24	0.25	0.26	0.27	0.29	0.30	0.32	0.33	0.35	0.36	0.40
	0.4	0.10	0.12	0.14	0.15	0.17	0.19	0.20	0.22	0.24	0.25	0.27	0.28	0.30	0.31	0.33	0.35	0.36	0.38	0.40	0.42	0.44	0.47	0.50	0.53
	0.5	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.30	0.32	0.34	0.35	0.37	0.39	0.41	0.43	0.45	0.48	0.50	0.53	0.56	0.59	0.63	0.67
	0.6	0.16	0.18	0.21	0.23	0.25	0.28	0.30	0.33	0.36	0.38	0.40	0.43	0.45	0.47	0.50	0.52	0.55	0.57	0.60	0.63	0.67	0.71	0.75	0.80
	0.7	0.18	0.21	0.24	0.27	0.30	0.33	0.35	0.38	0.42	0.44	0.47	0.50	0.52	0.55	0.58	0.61	0.64	0.67	0.70	0.74	0.78	0.82	0.88	0.93
	0.8	0.21	0.24	0.27	0.31	0.34	0.37	0.41	0.44	0.48	0.51	0.54	0.57	0.60	0.63	0.66	0.70	0.73	0.76	0.80	0.84	0.89	0.94	1.00	1.07
	0.9	0.23	0.27	0.31	0.34	0.38	0.42	0.46	0.49	0.54	0.57	0.61	0.64	0.67	0.71	0.75	0.78	0.82	0.86	0.90	0.95	1.00	1.06	1.13	1.20

FIG. X3.2 Corrected Loss from Observed Loss and Barometric Pressure mm Hg

X4. PROCEDURE TO EMULATE THE EMERGENT STEM ERROR OF A MERCURY-IN-GLASS THERMOMETER

X4.1 When an electronic or other sensor without an emergent stem error is used, the output of this sensor or the associated data system should emulate the output of a mercury-in-glass thermometer. Based on information supplied by four manufacturers of automated Test Method D 86 equipment, the averaged equations shown in X4.2 and X4.3 have been reported to be in use.

X4.1.1 The equations shown in X4.2 have limited applicability and are shown for information purposes only. In addition to the correction for the emergent stem, the electronic sensor and associated data system will also have to emulate the lag in response time observed for mercury-in-glass thermometers.

X4.2 When a low range thermometer would have been used, no stem correction is to be applied below 20°C. Above this temperature, the correction is calculated using the following formula:

$$ASTM\ 7C\ T_{clr} = T_t - 0.000162 \times (T_t - 20^\circ C)^2 \quad (X4.1)$$

X4.3 When a high range thermometer would have been used, no stem correction is to be applied below 35°C. Above this temperature the correction is calculated using the following formula:

$$ASTM\ 8C\ T_{chr} = T_t - 0.000131 \times (T_t - 35^\circ C)^2 \quad (X4.2)$$

where:

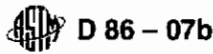
T_{clr} = emulated temperature in °C for low range thermometers,

T_{chr} = emulated temperature in °C for high range thermometers, and

T_t = true temperature in °C.

X5. EXPLANATORY REPORT FORMS

X5.1 Fig. X5.1 and Fig. X5.2 show report forms.



"Percent Recovered" Report Form

Date:
 Time:
 Operator:

Ambient temperature (°C)
 Atmospheric pressure (kPa)
 Condenser temperature (°C)
 Temperature of the bath around receiving cylinder (°C)

Percent Recovered	Corrected Temperature Reading (°C)	Time or ml. / min
IBP		
5		
10		
15		
20		
25		
30		
35		
40		
45		
50		
55		
60		
65		
70		
75		
80		
85		
90		
5 ml residue		
95		
FBP		

Percent Recovery
 Percent Residue
 Percent Total Recovery
 Percent Loss
 Corrected Percent Recovery Corrected Total Recovery
 Corrected Loss

Comments:

Ambient temperature at the start of the test

Ambient barometric pressure at the start of the test

Volume of condensate observed in the receiving cylinder at any point in the distillation, expressed as a percentage of the charge volume, in connection with simultaneous temperature reading

Temperature measuring device readings which are corrected to 101,3 kPa barometric pressure

Group 1, 2 & 3: 5 to 10 minutes
 Group 4: 5 to 15 minutes

Group 1 & 2: 60 to 100 seconds

4 to 5 ml / min uniform average rate from 5% recovered to 5 ml in flask

Volume of condensate observed in the receiving cylinder when the 5ml conditions are reached

Volume of condensate observed in the receiving cylinder when the final boiling point is observed

Maximum percent recovered

Volume of residue in the flask expressed as a percentage of the charge volume

Combined Percent Recovery and Percent Residue in the flask

Time from 5 ml in flask to FBP = < 5 minutes

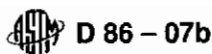
100 minus the Total Recovery

Percent Recovery corrected for barometric pressure

Percent Loss corrected for barometric pressure

Combined Percent Recovery and Percent Residue in the flask corrected for barometric pressure

