The LYCRA Company

PRODUCT INFORMATION | FOR GENERAL RELEASE | MAY 9, 2019

# TERATHANE® PTMEG (polyether glycol)

*Properties, uses, storage and handling*

## Product Information

TERATHANE® PTMEG is a family of polyether glycols from The LYCRA Company. They are liquid or a waxy, white solid that melts to a clear, colorless, viscous liquid over a wide temperature range near room temperature.

TERATHANE® PTMEG is provided in six molecular weights, or grades: 250, 650, 1000, 1400, 1800, and 2000. Table 1 provides sales specifications for TERATHANE® PTMEG.

TERATHANE® PTMEG is a blend of linear diols in which the hydroxyl groups are separated by repeating tetramethylene ether groups. For example, TERATHANE® PTMEG 1000 is $H(OCH_2CH_2CH_2CH_2)nOH$, where n averages 14. For TERATHANE® PTMEG 2000, n averages about 27.

The Chemical Abstracts Service covers TERATHANE® PTMEG under two names: furan, tetrahydro, polymer (CAS Registry Number 24979-97-3) and poly(oxy-1,4-butanediyl)-α-hydro-ω-hydroxy (CAS Registry Number 25190-06-1). The TSCA inventory lists only the latter number.

**Table 1.** TERATHANE® PTMEG: sales specifications.

| | PTMEG 250 | PTMEG 650 | PTMEG 1000 | PTMEG 1400 | PTMEG 1800 | PTMEG 2000 |
|---|---|---|---|---|---|---|
| **Molecular weight** daltons | 230 – 270 | 625 – 675 | 950 – 1050 | 1350 – 1450 | 1700 – 1900 | 1900 – 2100 |
| **Hydroxyl number** mg KOH/g | 415.6 – 487.8 | 166.2 – 179.5 | 106.9 – 118.1 | 77.4 – 83.1 | 59.1 – 66.0 | 53.4 – 59.1 |
| **Water** ppm | 150 max. | 150 max. | 150 max. | 150 max. | 150 max. | 150 max. |
| **Color** APHA | 40 max. | 40 max. | 40 max. | 40 max. | 40 max. | 40 max. |
| **Alkalinity number** meq KOH/kg x 30 | –2.0 – 1.0 | –2.0 – 1.0 | –2.0 – 1.0 | –2.0 – 1.0 | –2.0 – 1.0 | –2.0 – 1.0 |

**Table 2.** TERATHANE® PTMEG: typical properties.

| | PTMEG 250 | PTMEG 650 | PTMEG 1000 | PTMEG 1400 | PTMEG 1800 | PTMEG 2000 |
|---|---|---|---|---|---|---|
| **Viscosity at 40°C** | 40 – 80 cP | 100 – 200 cP | 260 – 320 cP | 480 – 700 cP | 850 – 1050 cP | 950 – 1450 cP |
| **Melting point** | -5 – 0°C<br>23 – 32°F | 11 – 19°C<br>52 – 66°F | 25 – 33°C<br>77 – 91°F | 27 – 35°C<br>81 – 95°F | 27 – 38°C<br>81 – 100°F | 28 – 40°C<br>82 – 104°F |
| **Density at 40°C** | 0.98 m/l<br>8.2 lb/gal | 0.98 m/l<br>8.2 lb/gal | 0.97 m/l<br>8.1 lb/gal | 0.97 m/l<br>8.1 lb/gal | 0.97 m/l<br>8.1 lb/gal | 0.97 m/l<br>8.1 lb/gal |
| **Refractive index** | 1.464 $n_D^{25}$ | 1.464 $n_D^{25}$ | 1.464 $n_D^{25}$ | 1.464 $n_D^{25}$ | 1.464 $n_D^{25}$ | 1.464 $n_D^{25}$ |
| **Flash point** (tag, open cup) | >163°C<br>>325°F | >163°C<br>>325°F | >163°C<br>>325°F | >163°C<br>>325°F | >163°C<br>>325°F | >163°C<br>>325°F |
| **Peroxide content** (as $H_2O_2$) | <5 ppm | <5 ppm | <5 ppm | <5 ppm | <5 ppm | <5 ppm |
| **Stabilizer** (BHT) | 200 – 350 ppm | 200 – 350 ppm | 200 – 350 ppm | 200 – 350 ppm | 150 – 350 ppm | 200 – 350 ppm |

## Physical Properties

Table 2 shows typical properties for TERATHANE® PTMEG.

