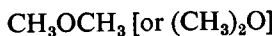


# Dimethyl Ether



Synonyms: Methyl ether, methyl oxide, wood ether

ICC Classification: Flammable compressed gas; red label

## PHYSICAL CONSTANTS

International symbol	—
Molecular weight	46.07
Vapor pressure at 70 F, psig	60
Specific gravity of gas (air = 1)	1.59
Specific gravity of liquid, at 68 F	0.661
Density, liquid, lb/cu ft	
at 70 F	41.2
at 105 F	39.2
at 115 F	38.6
at 130 F	37.7
Boiling point at 1 atm	−12.8 F
Freezing point at 1 atm	−223 F
Critical temperature	264 F
Critical pressure, psia	772
Specific heat, at −18 F, Btu/(lb)(°F)	0.96
Latent heat of vaporization, at −12.6 F, Btu/lb	201
Flammable limits in air, by volume	3.4–26.7 %
Flash point (closed cup)	−42 F
Autoignition temperature	662 F
Solubility in water at 75 F and 5 atm, by weight	35 %

**Properties.** Dimethyl ether is a colorless, flammable gas easily compressed to a colorless liquid. It has a faint sweetish odor and leads to anesthesia when inhaled in fairly large concentrations. It readily forms complexes with inorganic compounds and acts as a methylating agent.

**Materials of Construction.** Any commercially available metals may be used with dimethyl ether, as is it noncorrosive.

**Manufacture.** Dimethyl ether is produced by the dehydration of methanol, either with sulfuric acid or over alumina at high temperatures and pressures.

**Commercial Uses.** Dimethyl ether is used as a propellant in aerosol sprays and as a refrigerant (mixed with a fluorocarbon to reduce flammability). It is also used as a methylating agent in the dye industry, and as a chemical

reaction medium, a solvent, and a catalyst and stabilizer in polymerization.

**Physiological Effects.** Studies of dimethyl ether have found that inhalation of a 7.5 per cent concentration for 12 minutes resulted in a feeling of intoxication and some lack of attention; of a 10 per cent concentration for 64 minutes, in nauseous sickness; and of a 20 per cent concentration for 17 minutes, in unconsciousness. Early experiments investigating dimethyl ether as an anesthetic with animals and humans found no permanent residual effects.<sup>1</sup>

Prolonged contact of liquid dimethyl ether with the skin causes freezing or frostbite of the skin.

Precautions necessary for the safe handling of any flammable gas must be observed with dimethyl ether.

### DIMETHYL ETHER CONTAINERS

Dimethyl ether is authorized for shipment by the ICC in cylinders, in single-unit tank cars, in TMU (ton multi-unit) tank cars, and in TMU tanks on trucks.

**Filling Limit.** The maximum filling density authorized for dimethyl ether in cylinders is the maximum cylinder service pressure at 70 F. The maximum filling densities authorized for dimethyl ether in other containers are (per cent water capacity by weight): for single-unit tank cars, 62 per cent for TMU tanks, 59 per cent.

### SHIPPING METHODS; REGULATIONS

Under the appropriate regulations and tariffs, dimethyl ether is authorized for shipment as follows:

*By Rail:* In cylinders (freight or express), and in single-unit tank cars and TMU tank cars.

*By Highway:* In cylinders on trucks, and in TMU tanks on trucks.

*By Water:* In cylinders via cargo vessels only, and in authorized tank cars via train-ships only. In cylinders on barges of U. S. Coast Guard classes A and C only.

*By Air:* Aboard cargo aircraft only in appropriate cylinders up to 300 lb (140 kg) maximum net weight per cylinder.

### DIMETHYL ETHER CYLINDERS

Dimethyl ether is authorized for shipment of cylinders of any type currently approved by the ICC for liquefied compressed gases (these are cylinders that meet ICC specifications 3A, 3AA, 3B, 3BN, 3D, 3E, 4, 4A, 4B, 4BA, 4B-ET, 9, 40, and 41; cylinders meeting ICC specifications 3, 25, 26 and 38 may be continued in dimethyl ether service, but new construction is not authorized).

*Valve Outlet and Inlet Connections.* Standard connection, U. S. and Canada—No. 510.

**Cylinder Requalification.** All cylinders authorized for dimethyl ether service must be requalified by hydrostatic test every 5 years with the exceptions of: type 4, for which the

retest period is 10 years; type 3E, for which periodic retest is not required; and types 40 and 41, which are small inside containers that it is illegal to refill.

### SINGLE-UNIT TANK CARS AND TMU TANK CARS

Dimethyl ether is authorized for shipment in single-unit tank cars meeting ICC specifications 105A300W (provided that they have properly fitted loading and unloading valves). Rail shipment is also authorized for TMU tank cars of ICC specifications 106A500X and 110A500W.

### TMU TANKS ON TRUCKS

Shipment of TMU tanks of ICC specifications 106A500X and 110A500W on trucks is also authorized.

### STORAGE AND HANDLING EQUIPMENT

Storage and handling equipment for dimethyl ether must be designed to keep it from contact with the air, as it may form peroxides when exposed to atmospheric oxygen. Unloading and storage systems must be purged of all air before dimethyl ether is introduced into them. Compressed nitrogen is among substances recommended for such purging; carbon dioxide must not be used because it is highly soluble in dimethyl ether. Indoor storage areas must be located only in fire-resistant buildings and fitted with sprinkler systems to keep the storage container cool, should fire occur, because dimethyl ether exerts extreme pressure when heated. Ventilation must be provided for the floor level, to which dimethyl ether vapors sink. Should dimethyl ether ignite, recommended extinguishing agents for firefighting equipment include dry chemical, carbon dioxide and carbon tetrachloride.

### REFERENCE

1. Brown, W. E., *J. Pharmacol. Exp. Therapeutics*, **23**, 485-96 (1924); Davidson, B. M., **26**, 43-8 (1925).