FIG. X5.1 Percent Recovered Report Form



"Percent Evaporated" Report Form

Laboratory: _____

Date: _____
 Time: _____
 Operator: _____

Ambient temperature (°C)	_____
Atmospheric pressure (kPa)	_____
Condenser temperature (°C)	_____
Temperature of the bath around receiving cylinder (°C)	_____

Percent Recovered	Corrected Temperature Reading (°C)	Time or mL / min	Percent Evaporated	Temperature Readings at prescribed percent evaporated (°C)
IBP			IBP	
5			5	
10			10	
15			15	
20			20	
25			25	
30			30	
35			35	
40			40	
45			45	
50			50	
55			55	
60			60	
65			65	
70			70	
75			75	
80			80	
85			85	
90			90	
5 ml residue			95	
FBP			FBP	

Percent Recovery	_____	Corrected Loss	_____
Percent Residue	_____	Corrected Total Recovery	_____
Percent Total Recovery	_____		
Percent Loss	_____		
Corrected Percent Recovery	_____		

Comments: _____

- Ambient temperature at the start of the test
- Ambient barometric pressure at the start of the test
- Volume of condensate observed in the receiving cylinder at any point in the distillation, expressed as a percentage of the charge volume, in connection with simultaneous temperature reading
- Temperature measuring device readings which are corrected to 101,3 kPa barometric pressure
- Sum of the percent recovered and the percent loss
- Temperature measuring device readings at specified percentages evaporated calculated with arithmetical or graphical procedures
- Group 0: 2 to 5 minutes
- Group 1, 2 & 3: 5 to 10 minutes
- Group 4: 5 to 15 minutes
- Group 1 & 2: 60 to 100 seconds
- Group 0: time from first application of heat to 10% recovered = 3 to 4 minutes
- Group 0, 1, 2, 3 & 4: 4 to 5 ml / min uniform average rate from 5% recovered to 5 ml in flask
- Volume of condensate observed in the receiving cylinder when the 5ml conditions are reached
- Volume of condensate observed in the receiving cylinder when the final boiling point is observed
- Maximum percent recovered
- Volume of residue in the flask expressed as a percentage of the charge volume
- Combined Percent Recovery and Percent Residue in the flask
- Time from 5 ml in flask to FBP = < 5 minutes
- 100 minus the Total Recovery
- Percent Recovery corrected for barometric pressure
- Percent Loss corrected for barometric pressure
- Combined Percent Recovery and Percent Residue in the flask corrected for barometric pressure

FIG. X5.2 Percent Evaporated Report Form



D 86 – 07b

SUMMARY OF CHANGES

Subcommittee D02.08 has identified the location of selected changes to this standard since the last issue (D 86–07a) that may impact the use of this standard. (Approved Dec. 1, 2007.)

- (1) Revised Section 13 with new precision and bias statements.
- (2) Revised Annex A1 with new precision charts.
- (3) Revised A4.9.
- (4) Revised 10.2, 10.3, and X2.2.2 to reference correct table.
- (5) Added new note Note 18 and renumbered remaining notes.
- (6) Revised Note 19.

Subcommittee D02.08 has identified the location of selected changes to this standard since the last issue (D 86–07) that may impact the use of this standard. (Approved April 1, 2007.)

- (1) Revised 12.3.2.

Subcommittee D02.08 has identified the location of selected changes to this standard since the last issue (D 86–05) that may impact the use of this standard. (Approved Jan. 15, 2007.)

- (1) Deleted “natural gasolines” from 1.1.
- (2) Deleted “Group 0” from the entire standard.
- (3) Added Fig. 6.

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**California Code of Regulations
Title 17, Division 3
Chapter 1 – Air Resources Board
Subchapter 8.5 – Consumer Products
Article 2 – Consumer Products**

§ 94509. Standards for Consumer Products.

(a) Except as provided in Sections 94510 (Exemptions), 94511 (Innovative Products), 94514 (Variances), 94540 through 94555 (Alternative Control Plan), and 94567(a)(1) (Hairspray Credit Program), Title 17, California Code of Regulations, no person shall sell, supply, offer for sale, or manufacture for sale in California any consumer product which, at the time of sale or manufacture, contains volatile organic compounds in excess of the limits specified in the following Table of Standards after the specified effective dates.

Table of Standards Percent Volatile Organic Compounds by Weight

Product Category Standard [FN2]	Effective Date [FN1]	VOC
Adhesive Removers*:		
Floor or Wall Covering Adhesive Remover	12/31/2006	5
Gasket or Thread Locking Adhesive Remover	12/31/2006	50
General Purpose Adhesive Remover	12/31/2006	20
Specialty Adhesive Remover	12/31/2006	70

[See section 94509(n) for additional requirements that apply to adhesive removers.]

Adhesives [FNal]:		
aerosol	1/1/95	75
mist spray adhesives	1/1/2002	65
web spray adhesives	1/1/2002	55
special purpose spray adhesives mounting, automotive engine compartment, and flexible vinyl adhesives	1/1/2002	70
polystyrene foam and automobile headliner adhesives	1/1/2002	65
polyolefin and laminate repair/edgebanding adhesives	1/1/2002	60

[See 94509(i), 94512(d), and 94513(d) for additional requirements that apply to aerosol adhesives.]

construction, panel, and floor covering [FN3]	1/1/95	40
	12/31/2002	15
contact	1/1/95	80
contact adhesive - general purpose	12/31/2006	55
contact adhesive - special purpose	12/31/2006	80
general purpose	1/1/95	10

[FNal] See section 94510(i) for an exemption that applies to adhesives sold FN in containers of one fluid ounce or less.

