



Designation: D3437 – 15 (Reapproved 2022)

Standard Practice for Sampling and Handling Liquid Cyclic Products¹

This standard is issued under the fixed designation D3437; 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.

1. Scope

1.1 This practice covers procedures for sampling and handling several liquid cyclic products. These specifically cover liquids at ambient temperature and include benzene, toluene, xylenes, cyclohexane, styrene, pyridine, ethylbenzene, isopropylbenzene, and alpha-methylstyrene in a manner which represents and preserves product quality.

1.2 Any person sampling or handling these products should consult the applicable Safety Data Sheet (SDS) for specific first aid instructions and information on the proper equipment to have available for use in the event of personal contact or exposure.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see Sections 3, 4, 5, 6 and 7 and an appropriate SDS.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D56 Test Method for Flash Point by Tag Closed Cup Tester

¹ This practice is under the jurisdiction of ASTM Committee D16 on Aromatic, Industrial, Specialty and Related Chemicals and is the direct responsibility of Subcommittee D16.08 on Handling and Sampling Aromatic and Cyclic Hydrocarbons.

Current edition approved July 1, 2022. Published July 2022. Originally approved in 1978. Last previous edition approved in 2015 as D3437 – 15. DOI: 10.1520/D3437-15R22.

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.

D850 Test Method for Distillation of Industrial Aromatic Hydrocarbons and Related Materials

D3505 Test Method for Density or Relative Density of Pure Liquid Chemicals

E300 Practice for Sampling Industrial Chemicals

2.2 *American National Standards Institute Standard: Z 288.1 Flammable and Combustible Liquids Code*³

2.3 *API Document:*⁴

RP-500A Classification of Locations for Electrical Installations in Petroleum Refineries⁴

2.4 *Other Documents:*

OSHA Regulations, 29 CFR paragraphs 1910.1000 and 1910.2000⁵

OSHA Benzene Standard, 29 CFR 1910.1028⁵

U.S. DOT Regulations, 49 CFR Transportation Subchapter C, Parts 171-180⁵

DOT/USCG 46 CFR Subchapter O, Part 171⁵

3. Significance and Use

3.1 This practice is issued to provide information useful in establishing sampling and handling procedures. It is expected that this information will only be utilized in conjunction with an existing health and safety program and consultation with the appropriate SDS. The information provided herein cannot be used as a substitute for expert safety and medical advice, but rather as a supplement to such advice.

4. Description of Products (See Table 1)

4.1 These liquids are marketed in different grades of purity so the physical properties may vary slightly.

4.2 The products listed in Table 1 are classified by the Department of Transportation as flammable liquids, and containers must bear flammable liquid labels. Trucks and tank cars must have flammable liquid placards.

4.2.1 These products are ordinarily transported in steel drums, tank cars, tank trucks, barges and ships.

³ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, <http://www.api.org>.

⁵ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.ecfr.gov>.

TABLE 1 Typical Physical Properties

Product	Boiling Point, ^A °C	Solidification Point, ^B °C	Flash Point ^C Closed Cup, °C	Reid Vapor Pressure Characteristics, ^B kPa	Relative Density, ^D 15.56/15.56 °C	Odor Threshold, ^B mg/kg	Explosion Limit ^B Lower (volume %)	Explosion Limit ^B Higher	Autoignition Temperature ^B °C
Benzene	80	5.5	-11	22.20	0.88	4.7	1.3	7.9	592
Cyclohexane	80	6.6	-17	22.75	0.78	2.5	1.3	8.4	270
Ethylbenzene	136	-95	15	2.76	0.87	140	1.0	6.7	460
Isopropylbenzene	152	-96	46	3.45	0.87	1.2	0.9	6.5	425
Pyridine	115	-42	20	5.31	0.99	0.02	1.8	12.4	482
Styrene	145	-30	31	1.86	0.91	0.15	1.1	6.1	490
Toluene	110	-95	4	7.58	0.87	0.17	1.3	7.0	536
Xylene (mixed)	137 to 144	-65	27	2.76	0.87	0.05	1.0	7.0	525
o-Xylene	144	-25	17	1.93	0.88	0.05	1.1	7.0	465
p-Xylene	138	13	27	2.34	0.87	0.05	1.1	6.6	466
alpha-Methyl Styrene	165	-23	45	1.59	0.91	<10	1.9	6.1	574

^A See Test Method **D850**.