The density coefficient of TERATHANE® PTMEG is 0.066 g/ml/100°C. It is readily soluble in alcohols, esters and ketones, but insoluble in aliphatic hydrocarbons. TERATHANE® PTMEG will dissolve in aromatic and chlorinated hydrocarbons, but is insoluble in water.

Figure 1 shows approximate viscosity by molecular weight as a function of temperature.

The solubility of TERATHANE® PTMEG in functional solvents decreases as the length of aliphatic chains increase. For example, TERATHANE® PTMEG is completely miscible with methanol, but insoluble in dodecanol. 1,4 BDO dissolves up to approximately 20wt% TERATHANE® PTMEG 1000 at 25°C (77°F), but less than 10wt% TERATHANE® PTMEG 2000 (Figure 2).

TERATHANE® PTMEG is hygroscopic. At room temperature, it can absorb up to 2wt% water, depending on the molecular weight of the glycol. TERATHANE® PTMEG 250 is mostly miscible with water.

## Chemical Reactions

TERATHANE® PTMEG is a dihydric alcohol and undergoes the reactions typical of the hydroxyl group. The two commercially significant reactions are esterification with carboxylic acids and formation of urethanes with isocyanates. Reaction with acrylic acids results in the addition of a vinyl group that can be subsequently cross-linked.

## Stability

The approximate shelf-life of TERATHANE® PTMEG is two years if the product is stored in the original container at ambient temperature under a dry nitrogen blanket and tightly closed. Because storage and local ambient conditions vary and The LYCRA Company has no control over the practices, procedures and conditions at a customer's facility, this shelf-life estimate should be used as guidance only. It is not provided as a guarantee of shelf life.

## Shipping Containers

TERATHANE® PTMEG is available in railcars, tank trucks, ISO containers, or 55-gallon (441 lb/200 kg net) steel drums.

TERATHANE® PTMEG is not regulated as a hazardous material by the Department of Transportation (DOT), IMO or IATA as of July 2015 [1].

## Health Hazards, Personal Safety and First Aid

For safety, first aid and health hazards, please refer to the Safety Data Sheet.

## FDA Status

TERATHANE® PTMEG is comprised of alpha-hydro-omegahydroxypoly-(oxytetramethylene) (CAS #25190-06-1) with 150-500 ppm of 2,6-di-tert-butyl-p-cresol (BHT, Butylated hydroxytoluene, CAS# 128-37-0) as an antioxidant.

In the United States, BHT is listed as generally recognized as safe (GRAS) for use in food in 21 C.F.R. §182.3173. Pursuant to 21 C.F.R. § 174.5, substances that are GRAS for direct addition to food can also be used in food-contact applications.

**Figure 1.** Approximate viscosity as a function of temperature, by grade (molecular weight).

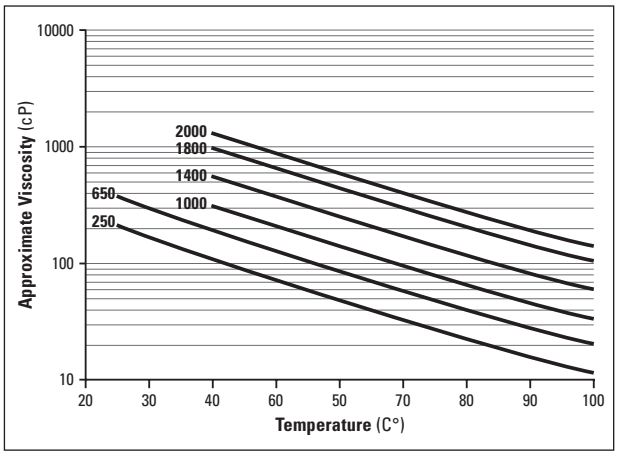
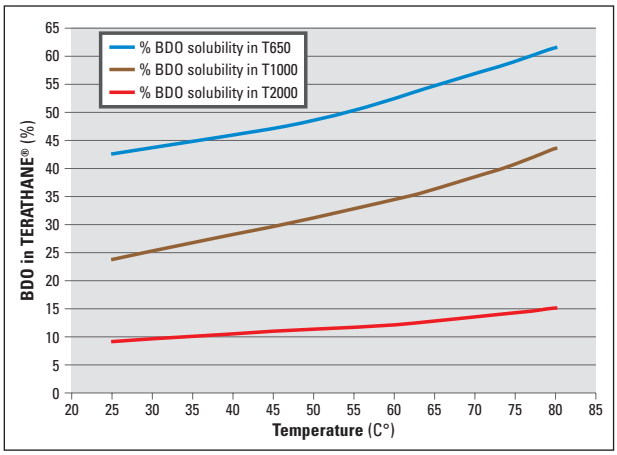



**Figure 2.** 1,4 BDO solubility in TERATHANE® PTMEG.



As to PTMEG, FDA's regulations clear several polymers produced from PTMEG for use in food contact applications in the following sections of the Code of Federal Regulations:

- 21 CFR 175.105 Adhesives
- 21 CFR 177.1590 Polyester elastomers
- 21 CFR 177.1630 Polyethylene phthalate polymers)
- 21 CFR 177.1680 Polyurethane resins
- 21 CFR 177.2600 Rubber articles intended for repeated use

Please note that The LYCRA Company makes no representations regarding the FDA regulatory status of polymers produced from Terathane® PTMEG. It is the customer's responsibility to ensure that the Terathane® PTMEG based polymer is FDA compliant. The regulatory listings included above are merely intended to illustrate the ways in which Terathane® PTMEG potentially can be used to produce FDA-compliant polymers.

## End Uses

The main uses for TERATHANE® PTMEG involve the reaction of the hydroxyl groups with either isocyanates or organic acids. The glycols become segments or building blocks in a variety of elastomers, such as polyurethanes, co-polyesters and polyamides.

Reaction with diisocyanates permits the use of TERATHANE® PTMEG as soft segments in polyurethanes[2]. If the diisocyanate is toluene diisocyanate (TDI), amines such as 4,4'-methylene-bis(2-chloroaniline) are favored as chain extenders or curatives. If diphenylmethane-4,4'-diisocyanate (MDI) is used, then 1,4 BDO is the favored chain extender[3,4].

TERATHANE® PTMEG and low molecular weight polyester glycols such as poly(butylene adipate) glycol both can yield very good polyurethanes and in most uses either can be used as the soft segment. However, a requirement for a particular property will often dictate the use of one or the other[5]. TERATHANE® PTMEG gives urethanes more resistance to low temperatures, to hydrolysis and resistance to degradation by microogranisms[4,6]. It also has excellent dynamic properties. TERATHANE® PTMEG imparts a low specific gravity and both the polyether glycol itself and its prepolymers have low viscosities leading to easier handling.

## Polyurethane Starting Formulations

Details are available in the technical bulletin *TERATHANE® PTMEG and 1,4 Butanediol Uses in Polyurethanes* (Doc. Ref.#P562).

## Storage, Handling & Precautions in Use

TERATHANE® PTMEG is a polymeric ether that is susceptible to both thermal and oxidative degradation. It contains an antioxidant to prevent formation of peroxides under normal handling and storage conditions. Peroxide formation can result in chain cleavage and therefore must be avoided.

Thermal decomposition occurs at 210–220°C (410–430°F) with extremely flammable tetrahydrofuran (THF) as one of the products[7]. Temperatures as low as 100°C (212°F) can cause dangerous pressure buildup in stored drums if the drums are unvented. To store drums containing TERATHANE® PTMEG, vent off pressure by loosening bungs before heating and store at 70°C (160°F) or less.

Oxidative degradation occurs when TERATHANE® PTMEG contacts air. It is usually encountered when high surface area material, e.g., pipe insulation, is impregnated with TERATHANE® PTMEG. Decomposition under these conditions can occur at temperatures as low as 100°C (212°F) with evolution of THF, aldehydes and ketones, which have a characteristic pungent odor and lachrymatory properties. The heat of the oxidative degradation is sufficient to sustain the decomposition reaction and cooling the mass is the only satisfactory way of terminating the reaction.

Water spray, alcohol-resistant foam, dry chemical or $CO_2$ extinguishers may be used to fight TERATHANE® PTMEG fires. When water or foam is used, frothing may occur[7].

## Spills

For spill handling and cleanup information, please refer to the Safety Data Sheet.