[FNa3] See section 94509(k) for the effective date of the VOC limit for FN certain types of "construction, panel, and floor covering adhesives."

Aerosol Cooking Sprays	1/1/95	18
Air Fresheners [FNa1]:		
double phase aerosols	1/1/93	30
	12/31/2004	25
single phase aerosols	1/1/93	70
	1/1/96	30
dual purpose air fresheners/disinfectant aerosols	1/1/94	60
liquid/pump sprays	1/1/93	18
solids/semi-solid	1/1/93	3

[FNa1] See sections 94510(f) and 94510(g)(2) for exemptions that o FN apply to certain air fresheners, and 94509(o) for additional requirements that apply to air fresheners.

Anti-static Product:		
Aerosol	12/31/2008	80
non-aerosol	12/31/2006	11

Automotive Brake Cleaners	1/1/97	50
	12/31/2002	45

Automotive Rubbing or Polishing Compounds	1/1/2005	17
---	----------	----

Automotive Wax/Polish/Sealant/Glaze:		
all other forms	1/1/2005	15
hard paste waxes	1/1/2005	45
instant detailers	1/1/2001	3

Automotive Windshield Washer Fluids:		
Type "A" areas [FNa1]	1/1/93	35
All other areas (all forms)	1/1/93	10
Dilutable and Pre-Mixed [FN1]	12/31/2002	1

[FNa1] See section 94508(a)(20), section 94508(a)(21), and section 94509(l) for provisions that apply to Automotive Windshield Washer Fluids.

[FNa] Type "A" areas include only the following: Del Norte, Shasta and FNTrinity Counties; the Great Basin Valley, Lake Tahoe, Mountain FNCounties, and Northeast Plateau Air Basins, as defined in Title 17, FNCalifornia Code of Regulations, Sections 60105, 60108, 60111, and FN60113.

Bathroom and Tile Cleaners:		
aerosols	1/1/94	7
all other forms	1/1/94	5

Bug and Tar Remover	1/1/2002	40
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Carburetor or Fuel-injection Air Intake Cleaners	1/1/95	75
[FNa2]	12/31/2002	45

[FNa]2 See section 94509(k) for the effective date of the VOC limit for

FN fuel-injection air intake cleaners.

Carpet and Upholstery Cleaner:		
aerosols	1/1/2001	7
.....		
non-aerosols (dilutables)	1/1/2001	.1
.....		
non-aerosols (ready-to-use)	1/1/2001	3
Charcoal Lighter Material		
	See 94509(h)	
Dusting Aids:		
aerosol	1/1/95	35
	1/1/97	25
.....		
all other forms	1/1/95	7
Electrical Cleaner*		
	12/31/2006	45
[*See section 94509(n) for additional requirements that apply to electrical cleaners.]		
Electronic Cleaner*		
	12/31/2006	75
[*See section 94509(m) for additional requirements that apply to electronic cleaners.]		
Engine Degreasers :		
	1/1/93	75
	1/1/96	50
.....		
aerosols	12/31/2004	35
.....		
non-aerosols	12/31/2004	5
Fabric-Refreshers:		
Aerosol	12/31/2006	15
.....		
non-aerosol	12/31/2006	6
Fabric Protectants		
	1/1/95	75
	1/1/97	60
Floor Polishes/Waxes:		
products for flexible flooring materials	1/1/94	7
.....		
products for nonresilient flooring	1/1/94	10
.....		
wood floor wax	1/1/94	90
Floor Wax Stripper:		
non-aerosols	See Section 94509(j)	
Footware or Leather Care Product*:		
Aerosol	12/31/2006	75
.....		
solid	12/31/2006	55
.....		
all other forms	12/31/2006	15
[*See section 94509(m) for additional requirements that apply to footware or leather care products.]		
Furniture Maintenance Products:		
aerosols	1/1/94	25
	12/31/2004	17
.....		
all other forms (except solid/paste forms)	1/1/94	7

Furniture Maintenance Products:		
aerosols	1/1/94	25
	12/31/2004	17
.....		
all other forms (except solid/paste forms)	1/1/94	7
General Purpose Cleaners		
aerosols and non-aerosols:	1/1/94	10
.....		
non-aerosols	12/31/2004	4
General Purpose Degreasers:		
aerosols	1/1/2002	50
.....		
non-aerosols	12/31/2004	4
[*See section 94509(m) for additional requirements that apply to general purpose degreasers.]		
Glass Cleaners:		
aerosols	1/1/93	12
.....		
non-aerosols	1/1/93	8
	1/1/96	6
	12/31/2004	4
Graffiti Remover*:		
Aerosols	12/31/2006	50
.....		
non-aerosols	12/31/2006	30
[*See section 94509(n) for additional requirements that apply to graffiti removers.]		
Hair Mousses		
	1/1/94	16
	12/31/2002	6
Hair Shine		
	1/1/2005	55
Hair Spray		
	1/1/93	80
	6/1/99	55
Hair Styling Gels		
	1/1/94	6
Hair Styling Product		
aerosols and pump sprays	12/31/2006	6
.....		
all other forms	12/31/2006	2
Heavy-duty Hand Cleaners or Soap		
	1/1/2005	8
Insect Repellants:		
aerosols	1/1/94	65
Insecticides [FNa1]:		
crawling bug (all forms):	1/1/95	40
	1/1/98	20
aerosol crawling bug insecticides	12/31/2004	15
.....		
flea and tick	1/1/95	25
.....		
flying bug (all forms):	1/1/95	35
aerosols	12/31/2003	25
.....		
foggers	1/1/95	45
.....		