^B Weiss, G., *Hazardous Chemicals Data Book*, Second Edition, Noyes Publications, Park Ridge, NJ, 1986.

^C See Test Method **D56**.

^D See Test Method **D3505**.

4.2.2 While these products are dangerous when handled improperly, their unloading need not be hazardous providing the hazards are recognized and handling instructions are rigidly observed.

4.3 Products shipped by air must be packaged to meet IATA and ICAO requirements.

5. Hazards

5.1 *Health*—Consult current OSHA regulations, supplier's Safety Data Sheet, and local regulations for all materials used in this practice.

5.2 Fire:

5.2.1 All of these liquids introduce a potential fire hazard where they are stored, handled, or used.

5.2.2 Vapors of all of these materials can form explosive mixtures with air.

5.2.3 Foam, carbon dioxide, dry chemical, or water fog can be used in fighting fires of these products. Special alcohol-type foam is required to effectively extinguish a fire involving pyridine.

6. Protection Equipment

6.1 Employees who work with the chemicals listed in **Table 1** should be trained and should maintain safe working conditions. Persons working with these chemicals require eye, face, body protection, and, for benzene, various types of respiratory protection that is dictated by the amount of exposure. Consult the appropriate SDS for more specific recommendations.

6.2 Personal protective equipment is not an adequate substitute for good safe working conditions, proper ventilation, and intelligent conduct. Correct usage of protection equipment requires education in proper use.

7. Safety Precautions

7.1 Unloading, loading and sampling operations must be conducted by carefully instructed employees and only when adequate lighting is provided.

7.2 Be sure that the storage tank is safely vented before connecting the unloading line.

7.3 Take extreme care to prevent spills and leaks. In case material is spilled, wash contaminated areas thoroughly with large quantities of water and collect the liquid in the plant chemical waste system. All spill-related activities should comply with applicable EPA, OSHA and local regulations and laws.

7.4 Because of the flammability of vapors, do not permit sparks or open flames in the vicinity of barges, ships, tank cars, tank trucks, drums, or storage tanks. All electrical equipment and wiring shall be of a type specified by and shall be installed in accordance with the National Electrical Code after determining whether or not the operation is carried out in a classified or unclassified area for electrical installations. Electrically bond tank cars, tank trucks, and drums by an approved method. Smoking is absolutely prohibited.

NOTE 1—See API RP-500A and ANSI Z 288.1, Chapters VI and VIII, on electric installations.

7.5 Do not permit personnel to enter an empty storage vessel, barge, ship, tank car, or tank truck until it has been thoroughly washed out with warm water, followed by a thorough steaming, and the tank atmosphere analyzed for oxygen as well as flammables. Entry should not be made without respiratory protection if the vapor space is not in compliance with OSHA TWA values. SUPERVISOR'S APPROVAL FOR ENTRY IS REQUIRED IN EVERY CASE.

7.6 Employees handling benzene must be trained annually to meet the requirements of OSHA Benzene Standard (29 CFR 1910.1028) and wear the respiratory protection listed.

7.7 Employees shall:

7.7.1 Know the hazards connected with the handling of specific products;

7.7.2 Be completely acquainted with the purpose, use, and maintenance of personal protective equipment;

7.7.3 Be trained to report promptly to supervision all suspected leaks or equipment failures;

7.7.4 Be trained to recognize and report any symptoms of systemic poisoning or skin contact; be thoroughly trained in the proper procedures for administering first aid and for obtaining professional medical help;

7.7.5 Know and routinely practice the accepted methods of sampling and handling these materials in order to avoid spilling or splashing, leaks, skin contact, vapor or mist inhalation, or ingestion;

7.7.6 Be completely familiar with the location and operation of safety showers, eye baths, hose lines, and all other first aid equipment; and

7.7.7 Know the importance of personal cleanliness and the necessity for immediate removal of clothing contaminated with these products.

8. Unloading and Sampling of Tank Cars

8.1 Unloading:

8.1.1 Because of the flammable properties of these materials, the unloading of tank cars containing chemicals is a hazardous operation. Carefully read and follow all shipper's instructions and all caution markings on both sides of the tank and dome.

