Storage and Handling of Gasoline-Methanol/Cosolvent Blends at Distribution Terminals and Service Stations

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Marketing Department

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FOREWORD

The use of methanol (methyl alcohol) with a cosolvent in motor fuel has been increasing so that recommended procedures for the storage and handling of gasoline-methanol/cosolvent blends are needed. The scope of this publication is limited to the storage and handling of gasoline-methanol/cosolvent blends at distribution terminals and service stations. For the purposes of this publication, gasoline-methanol1 cosolvent blends are defied as a mixture of unleaded gasoline, methanol, a cosolvent, and corrosion inhibitors, as approved by the U.S. Environmental Protection Agency (EPA) waiver provisions under the Clean Air Act, Section 211(f). Blends made with leaded gasoline do not require an EPA waiver and may contain ratios of oxygenates that are different from the EPA-waived blends.

A gasoline-methanol/cosolvent blend must conform to EPA regulations and to final product specification ASTM D 439 or ASTM P 176 (see 1.2 in text). Because of these requirements, the blend components are normally preblended with gasoline by the supplier, so this publication does not address terminal blending. The blend-component supplier should be contacted regarding instructions for terminal blending.

There are differences between the storage and handling of gasoline and the storage and handling of gasoline-methanollcosolvent blends; there are similar differences in safety and fire-fighting considerations. Thus, API's Marketing Operations and Engineering Committee and Committee on Safety and Fire Protection have jointly prepared this publication.

This publication addresses problems of a general nature. With respect to specific environmental safety and health risks and particular circumstances, local, state, and federal laws and regulations should be reviewed.

Suggested revisions are invited and should be submitted to the director of the Marketing Department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.

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Storage and Handling of Gasoline-Methanol/Cosolvent Blends at Distribution Terminals and Service Stations

SECTION 1—GENERAL

1.1 Scope

Motor fuels that consist of a blend of gasoline, methanol, a cosolvent or cosolvents, and corrosion inhibitors have properties similar to those of gasoline that is not blended with these additives. With some exceptions, the facilities required for the handling of gasoline-methanol1 cosolvent blends are also similar to those required for gasoline. There are, however, differences that must be recognized by those who store, handle, or provide fire protection for the blended product. This publication describes recommended practices for the storage, handling, and fire protection of gasoline-methanol/cosolvent blends at distribution terminals and service stations.

Methanol is an alcohol with a wide variety of uses as a solvent. It also serves as a basic building block for producing other chemicals and as a high-octane blending component for gasoline.

Cosolvent alcohols act as a link between methanol and other gasoline components. They improve a gasoline-methanol blend's water-tolerance properties. Cosolvents also help control the effects of methanol on the vapor pressure of a finished gasoline-methanol/cosolvent blend.

1.2 Referenced Publications

The following documents are referenced in this publication. The most recent edition or revision of these documents forms a part of this recommended practice to the extent specified in the text.

API

Bull 1615	*Installation of Underground Petroleum Storage Systems*
Publ 1621	*Recommended Practice for Bulk Liquid Stock Control at Retail Outlets*
RP 2003	*Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents*
Publ 2015	*Cleaning Petroleum Storage Tanks*
Publ 2021	*Guide for Fighting Fires in and Around Petroleum Storage Tanks*
Publ 2300	*Evaluation of Firefighting Foams as Fire Protection for Alcohol Containing Fuels*

ASTM[1]

D 439	*Specification for Automotive Gasoline*
P 176	*Proposed Specification for Automotive Spark-Ignition Engine Fuel*

NFPA[2]

11	*Foam Extinguishing Systems and Combined Agent Systems*
30	*Flammable and Combustible Liquids Code*
30A	*Automotive and Marine Service Station Code*

1.3 Materials

Most materials used in storing, blending, and transporting gasoline are also suitable for use with gasoline-methanol/cosolvent blends; however, sound engineering judgment is required when materials are selected for use with gasoline-methanollcosolvent blends to ensure the safety of the facilities that handle these liquids. Some commonly used materials and their compatibility with gasoline-methanol/cosolvent blends are listed in Table 1.

Before any system is converted to handle gasoline-methanol/cosolvent blends, it should be inspected for safe operability and modified as necessary. All materials in the system should be checked for their suitability for use with gasoline-methanol/cosolvent blends and replaced as required. Once the facility is in operation, it should be inspected periodically, and any malfunctions should be corrected promptly.

1.4 Safety and Fire Considerations

1.4.1 GENERAL

The safety precautions for storing and handling gasoline-methanol/cosolvent blends are similar to those for storing and handling gasoline. All applicable government regulations and industry standards should be followed.

[1]ASTM, 1916 Race Street, Philadelphia, Pennsylvania 19103.
[2]National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269.

Table 1—Compatibility of Commonly Used Materials with Gasoline-Methanol1 Cosolvent Blends

Recommended[a]	Not Recommended
Metals	
Aluminum	Galvanized metals
Carbon steel	
Stainless steel	
Bronze	
Elastomers	
Buna-N[b,c]	Buna-N[b,c]
Fluorel[b]	Neoprene[c]
Fluorosilicone[d]	
Neoprene[c]	
Polysulfide rubber	
Viton[b]	
Polymers	
Acetal	Polyurethane[d]
Nylon	Alcohol-based pipe dope (recently applied)[d]
Polyethylene	
Polypropylene	
Teflon[b]	
Fiberglass-reinforced plastic[d]	

[a]These recommendations may not apply to phase-separated blends or to the gasoline-methanol/cosolvent blending components. The manufacturer of the specific material should be consulted.
[b]Registered trademark.
[c]Buna-N and neoprene are recommended for hoses and gaskets but not seals.
[d]The manufacturer of the specific material should be consulted.

Although there arc similarities in extinguishing fires involving gasoline-methanol/cosolvent blends and those involving gasoline, some important differences exist (see Section 4 for details).

1.4.2 HEALTH WARNING

Tests have shown that prolonged or repeated exposure to some petroleum substances, in liquid or vapor form, may cause serious illness, including cancer, in laboratory animals. The significance of these results for human health is not fully understood because of the difficulty in translating the data for animals to humans. Nevertheless, everyone should minimize exposure to some petroleum substances. The following health precautions are suggested:

1. Minimize skin contact and breathing of vapors.
2. Keep these substances away from the mouth; they may be harmful or fatal if swallowed.
3. Keep work areas clean and well ventilated.
4. Clean up any spills promptly.
5. Use soap and water or waterless hand cleaner to remove any petroleutn substances that come in contact with the skin.
6. Do not use gasoline or similar solvents to remove oil and grease from skin.
7. Promptly wash oil-soaked clothes, and avoid using oil-soaked leather goods.

Information concerning health risks with respect to individual components and blended products should be obtained from the employer, the supplier of the component, or the Material Safety Data Sheet. Government health, safety, and environmental agencies are additional sources of information.

1.5 Special Requirements

1.5.1 GENERAL

The comments in 1.5.2 through 1.5.4 result from a review of the current literature on the subject of special requirements. Experience with the storage and handling of gasoline-methanol/cosolvent blends in the United States is relatively limited. Specific questions about this subject that are not addressed in this recommended practice should be directed to knowledgeable personnel, namely, the supplier of the component in question or safety and fire officials.

1.5.2 TANKS AND TANK LININGS

1.5.2.1 Storage Tanks

Gasoline-methanol/cosolvent blends can be stored in aboveground or underground tanks that are the same as those used to store gasoline,

1.5.2.2 Tank Materials

Unlined steel tanks are suitable for the storage of gasoline-methanol/cosolvent blends. Although the solvent characteristics of these products can cause rust from the interior walls to loosen, the rust can be removed by cleaning the tank or by flushing and filtration of the tank's contents. (Refer to API Publication 2015 for guidelines covering tank cleaning.)

Internally lined steel tanks may not be suitable for conversion to storage of gasoline-methanol/cosolvent blends. Many general-purpose tank liners installed in the past can be damaged by these products, In 1979 and 1980, formulations were devised for linings that are compatible with gasoline-methanol/cosolvent blends. The tank-lining manufacturer should be consulted about the compatibility of a particular lining.

Fiberglass-reinforced plastic tanks may or may not be suitable for the storage of gasoline-methanol/cosolvent blends. Resins have changed since fiberglass-reinforced

plastic tanks were initially fabricated, and the tank manufacturer should be consulted about the compatibility of materials.

NOTE: **Water bottoms must be avoided. Water bottoms may have a higher concentration of methanol and cosolvent than the gasoline-methanollcosolvent blend and may be more damaging to both internally lined and fiberglass-reinforced plastic tanks.**

1.5.2.3 Tank Vents

Tank vents can be normal, gasoline-type, upward-discharging open-vent caps, or they can be pressure-vacuum vent valves. Both kinds have been used, reportedly without significant problems. Pressure-vacuum valves should minimize product loss and moisture intake but require periodic maintenance.

1.5.3 PIPING AND FITTINGS

Manufacturer-approved nonmetallic pipe or cathodically protected steel pipe can be used, subject to the recommendations given in 1.5.2 for tanks. New flanged and screwed pipe joints should be made using gaskets, thread compound, or tape that is not adversely affected by methanol.

Existing steel piping should be satisfactory for conversion from gasoline to a gasoline-methanollcosolvent blend. Nonmetallic piping may or may not be suitable for conversion to a gasoline-methanollcosolvent blend. The piping manufacturer or supplier should be consulted about the compatibility of the piping.

1.5.4 PUMPS AND DISPENSERS

As noted in 1.5.2.2, the solvent characteristics of gasoline-methanol/cosolvent blends tend to loosen rust and deposits in unlined steel tanks and piping. These materials should be removed by filters, since they can cause accelerated wear in meters, seals, and gaskets. Filters may initially need to be changed frequently to remove such deposits.

Corrosion of metal components in the equipment does not appear to be of consequence unless phase separation has occurred.

1.6 Testing of Gasoline-Methanol1 Cosolvent Blends

1.6.1 TESTING FOR TANK BOTTOMS

Free water can extract a significant portion of the methanol/cosolvent from the gasoline-methanollcosolvent blend. Storage tanks should be checked regularly for tank bottoms. The usual water detection pastes are ineffective in the presence of most alcohols. Suitable waterlalcohol detection pastes are available from petroleum equipment supply sources. The use of a bottoms sampler is also an appropriate method for determining the presence of waterlalcohol bottoms.

If waterlalcohol bottoms are present in a storage tank, they should be removed as soon as is practical. The waterlalcohol mixture removed from the tank should be considered flammable, and appropriate precautions should be taken during its handling and disposal. This mixture must be disposed of in accordance with local, state, and federal regulations.

An investigation should be made to determine the source of any water in the storage tank. Water/alcohol bottoms may also contain gasoline.

1.6.2 TESTING FOR THE AMOUNT OF METHANOL/COSOLVENT

No standard field test exists for determining the amount of methanol/cosolvent in the gasoline-methanollcosolvent blend at the service station. Testing can be performed by qualified laboratory personnel.

SECTION 2—DISTRIBUTION TERMINALS

2.1 General

A gasoline-methanollcosolvent blend must conform to U.S. Environmental Protection Agency (EPA) regulations and to final product specification ASTM D 439 or ASTM P 176. Because of these requirements, the components of the gasoline-methanollcosolvent blend are normally preblended with gasoline by the supplier. Therefore, this publication does not address terminal blending. The blend-component supplier should be contacted regarding instructions for terminal blending.

If a gasoline-methanollcosolvent blend is stored at and transported from a distribution terminal, the facilities required and the methods of handling are essentially the same as those at a service station.

2.2 Tanks and Tank Linings

Tanks used to store gasoline-methanollcosolventblends should comply with generally accepted standards for storage of flammable liquids, such as those given in NFPA 30 and NFPA 30A.

Riveted tanks are likely to leak and should not be used unless a liner resistant to the gasoline-methanol/cosolvent blend is installed (see 1.5.2.2).

2.3 Piping

If existing lines are to be used, they must be thoroughly flushed with the blended product beforehand. Gasoline-methanol/cosolvent blends will loosen scale, rust, and dirt from the interior surface of the piping. An 80-mesh basket strainer should be installed in the line at the loading rack. The strainer should be removed and cleaned as necessary.

SECTION 3—SERVICE STATIONS

3.1 New Facilities

In addition to the recommendations given in this publication, underground storage tanks and piping systems should be installed according to the applicable requirements and recommendations of API Bulletin 1615 and API Recommended Practice 2003. Tanks used to store gasoline-methanol/cosolvent blends should comply with the provisions of 2.2. Care sliould be exercised to assure that nonmetallic parts are not adversely affected by the gasoline-methanol/cosolvent blend. The nonmetallic-parts manufacturer should be consulted about possible adverse effects.

3.2 Converting Existing Facilities from Use with Other Products

Several methods are used to prepare a storage tank and piping system for use with a gasoline-methanollcosolvent blend. The following procedure is an example of an acceptable method:

1. If the tank has a liner or is of nonmetallic construction, consult the supplier or manufacturer to determine the tank's compatibility with the gasoline-methanollcosolvent blend (see 1.5.2.2).
2. Inspect the fill-pipe cap and adapters to ensure that they are in good condition and will prevent water from entering the tank. Take corrective action if necessary.
3. Strip the tank bottom of all water and sludge, using a thief pump if necessary. Tank bottoms and sludge should be disposed of in accordance with appropriate environmental regulations (see 1.6.1).
4. Pump gasoline down to as low a level as is possible. This may be accomplished by sales through the service station dispenser. If regulations require that the exact gasoline-methanol/cosolvent blend percentage be posted, remove all gasoline from the tank.
5. Install filters in the dispensing system to ensure the delivery of clean product to the customer.
6. Fill the tank 85–90 percent full with gasoline-methanol/cosolvent blend.
7. If the previous product was leaded and the gasoline-methanol/cosolvent blend is to be unleaded, change the nozzle spout to the size for unleaded gasoline, after checking the lead content of the product for conformance with BPA requirements.
8. Change the dispenser filter and/or clean the dispenser strainer as necessary. Periodically inspect the pumping equipment for any evidence of leaks due to shrinking of gaskets or other causes.
9. Calibrate the dispenser's liquid meter at the time of conversion and at 2–3 months after conversion to verify the meter's accuracy. Particulate matter may increase wear of the meter, which would then require more frequent calibration.
10. Check the storage tanks daily for water bottoms.

3.3 Identification

The identification on the converted dispenser and the underground tank's fill pipe should be corrected. Corrections should include the following items:

1. The dispenser's product identification panel. (The product supplier should be consulted regarding the correct information.)
2, The required federal, state, local, and/or supplier labeling.
3, The fill-pipe identification tag, fill box, and/or manhole cover.

3.4 Record Keeping

Daily inventory records should be maintained in the same manner as for atiy other gasoline motor fuel. These procedures are given in API Publication 1621. Since water is a serious problem in the storage and handling of gasoline-methanollcosolvent blends, it is important to check tanks for water as described in 1.6 and to record the results of these tests with the inventory records.

SECTION 4—SAFETY AND FIRE PROTECTION

4.1 Safe Handling

Similar safety equipment and precautions should be used when handling either gasoline-methanol/cosolvent blends or gasoline (see 1.4.2).

4.2 Surface Spills

Gasoline-methanol/cosolvent blends should be handled in accordance with the applicable environmental regulations. Spills should be treated in the same manner as gasoline spills, including notification of the proper authorities.

4.3 Leaks

Underground leaks of gasoline-methanol/cosolvent blends should be handled in the same manner as underground leaks of gasoline. Because alcohols are soluble in water, they will separate from the gasoline when they reach the water table. Alcohols cannot be separated from underground water using the conventional techniques used to separate gasoline. Recent research indicates that under certain conditions, the alcohol may be biodegraded in the subsurface environment.[3] Toxicity will depend on the concentration.

4.4 Fire Protection

4.4.1 GENERAL

Personnel should approach a gasoline-methanol/cosolvent blend fire with the same caution as they would approach a gasoline fire, and similar fire-fighting techniques should be used. Information on the control and extinguishment of flammable-liquid fires is provided in API Publication 2021, API Publication 2300, and applicable NFPA standards.

As new alcohol-containing fuels and blends become available, testing of extinguishing agents may be necessary to determine the compatibility of the agents with these fuels and the required rate of application. The capabilities, application methods, and limitations of dry chemical, halon, carbon dioxide, and foam to extinguish fires involving gasoline-methanol/cosolvent blends are discussed in 4.4.2.

4.4.2 FIRE-FIGHTING AGENTS

4.4.2.1 Dry Chemical

All types of gasoline-methanollcosolvent blend fires (spill, pressure, three-dimensional, and fuel in-depth) can be extinguished with dry chemical at the same rate of application required to extinguish gasoline fires.

4.4.2.2 Carbon Dioxide, Halon 1211, and Halon 1301

Spill fires involving a gasoline-methanol/cosolvent blend can be extinguished using carbon dioxide, Halon 1211, or Halon 1301 at the same volumetric concentration or rate of application required to extinguish gasoline fires.

4.4.2.3 Foam

Gasoline-methanol/cosolvent blend spill fires (fuel depth less than $^1/_4$ inch) can be extinguished with aqueous-film-forming foams (AFFFs), polar-solvent (alcohol-resistant) foams, fluoroprotein foam, or regular protein foams in accordance with the recommended application rates given in NFPA 11.

Gasoline-methanol/cosolvent blend in-depth fires (fuel depth of $^1/_4$ inch or greater) can be extinguished with AFFFs, polar-solvent (alcohol-resistant) foams, or fluoroprotein foam in accordance with the recommended application rates given in NFPA 11.

Subsurface foam injection is not recommended for extinguishing gasoline-methanol/cosolvent blend tank fires. Detailed information on controlling and extinguishing fires involving gasoline/alcohol blends can be found in API Publication 2300.

[3] J. T. Novak, C. D. Goldsmith, R. E. Benoit, and J. H. O'Brien, "Biodegradation of Methanol and Tertiary Butyl Alcohol in Subsurface Systems," Paper presented at the International Seminar on Degradation, Retention and Dispersion of Pollutants in Groundwater, Copenhagen, September 1984, and at the meeting of the National Water Well Association, Houston, Texas, November 1985.