lawn and garden (all forms)	1/1/95	20
non-aerosol lawn and garden insecticides	12/31/2003	3
.....		
wasp and hornet	1/1/2005	40
FN*al See sections 94510(g) and 94510(k) for exemptions that apply to FN certain insecticides.		
<hr/>		
Laundry Prewash:		
aerosols/solids	1/1/94	22
.....		
all other forms	1/1/94	5
<hr/>		
Laundry Starch Products	1/1/95	5
<hr/>		
Metal Polish/Cleanser	1/1/2005	30
<hr/>		
Multi-purpose Lubricant: (excluding solid or semisolid products)	1/1/2003	50
<hr/>		
Nail Polish Removers	1/1/94	85
	1/1/96	75
	12/31/2004	0
<hr/>		
Non-selective Terrestrial Herbicide: non-aerosols	1/1/2002	3
<hr/>		
Oven Cleaners:		
aerosols/pump sprays	1/1/93	8
.....		
liquids	1/1/93	5
<hr/>		
Paint Remover or Stripper	1/1/2005	50
<hr/>		
Penetrant	1/1/2003	50
<hr/>		
Personal Fragrance Products [FNal]: products with 20% or less fragrance	1/1/95	80
	1/1/99	75
.....		
products with more than 20% fragrance	1/1/95	70
	1/1/99	65
[FNal] See sections 94510(h), 94510(j), and 94510(l) for exemptions that FN apply to personal fragrance products.		
<hr/>		
Rubber and Vinyl Protectant:		
aerosols	1/1/2005	10
.....		
non-aerosols	1/1/2003	3
<hr/>		
Sealants and Caulking Compounds	12/31/2002	4
<hr/>		
Shaving Creams	1/1/94	5
<hr/>		
Shaving Gel	12/31/2006	7
	12/31/2009	4
<hr/>		
Silicone-based Multi-purpose Lubricant: (excluding solid or semisolid products)	1/1/2005	60
<hr/>		
Spot Remover:		
aerosols	1/1/2001	25
.....		
non-aerosols	1/1/2001	8

Tire Sealants and Inflators	12/31/2002	20
<hr/>		
Toilet/Urinal Care Product:*		
Aerosol	12/31/2006	10
.....		
non-aerosol	12/31/2006	3
[See section 94509(o) for additional requirements that apply to Toilet/Urinal Care Products]		
<hr/>		
Undercoating:		
aerosols	1/1/2002	40
<hr/>		
Wood Cleaner:		
Aerosol	12/31/2006	17
.....		
non-aerosol	12/31/2006	4
<hr/>		

[FN1] See section 94509(d) for the effective date of the VOC standards for products registered under FIFRA, and section 94509(c) for the "Sell-through" allowed for products manufactured prior to the effective date of standards.

[FN2] See section 94510(c) for an exemption that applies to fragrances in consumer products, and section 94510(d) for an exemption that applies to LVP-VOCs.

(b) Products that are diluted prior to use

(1) Except for "Automotive Windshield Washer Fluids (Dilutable)," for consumer products for which the label, packaging, or accompanying literature specifically states that the product should be diluted with water or non-VOC solvent prior to use, the limits specified in subsection (a) shall apply to the product only after the minimum recommended dilution has taken place. For purposes of this subsection (b), "minimum recommended dilution" shall not include recommendations for incidental use of a concentrated product to deal with limited special application such as hard-to-remove soils or stains.

(2) For consumer products for which the label, packaging, or accompanying literature states that the product should be diluted with any VOC solvent prior to use, the limits specified in subsection (a) shall apply to the product only after the maximum recommended dilution has taken place.

(3) For "Automotive Windshield Washer Fluids (Dilutable)" for which the label, packaging, or accompanying literature specifically states that the product should be diluted with water or non-VOC solvent prior to use;

(A) the VOC limits specified in section 94509(a) shall apply to the product only after the minimum recommended dilution has taken place;

(B) for the purpose of complying with the VOC limits specified in section 94509(a), different dilution instructions for "Type A areas" and other areas of California may be specified on the product label if the dilution instructions meet the following criteria:

1. The instructions are readily visible, and
2. The instructions can be easily understood by the consumer, and
3. The instructions clearly specify the recommended dilutions to apply in "Type A areas" and in other areas of California, and

If the dilution instructions specified on the product label meet these criteria, the VOC limits specified in section 94509(a) shall apply to the product only after the minimum recommended dilution has taken place for the area in which the product is sold, supplied, or offered for sale.

(c) Sell-through of products.

(1) Sell-through period. Notwithstanding the provisions of Section 94509(a) or 94509(j), a consumer product manufactured prior to each of the effective dates specified for that product in the Table of Standards may be sold, supplied, or offered for sale for up to three years after each of the specified effective dates. This subsection (c) also does not apply to:

(A) any consumer product which does not display on the product container or package the date on which the product was manufactured, or a code indicating such date, or

(B) any consumer product on which the manufacturer has used a code indicating the date of manufacture that is different than the code specified in section 94512(b)(2), but an explanation of the code has not been filed with the ARB Executive Officer by the deadlines specified in section 94512(c)(1) or section 94512(c)(2), or

(C) Solid Air Fresheners and Toilet/Urinal Care Products that contain para-dichlorobenzene; these products are subject to the one-year sell-through period specified in section 94509(o).

(D) Products contained in multi-unit packages, as specified below:

1. Subsection (c)(1) does not apply to any individual consumer products unit contained within a multi-unit package that is produced or assembled after January 1, 2006, where the multi-unit package does not display the date(s) or date-code(s) of the individual product units, or display the

date of assembly, such that the displayed information is not readily observable without irreversibly disassembling any portion of the container or packaging.

2. For the purposes of this section, "date of assembly" means the date that the individual product units are assembled into the finished multi-unit package.

3. For multi-unit packages that display the "date of assembly" instead of the date(s) or date-code(s) of the individual product units, the "date of assembly" shall be the "date of manufacture " for all of the product units contained within the multi-unit package. In other words, all of the product units shall be deemed to have been manufactured on the date these units are assembled into the multi-unit package, even if the individual product units show different date(s) or date-code(s).

(2)Notification for products sold during the sell-through period. Any person who sells or supplies a consumer product subject to the Table of Standards in section 94509 must notify the purchaser of the product in writing of the date on which the sell-through period for that product will end, provided, however, that this notification must be given only if all of the following conditions are met:

(A) the product is being sold or supplied to a distributor or retailer;

(B) the sell-through period for the product will expire 6 months or less from the date the product is sold or supplied;

(C) the product does not comply with the lowest VOC standard that applies on the date the sell-through period ends; and

(D) the product is subject to a VOC standard with an effective date on or after December 31, 2004.

(d)Products registered under FIFRA. For those consumer products that are registered under the Federal Insecticide, Fungicide, and Rodenticide Act, (FIFRA; 7 U.S.C. Section 136-136y), the effective date of the VOC standards specified in subsection (a) is one year after the date specified in the Table of Standards. For those consumer products that are registered under FIFRA, the three year period provided in subsection (c) shall also begin one year after the date specified in the Table of Standards.

(e)Products containing ozone-depleting compounds. For any consumer product for which VOC standards are specified under subsection (a), no person shall sell, supply, offer for sale, or manufacture for sale in California any consumer product which contains any of the following ozone depleting compounds:

CFC-11 (trichlorofluoromethane),

CFC-12 (dichlorodifluoromethane),

CFC-113 (1,1,1-trichloro-2,2,2-trifluoroethane),

CFC-114 (1-chloro-1,1-difluoro-2-chloro-2,2-difluoroethane),

CFC-115 (chloropentafluoroethane), halon 1211 (bromochlorodifluoromethane), halon 1301 (bromotrifluoromethane), halon 2402 (dibromotetrafluoroethane),

HCFC-22 (chlorodifluoromethane),

HCFC-123 (2,2-dichloro-1,1,1-trifluoroethane),

HCFC-124 (2-chloro-1,1,1,2-tetrafluoroethane),

HCFC-141b (1,1-dichloro-1-fluoroethane),

HCFC-142b (1-chloro-1,1-difluoroethane), 1,1,1-trichloroethane, and carbon tetrachloride.

(f) The requirements of section 94509(e) shall not apply to any existing product formulation that complies with the Table of Standards or any existing product formulation that is reformulated to meet the Table of Standards, provided the ozone depleting compound content of the reformulated product does not increase.

(g) The requirements of section 94509(e) shall not apply to any ozone-depleting compounds that may be present as impurities in a consumer product in an amount equal to or less than 0.01% by weight of the product.

(h) Requirements for charcoal lighter materials. The following requirements shall apply to all charcoal lighter material products as defined in section 94508(a)(27):

(1) Regulatory Standards

(A) In all areas of California except the South Coast Air Quality Management District no person shall sell, supply, or offer for sale after January 1, 1993 any charcoal lighter material product unless at the time of the transaction:

1. the manufacturer or distributor of the charcoal lighter material has been issued a currently

effective certification pursuant to subsection (h)(2).

2. the charcoal lighter material meets the formulation criteria and other conditions specified in the applicable Executive Order issued pursuant to subsection (h)(2).

3. the product usage directions for the charcoal lighter material are the same as those provided to the Executive Officer pursuant to subsection (h)(2)(C).

(B) In the South Coast Air Quality Management District, the regulatory standards specified in subsection (h)(1)(A) shall be applicable upon the effective date of this subsection.

(2) Certification Requirements

(A) No charcoal lighter material formulation shall be certified under this subsection unless the applicant for certification demonstrates to the Executive Officer's satisfaction that the VOC emissions from the ignition of charcoal with the charcoal lighter material are less than or equal to 0.020 pound of VOC per start, using the procedures specified in the South Coast Air Quality Management District Rule 1174 Ignition Method Compliance Certification Protocol, dated February 27, 1991 (the "SCAQMD Rule 1174 Testing Protocol"). The provisions relating to LVP-VOC in sections 94508(a)(91) and 94510(d) shall not apply to any charcoal lighter material subject to the requirements of sections 94509(a) and (h).

(B) The Executive Officer may approve alternative test procedures which are shown to provide equivalent results to those obtained using the SCAQMD Rule 1174 Testing Protocol.

(C) A manufacturer or distributor of charcoal lighter material may apply to the Executive Officer for certification of a charcoal lighter material formulation in accordance with this subsection (h)(2). The application shall be in writing and shall include, at a minimum, the following:

1. the results of testing conducted pursuant to the procedures specified in SCAQMD Rule 1174 Testing Protocol.

2. the exact text and/or graphics that will appear on the charcoal lighter material's principal display panel, label, and any accompanying literature. The provided material shall clearly show the usage directions for the product. These directions shall accurately reflect the quantity of charcoal lighter material per pound of charcoal that was used in the SCAQMD Rule 1174 Testing Protocol for that product, unless:

i) the charcoal lighter material is intended to be used in fixed amounts independent of the amount of charcoal

used, such as certain paraffin cubes, or

ii) the charcoal lighter material is already incorporated into the charcoal, such as certain "bag light", "instant light" or "match light" products.

3. For a charcoal lighter material which meets the criteria specified in subsection (h)(2)(C)2.i), the usage instructions provided to the Executive Officer shall accurately reflect the quantity of charcoal lighter material used in the SCAQMD Rule 1174 Testing Protocol for that product.

4. Any physical property data, formulation data, or other information required by the Executive Officer for use in determining when a product modification has occurred and for use in determining compliance with the conditions specified on the Executive Order issued pursuant to section (h)(2).

(D) Within 30 days of receipt of an application, the Executive Officer shall advise the applicant in writing either that it is complete or that specified additional information is required to make it complete. Within 30 days of receipt of additional information, the Executive Officer shall advise the applicant in writing either that the application is complete, or that specified additional information or testing is still required before it can be deemed complete.

(E) If the Executive Officer finds that an application meets the requirements of this subsection (h)(2), then he or she shall issue an Executive Order certifying the charcoal lighter material formulation and specifying such conditions as are necessary to insure that the requirements of this subsection (h) are met. The Executive Officer shall act on a complete application within 90 days after the application is deemed complete.

(3) Notice of Modifications

For any charcoal lighter material for which certification has been granted pursuant to subsection (h)(2), the applicant for certification shall notify the Executive Officer in writing within 30 days of: (i) any change in the usage directions, or (ii) any change in product formulation, test results, or any other information submitted pursuant to subsection (h)(2) which may result in VOC emissions greater than 0.020 pound of VOC per start.

(4) Revocation of Certification

If the Executive Officer determines that any certified charcoal lighter material formulation results in VOC emissions from the ignition of charcoal which are greater than 0.020 pound of VOC per start, as determined by the SCAQMD Rule 1174 Testing Protocol and the statistical analysis procedures contained therein, the Executive Officer shall revoke or modify the certification as is necessary to assure that the charcoal lighter material will result in VOC emissions of less than or equal to 0.020 pound of VOC per start. The Executive Officer shall not revoke or modify the prior certification

without first affording the applicant for the certification an opportunity for a hearing in accordance with the procedures specified in Title 17, California Code of Regulations, Division 3, Chapter 1, Subchapter 1, Article 4 (commencing with section 60040), to determine if the certification should be modified or revoked.

(5) Notwithstanding any other provision of this subsection 94509(h), charcoal lighter material products manufactured prior to January 1, 1993, may be sold, supplied, or offered for sale until July 1, 1994, in all areas of California except the South Coast Air Quality Management District. Charcoal lighter material products subject to SCAQMD Rule 1174 and sold, supplied, or offered for sale in the South Coast Air Quality Management District shall meet the requirements of sections 94509(h) upon the effective date of this subsection, regardless of the date on which the products were manufactured.

(i) Requirements for aerosol adhesives (as defined in section 94508(a)(1)).

(1) As specified in Health and Safety Code section 41712(h)(2), the standards for aerosol adhesives apply to all uses of aerosol adhesives, including consumer, industrial, and commercial uses. Except as otherwise provided in sections 94509(c), 94510, 94511, and 94514, no person shall sell, supply, offer for sale, use or manufacturer for sale in California any aerosol adhesive which, at the time of sale, use, or manufacture, contains VOCs in excess of the specified standard.

(2)(A) In order to qualify as a "Special Purpose Spray Adhesive" the product must meet one or more of the definitions for "Special Purpose Spray Adhesive" specified in section 94508(a)(132), but if the product label indicates that the product is suitable for use on any substrate or application not listed in one of the definitions for "Special Purpose Spray Adhesive," then the product shall be classified as either a "Web Spray Adhesive" or a "Mist Spray Adhesive."

(B) If a product meets more than one of the definitions specified in section 94508(a)(132) for "Special Purpose Spray Adhesive," and is not classified as a "Web Spray Adhesive" or "Mist Spray Adhesive" under subsection (2)(A), then the VOC limit for the product shall be the lowest applicable VOC limit specified in section 94509(a).

(3) Effective 1/1/2002, no person shall sell, supply, offer for sale, or manufacture for use in California any aerosol adhesive which contains any of the following compounds: methylene chloride, perchloroethylene, or trichlorethylene, except that an aerosol adhesive manufactured before 1/1/2002 may be sold, supplied, or offered for sale until 1/1/2005, so long as the product container or package displays the date on which the product was manufactured, or a code indicating such date.

(4) All aerosol adhesives must comply with the labeling requirements specified in section 94512(d), and all manufacturers and responsible parties for aerosol adhesives must comply with the special reporting requirements specified in section 94513(d).

(j)Requirements for Floor Wax Strippers. After an effective date of January 1, 2002, no person shall sell, supply, offer for sale, or manufacture for use in California any floor wax stripper unless the following requirements are met:

(1) The label of each non-aerosol floor wax stripper must specify a dilution ratio for light or medium build-up of polish that results in an as-used VOC concentration of 3 percent by weight or less.

(2) If a non-aerosol floor wax stripper is also intended to be used for removal of heavy build-up of polish, the label of that floor wax stripper must specify a dilution ratio for heavy build-up of polish that results in an as-used VOC concentration of 12 percent by weight or less.

(3) The terms "light build-up," "medium build-up" or "heavy build-up" are not specifically required, as long as comparable terminology is used.

(k)Effective dates of the VOC limits for "Carburetor or Fuel-injection Air Intake Cleaners" and "Construction, Panel, and Floor Covering Adhesives."The definitions for the product categories of "Carburetor or Fuel-injection Air Intake Cleaners" and "Construction, Panel, and Floor Covering Adhesives" were modified as part of the "Mid-term Measures II" rulemaking action that was considered by the Board in October 1999. As a result of these modifications, certain types of consumer products were included in these definitions that had not previously been included. For those consumer products that were included in these definitions for the first time as a result of the "Mid-term Measures II" rulemaking action, the VOC limits (in section 94509(a)) applicable to these newly included products shall not become legally effective until December 31, 2002.

(l)Automotive Windshield Washer Fluids. The provisions of subsection 94509(b)(1) shall not apply to "Automotive Windshield Washer Fluid (Pre-Mixed)" as defined in section 94508(a)(21).

(m)Requirements for Contact Adhesives, Electronic Cleaners, Footwear or Leather Care Products, and General Purpose Degreasers.

(1) Except as provided below in sections 94509(m)(2) and (m)(4), effective December 31, 2005, no person shall sell, supply, offer for sale, or manufacture for use in California any Contact Adhesive, Electronic Cleaner, Footwear or Leather Care Product, or General Purpose Degreaser that contains any of the following compounds: methylene chloride, perchloroethylene, or trichloroethylene.

(2)Sell-through of Products. Contact Adhesives, Electronic Cleaners, Footwear or Leather Care Products, and General Purpose Degreasers that contain methylene chloride, perchloroethylene, or trichloroethylene and were manufactured before December 31, 2005, may be sold, supplied, or offered for sale until December 31, 2008, so long as the product container or package displays the date on which the product

was manufactured, or a code indicating such date.

(3) Notification for products sold during the sell-through period. Any person who sells or supplies a consumer product identified above in section 94509(m)(1) must notify the purchaser of the product in writing that the sell-through period for that product will end on December 31, 2008, provided, however, that this notification must be given only if both of the following conditions are met:

(A) the product is sold or supplied to a distributor or retailer; and

(B) the product is sold or supplied on or after June 30, 2008.

(4) Impurities. The requirements of section 94509(m)(1) and (m)(3) shall not apply to any Contact Adhesive, Electronic Cleaner, Footwear or Leather Care Product, or General Purpose Degreaser containing methylene chloride, perchloroethylene, or trichloroethylene that is present as an impurity in a combined amount equal to or less than 0.01% by weight.

(n) Requirements for Adhesive Removers, Electrical Cleaners, and Graffiti Removers.

(1) Except as provided below in sections 94509(n)(2) and (n)(4), effective December 31, 2006, no person shall sell, supply, offer for sale, or manufacture for use in California any Adhesive Remover, Electrical Cleaner, or Graffiti Remover that contains any of the following compounds: methylene chloride, perchloroethylene, or trichloroethylene.

(2) Sell-through of Products. Adhesive Removers, Electrical Cleaners, and Graffiti Removers that contain methylene chloride, perchloroethylene, or trichloroethylene and were manufactured before December 31, 2006, may be sold, supplied, or offered for sale until December 31, 2009, so long as the product container or package displays the date on which the product was manufactured, or a code indicating such date.

(3) Notification for products sold during the sell-through period. Any person who sells or supplies a consumer product identified above in section 94509(n)(1) must notify the purchaser of the product in writing that the sell-through period for that product will end on December 31, 2009, provided, however, that this notification must be given only if both of the following conditions are met:

(A) the product is sold or supplied to a distributor or retailer; and

(B) the product is sold or supplied on or after June 30, 2009.

(4) Impurities. The requirements of section 94509(n)(1) and (n)(3) shall not apply to any Adhesive

Remover, Electrical Cleaner, or Graffiti Remover containing methylene chloride, perchloroethylene, or trichloroethylene that is present as an impurity in a combined amount equal to or less than 0.01% by weight.

(o) Requirements for Solid Air Fresheners and Toilet/Urinal Care Products.

(1) Effective December 31, 2005, no person shall sell, supply, offer for sale, or manufacture for use in California any Solid Air Fresheners or Toilet/Urinal Care Products that contain para-dichlorobenzene, except that Solid Air Fresheners and Toilet/Urinal Care Products that contain para-dichlorobenzene and were manufactured before December 31, 2005 may be sold, supplied, or offered for sale until December 31, 2006, so long as the product container or package displays the date on which the product was manufactured, or a code indicating such date.

(2) Notification for products sold during the sell-through period. Any person who sells or supplies any Solid Air Freshener or Toilet/Urinal Care Product that contains para-dichlorobenzene must notify the purchaser of the product in writing that the sell-through period for the product will end on December 31, 2006, provided, however, that this notification must be given only if both of the following conditions are met:

(A) the product is sold or supplied to a distributor or retailer; and

(B) the product is sold or supplied on or after June 30, 2006.

Note: Authority cited: Sections 39600, 39601, 39650, 39658, 39659, 39666 and 41712, Health and Safety Code. Reference: Sections 39002, 39600, 39650, 39655, 39656, 39658, 39659, 39666, 40000 and 41712, Health and Safety Code.

HISTORY

1. New section filed 9-19-91; operative 10-21-91 (Register 92, No. 12).
2. Amendment of table in subsection (a), new table in subsection (a), amendment of subsections (c)-(f), redesignating of subsection (f)(2) to (g) and amendment, and new subsections (h)-(h)(5) filed 12-7-92; operative 1-6-93 (Register 92, No. 50).
3. Amendment filed 11-18-97; operative 11-18-97 pursuant to Government Code section 11343.4(d) (Register 97, No. 47).
4. Amendment of subsection (a) filed 12-23-97; operative 12-23-97 pursuant to Government Code section 11343.4(d) (Register 97, No. 52).
5. Amendment filed 7-17-98; operative 8-16-98 (Register 98, No. 29).
6. Amendment of subsection (a) filed 8-24-98; operative 8-24-98 pursuant to Government Code section 11343.4(d) (Register 98, No. 35).

Electronic Filing - Received, Clerk's Office, July 10, 2008

*** * * * * Errata Sheet and PC #3 * * * * ***

7. Amendment implementing Mid-Term Measures II redesigning table of standards and adding subsections (k)-(l) filed 10-20-2000; operative 11-19-2000 (Register 2000, No. 42).

8. Amendment of Table of Standards, amendment and redesignation of portion of subsection (i) as subsection (i)(1), new subsections (i)(2)-(4) and amendment of Notefiled 4-18-2001; operative 5-18-2001 (Register 2001, No. 16).

9. Amendment of section andNotefiled 6-20-2005; operative 7-20-2005 (Register 2005, No. 25).

17 CCR s 94509, 17 CA ADC s 94509
1CAC

17 CA ADC s 94509

Last updated July 5, 2007

STATE OF ILLINOIS)
)
COUNTY OF SANGAMON) SS

CERTIFICATE OF SERVICE

I, the undersigned, an attorney, state that I have electronically served the attached ILLINOIS ENVIRONMENTAL PROTECTION AGENCY'S THIRD ERRATA SHEET TO ITS PROPOSAL FOR THE ADDITION OF 35 ILL. ADM. CODE 223 and the ILLINOIS ENVIRONMENTAL PROTECTION AGENCY'S POST-HEARING COMMENTS TO THE JUNE 4, 2008 HEARING ON THE PROPOSAL FOR THE ADDITION OF 35 ILL. ADM. CODE 223 upon the following person:

John Therriault, Assistant Clerk
Illinois Pollution Control Board
James R. Thompson Center
100 West Randolph, Suite 11-500
Chicago, Illinois 60601-3218

and mailing it by first class mail from Springfield, Illinois, with sufficient postage affixed to the following persons:

SEE ATTACHED SERVICE LIST

ILLINIOS ENVIRONMENTAL
PROTECTION AGENCY

By: _____
Charles E. Matoesian
Assistant Counsel
Division of Legal Counsel

DATED: July 10, 2008

1021 North Grand Ave. East
Springfield, IL 62794-9276
217.782.5544
217.782.9143 (TDD)

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:)
)
PROPOSED NEW 35 ILL. ADM. CODE)
PART 223 STANDARDS AND) **R08 - 017**
LIMITATIONS FOR ORGANIC) **(Rulemaking – Air)**
MATERIAL EMISSIONS FOR AREA)
SOURCES)
)

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