## Transportation Emergencies

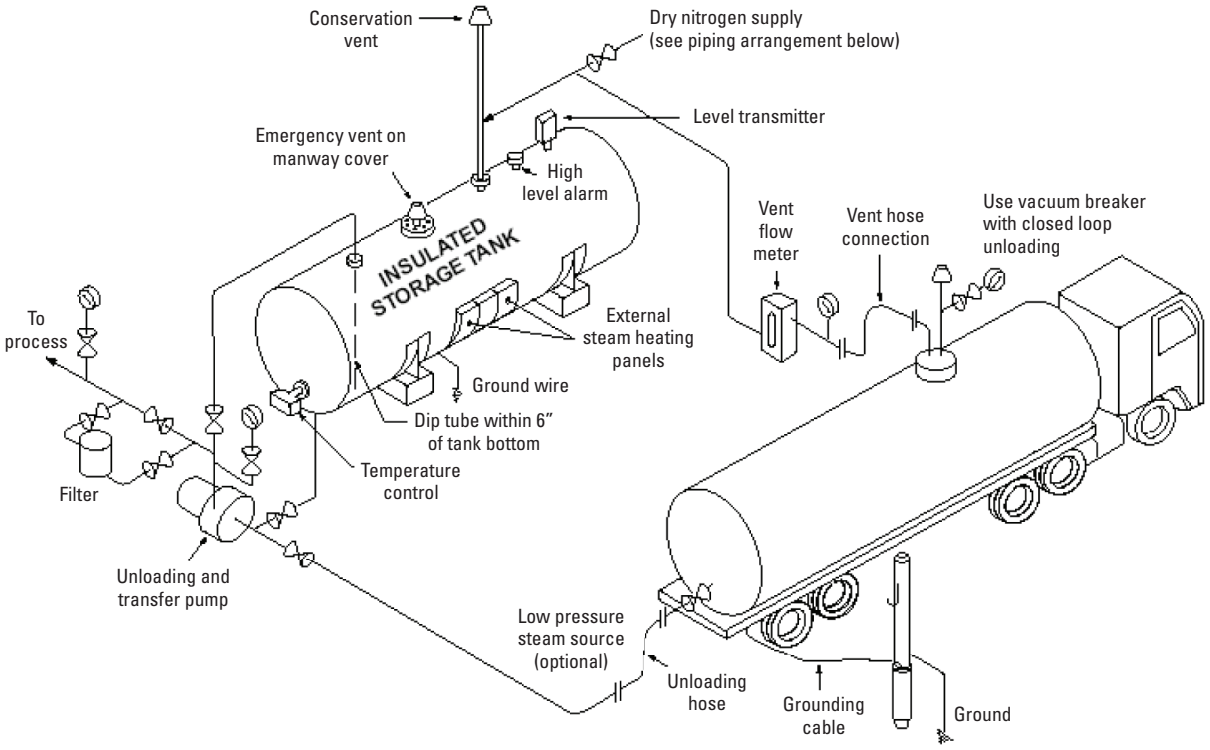
If a transportation emergency arises in the continental United States, call (800) 424-9300 toll free. You will be connected with the Chemical Manufacturers Association's Chemical Transportation Emergency Center (Chemtrec) in Washington, DC. The Chemtrec telephone is attended around the clock to provide expert help. Chemtrec specialists relay handling and hazard information and report the accident to the shipper.

## Unloading and Transfer

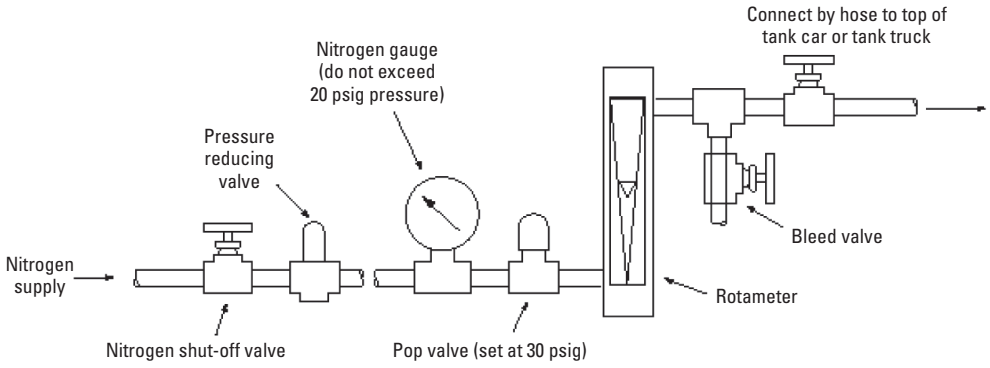
Drums should be stored in a warm room to prevent freezing. TERATHANE® PTMEG is hygroscopic. The LYCRA Company recommends that nitrogen be used to prevent moisture contamination during thawing. As a polymer, TERATHANE® PTMEG has a

**Figure 3.** Unloading and transferring.

## *Tank truck unloading and outdoor storage*




## *Typical piping arrangement for nitrogen blanketing*




**NOTES:**

- Use a 0 – 15 cfm (0 – 7 L/sec) nitrogen rotameter to balance nitrogen flow with liquid pumping rate. This maintains positive pressure on cargo tank. Flow rate of 13.3 cfm is equivalent to a glycol flow rate of 100 gpm (or 6.3 L/sec).
- Caution: the cover over the nitrogen valves on the dome of a tank car is hinged and a potential pinch point.

certain molecular weight distribution and a separation takes place in the drum over the storing time and upon freezing. Frozen drums can be thawed by loosening the bung caps and storing for at least one day in a warming oven or thaw box at 60–70°C in order to liquefy the contents. The material in the drum should be homogenized before use. Before opening a drum, any water in the depression in the bung should be removed. To prevent moisture and oxygen contamination, drums should be opened under a nitrogen blanket.

Bulk truck shipping temperatures are normally 80–100°C (175–210°F). At the receiving site, the polyether glycols are often still hot enough to cause thermal burns on skin contact.

If shipments of TERATHANE® PTMEG have been subjected to low temperature in transit, careful attention will be required to avoid plugging of vent, product and gas supply lines. Cargo tanks are typically insulated and provided with heating coils to reheat the contents if required.

A typical tank truck unloading and storage system is shown in Figure 3.

## Storage

TERATHANE® PTMEG is hygroscopic and can oxidize. They should be stored in completely enclosed tanks under a dry nitrogen blanket. Do not store in containers with a low barrier to oxygen, such as polyethylene.

The storage tank should be provided with external or internal heating to maintain a temperature of about 50°C (120°F). Tanks should be designed and built in accordance with good industrial practice and appropriate federal, state and local codes.

**REFERENCES**


1. Due to changing government regulations, such as those of the U.S. Department of Transportation, Department of Labor, Environmental Protection Agency and the Food and Drug Administration, and corresponding agencies in other countries, references herein to government requirements may be superseded. Each user should consult and follow the current government regulations, such as Hazard Classification, Labeling, Food Use Clearances, Worker Exposure Limitations and Waste Disposal for the up-to-date requirements for the products described in this bulletin.
2. **Kimball ME and Fielding-Russell GS.** Effect of Cure Temperature on Urethane Networks. *Polymer* (1977) 18(8), 777–780
3. **Hagen EL.** Solve MDI Prepolymer Processing Problems. *Plastics Technology* (1978) 24(10), 95–99
4. **Schollenberger CS and Stewart FD.** Thermoplastic Polyurethane, Hydrolysis Stability. *Advances in Urethane Science and Technology* (1971) Vol. 1, 65–93
5. **Ferrari RJ.** Urethane Elastomers–A Comparison. *Rubber Age* (1967) 99(2)(10), 53–57
6. **Reinhardt HG.** Verarbeitung und Anwendung von Polyaetherurethan Elastomeren. *Kunststoffe* (1977) 67(11), 687–690
7. Fire Hazard Properties of Flammable Liquids, Gases, Volatile Solids, National Fire Protection Association, No. 325M, 1977.

TERATHANE®
POLYETHER GLYCOL

The LYCRA Company innovates and produces fiber and technology solutions for the apparel and hygiene industries, as well as specialty chemicals used in the spandex and polyurethane value chains. Headquartered in Wilmington, Delaware, The LYCRA Company is recognized worldwide for its innovative products, technical expertise, and unmatched marketing support. The LYCRA Company owns leading consumer and trade brands: LYCRA®, LYCRA HyFit®, LYCRA® T400®, L by LYCRA®, COOLMAX®, THERMOLITE®, ELASPAN®, SUPPLEX®, TACTEL®, and TERATHANE®. While The LYCRA Company's name is new, its legacy stretches back to 1958 with the invention of the original spandex yarn, LYCRA® fiber. Today, The LYCRA Company is focused on adding value to its customers' products by developing unique innovations designed to meet the consumer's need for comfort and lasting performance. For more information, visit connect.lycra.com and lycra.com.



***Contact Information:***

**Americas**
Richard Lemerise
*richard.lemerise@LYCRA.com*
Phone: + 1-302-683-3071

**Asia**
Jason Shang
*jason.shang@LYCRA.com*
Phone: + 86-21-63876666-2228

**Europe**
Morteza Shirazi
*morteza.shirazi@LYCRA.com*
Phone: + 34-932-379-282

Doc Ref: **P554**

The LYCRA Company