8.1.2 Before removing the manhole cover or outlet valve cap, relieve the tank car of all internal pressure by venting the tank. This can be accomplished by raising the safety valve, or opening the vent on the dome at short intervals. If venting to relieve pressure will cause a dangerous amount of vapor to escape, defer venting and unloading until the pressure is reduced by allowing the car to stand overnight or otherwise cooling the contents.

8.1.3 Use bonding facilities for protection against static sparks during the unloading of tank cars through open domes. This shall consist of a bond wire permanently electrically connected to the unloading pipe or some part of the structure in electrical contact with the unloading pipe. Provide the free end of such wire with a clamp or equivalent device for convenient attachment to some metallic part of the tank car. Such bonding connection shall be made fast to the tank car before dome covers are raised and shall remain in place until unloading is complete and all dome covers closed and secure. This bond wire is not required when the unloading pipe is all metal and the unloading pipe is electrically bonded to the rail tracks.

NOTE 2—See ANSI Z 288.1, Chapter VI.

8.1.4 Tank cars can be unloaded through the dome connection or through the bottom outlet. Never use air pressure for this purpose. Use of a pump or nitrogen pressure are the recommended methods. If the car does not have an eduction pipe, insert one and remove the contents by pumping. If it is necessary to leave the car unattended after unloading has been started, disconnect all unloading connections. First close all valves tightly and apply the closures to all other openings securely.

8.2 Sampling:

8.2.1 Samples may be taken through the manway opening by means of a clean, dry, 1-L bottle held in a clean, dry sheath of nickel or stainless steel attached to a long rod or lightweight chain of the same material. Fit the bottle with a glass stopper

to which is attached a light metal chain. Lower the bottle to near the bottom of the tank and pull out the stopper with a sharp jerk of the chain. Raise it at such a rate that it is about three fourths full when it emerges from the liquid. Stopper the bottle before attempting to rinse the material from the outside. Label the sample bottle according to OSHA Regulations.

8.2.2 Label the sample container to indicate, as a minimum, the date and time, source of the sample, type of material, quantity, hazards, purpose of the sample and the name of the samples.

8.2.3 Emphasis should be placed on cleanliness and dryness. Both the sample bottle and its holder must be CLEAN AND DRY. Transfer the sample to another bottle for storage. A suitable bottle for storing the sample is one known as a "Boston Round." The closure should be a screw cap with poly-seal or an aluminum foil liner.

8.2.4 If new bottles are used, first rinse them thoroughly with acetone or methanol and then dry in an explosive-proof hot-air oven. Hold in a desiccator while cooling to ambient temperature. Protect them from dirt or moisture by enclosure in a polyethylene bag. Rinse used bottles very thoroughly with water, detergents, and solvents and then treat as new bottles.

NOTE 3—Brown bottles are recommended for sampling and storing photo-sensitive products.

8.3 Return Precautions:

8.3.1 As soon as the tank car is completely unloaded, close all valves tightly, remove the unloading connections, and make all other closures tight, except the heater coil and steam connections. Observe DOT regulations concerning return placarding.

9. Unloading and Sampling of Tank Trucks

9.1 Unloading:

9.1.1 Because of the flammable properties of these materials, the unloading of tank trucks containing them is a hazardous operation. Follow the DOT regulations, shipper's instructions and all caution markings.

9.1.2 Stop the engine before unloading a truck, and do not start it again during the entire unloading operation unless it is necessary to operate the pump by power take-off. Set truck brakes and block the wheels.

9.1.3 Before making any connection or contact between the tank truck and the unloading line or other unloading equipment, electrically bond the tank truck in a manner similar to that for tank cars as described in 8.1.3.

9.1.4 Tank trucks can be either top or bottom unloaded in the same manner as for tank cars as described in 8.1.4.

9.1.5 Air pressure is not permissible for unloading tank trucks of these materials. Nitrogen pressure is permissible for this purpose.

9.2 Sampling:

9.2.1 Sample a tank truck in the same way as tank cars, with the same rigid adherence to the precautions against moisture and color degradation.

9.2.2 Label sample containers as described in 8.2.2.

10. Unloading and Sampling of Drums

10.1 Unloading: