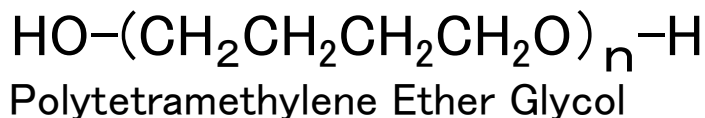


# FAS PTMG



## [ 1 ] INTRODUCTION ON FAS PTMG

Formosa Asahi Spandex Co., Ltd. (FAS) has been newly manufacturing polytetramethylene ether glycol(PTMG) for sale. The producing process of PTMG was developed by Asahi Kasei Corp. in Japan, which have been producing Spandex(ROICA) using the PTMG prepared by their original method for several decades.

FAS also started to manufacturing Spandex(ROICA) using PTMG prepared by ourselves.

PTMG is a blend of linear diol in which the hydroxy groups are separated by repeating tetramethylene ether groups. It is a waxy, white solid that melts to be a clear, colorless, viscous liquid on a wide temperature range near room temperature.

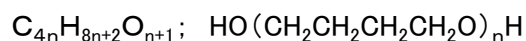
PTMG reacts easily with isocyanates(MDI, TDI etc.) or the like, to give a variety of polymers, which have the characteristics of superb abrasion resistance, hydrolysis resistance, excellent dynamic properties including resilience under low temperature, resistance to fungus attack.

FAS manufactures PTMG in five nominal molecular weights; PTMG-650, 1000, 1800, 2000 and 3000. PTMG products with other molecular weights can be produced on special order of customers. For specific information, please contact FAS as shown on the back cover.

### (1) Chemical Nomenclature

$\alpha$ -hydro- $\omega$ -hydroxy-poly(oxy-1,4-butanediyl)  
(according to IUPAC and CAS)  
CAS Registry Number; 25190-06-1

#### Formation



### (2) Synonyms

Polytetramethylene Ether Glycol (PTMEG)  
Poly(oxytetramethylene) Glycol  
Polytetramethylene Oxide (PTMO)  
Polybutylene Glycol  
Polytetrahydrofuran (PTHF)  
PTMG

[ II ] Typical Chemical and Physical Properties of FAS PTMG

| PTMG   | unit       | PTMG-650   | PTMG-1000  | PTMG-1800  | PTMG-2000  | PTMG-3000    |
|--|------------|--|------------|------------|------------|--------------|
| Appearance                                   | —          | Waxy, white solid (or clear colorless liquid)  |            |            |            |              |
| Color, APHA                                  | APHA       | < 10   | < 10       | < 10       | < 10       | < 10         |
| OH-value                                     | mg KOH/g   | 172.6  | 112.2      | 62.3       | 56.1       | 37.4         |
| Molecular Weight(Mn)                         | —          | 650  | 1000       | 1800       | 2000       | 3000         |
| MWD (Mw/Mn) <sup>*1</sup>                    | —          | 1.5  | 1.46       | 1.47       | 1.47       | 1.46         |
| Acid Number                                  | mg KOH/g   | 0.01   | 0.008      | 0.012      | 0.011      | 0.01         |
| Melting Point                                | °C         | 15   | 21.1       | 26.6       | 26.8       | no detection |
| Flash Point                                  | °C         | >200   | >200       | >200       | >200       | >200         |
| Specific Gravity                             | (40°C/4°C) | 0.975  | 0.975      | 0.972      | 0.972      | 0.972        |
| Viscosity, 40°C                              | cps        | 152  | 225        | 530        | 600        | 1468.3       |
| Water  | wt%        | <0.025   | <0.025     | <0.025     | <0.025     | <0.025       |
| Specific Heat                                | cal/g·deg  | 0.5 ~ 0.52   | 0.5 ~ 0.52 | 0.5 ~ 0.52 | 0.5 ~ 0.52 | 0.5 ~ 0.52   |
| Iron   | ppm        | <1   | <1         | <1         | <1         | <1           |
| Peroxide (as H <sub>2</sub> O <sub>2</sub> ) | ppm        | <10  | <10        | <10        | <10        | <10          |
| Solubility                                   |            | readily soluble in alcohols, esters and ketones aromatic and chlorinated hydrocarbons insoluble in aliphatic hydrocarbons and water tendency to decrease the solubility as molecular weight increase |            |            |            |              |
| Hygroscopicity                               |            | All hygroscopic<br>At room temperature, PTMG can absorb up to 2% water depending on the molecular weight.  |            |            |            |              |

\*) Evaluated by GPC using monodispersed PTMG as a standard substances.

The typical molecular weight distribution for PTMG-2000 and 1800 are shown in Figure-1.

Temperature dependence of viscosity and specific gravity are shown in Figure-2 and 3, respectively.

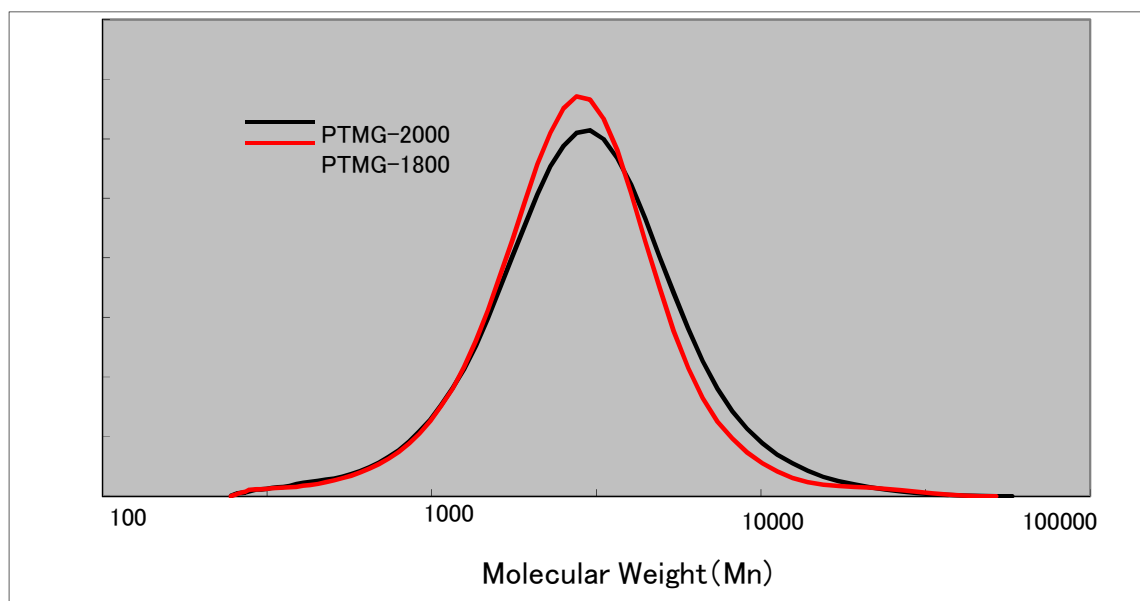


Figure-1 Molecular Weight Distribution of FAS PTMG-2000 and 1800 measured by GPC (Monodispersed PTMGs are used as a standard substance)

Technical Data Sheet(FAS)

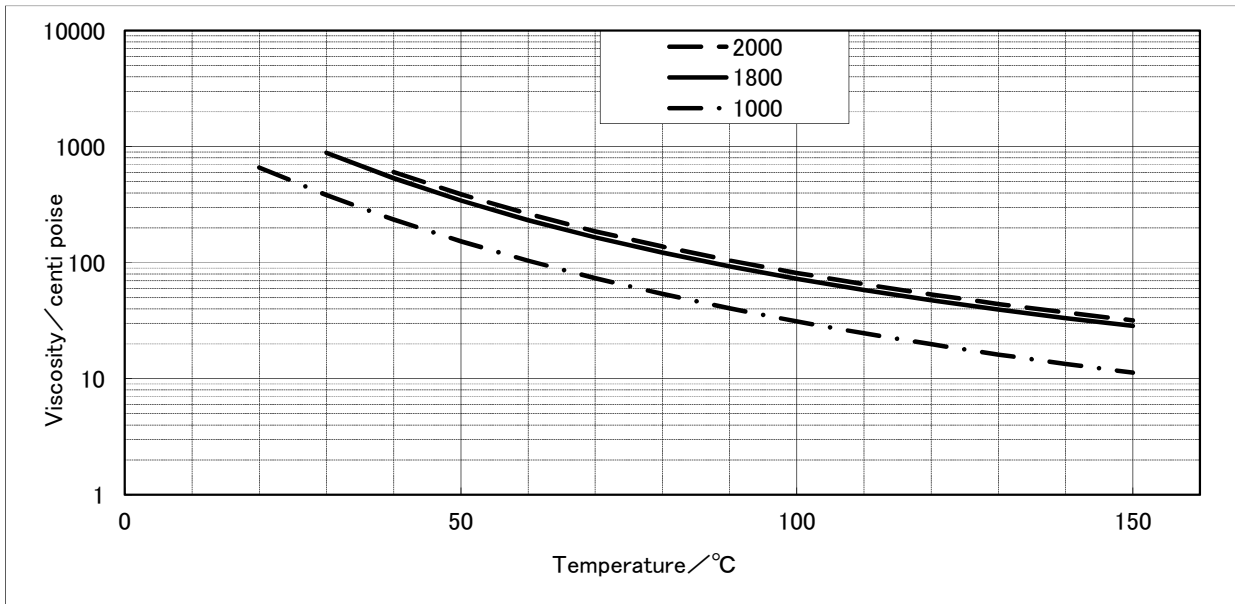


Figure-2 Viscosities of FAS PTMG(2000,1800 and 1000)

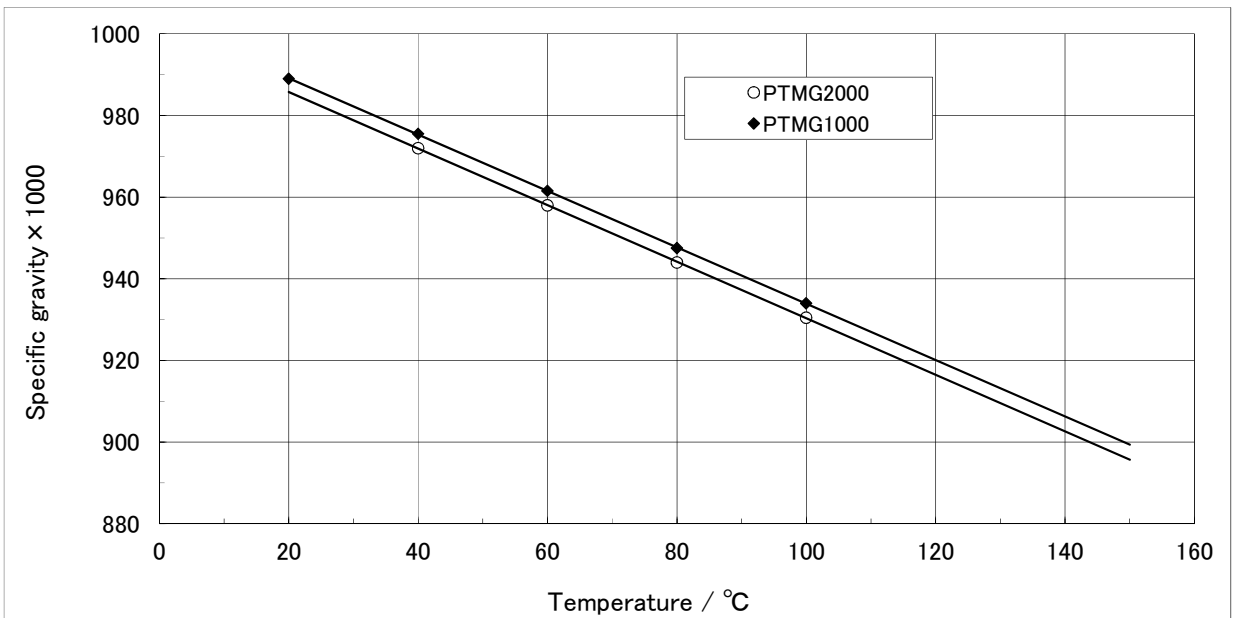


Figure-3 Specific Gravities of FAS PTMG(2000 and 1000)

**[Ⅲ] SALES SPECIFICATION of FAS PTMG**

| Products             | unit     | PTMG-650                                      | PTMG-1000   | PTMG-1800 | PTMG-2000 | PTMG-3000   |
|----------------------|----------|---|-------------|-----------|-----------|-------------|
| Appearance           | -        | Waxy, white solid (or clear colorless liquid) |             |           |           |             |
| Molecular Weight(Mn) | g/mol    | 600~700                                       | 950~1050    | 1700~1900 | 1900~2100 | 2950~3150   |
| OH-value             | mg KOH/g | 160.3~187                                     | 106.9~118.1 | 59.1~66   | 53.4~59.1 | 35.62~39.37 |
| Color, APHA          | —        | < 40  | < 40        | < 40      | < 40      | < 40        |
| Acid Number          | mg KOH/g | < 0.1   | < 0.1       | < 0.1     | < 0.1     | < 0.1       |
| Water                | wt%      | <0.025  | <0.025      | <0.025    | <0.025    | <0.025      |

FAS PTMG is manufactured under strictly controlled manner, resulting a high and stable quality PTMG will be provided for the customers.

Query about the quality or analytical method will be settled for after contacting FAS.

**[Ⅳ] APPLICATIONS AND USES of PTMG**

PTMG is dehydric alcohols and undergo reactions typical of hydroxyl group.

The two commercially significant reactions are formation of urethanes with isocyanates and esterification with carboxylic acids. And PTMG is used as an ingredient for these reactions to form segments or build-in blocks in the polymers.

Specifically, PTMG gives polyurethanes with excellent resistance to low temperatures, fungus attack and hydrolysis. They have also superb dynamic properties including resilience.

Therefore, the polymers based on PTMG are applied for the versatile end uses; to consumer goods, such as fashionable clothing or the like and to industrial goods, such as the parts of the machinery.

Demand for PTMG is increasing and the polymers based on PTMG are expected to be diversified.

★PTMG for Polyurethane

| USES   | APPLICATIONS   |
|--|--|
| Polyurethane Fiber(Spandex)                              | Swimsuits, Underwear, Sportswear, Stocking etc.  |
| Polyurethane Elastomer<br>(Thermoplastic, Thermosetting) | Automotive parts, Cable and Wire, Hose and Tubing,<br>Wheels and Rollers, Solid Tires etc. |
| Synthetic Leathers                                       | Shoes, Bags etc.   |
| Paint, Coating Agent                                     | Water resistant coatings etc.  |
| Adhesives, Sealants                                      | Adhesives for industry and building  |

★PTMG for Polyester and Polyamide

| USES                | APPLICATIONS   |
|---------------------|--|
| Polyester Elastomer | Automotive parts, Cables, Hose and Tubing etc.             |
| Polyamide Elastomer | OA machinery parts, Skiing boots, Belts, Roller skate etc. |

**[Ⅴ] PACKING of PTMG**

| Packing  | Weight    | Remarks             |
|----------|-----------|---------------------|
| Drum     | 2 0 0 k g | Standard steel drum |
| Iso Tank | 2 0 Ton   | Export/Domestic     |

## 【VI】 ADVANTAGE of FAS PTMG

FAS PTMG has extraordinary sharp molecular weight distribution, as shown in Figure-1, which is produced by the emulsion polymerization using the unique catalyst developed initially by Asahi Kasei Corp.

FAS PTMG is superior in heat resistance to the conventional PTMG with broad molecular weight distribution, which is originated from sharp molecular weight distribution.

And the elastomers based on FAS PTMG will give superb resistance to low temperature, especially in resilience, compared with the elastomers based on the conventional PTMG.

Additionally, the viscosity of FAS PTMG is predominantly lower than that of the conventional PTMG, thus the processability would be improved dramatically.

## 【VII】 PERSONAL SAFETY AND FIRST AID

### Health Hazards

PTMG may cause mild skin and eye irritation based on test results with laboratory animals.

PTMG shows a very low order of toxicity, when tested orally in rats.

The vapor pressure of PTMG is very low and no adverse effects of inhalation have been observed.

### Safety Precautions

In order to avoid contact with eye or skin, wear chemical splash goggles and globes.

Particularly, in handling PTMG as liquid state, globes are inevitable because it may be hot. Wash thoroughly after handling.

### Fires

PTMG is ignitable at high temperature. Alcohol foam or Carbon dioxide are available to fight PTMG fires.

### First Aid

In case of skin contact with PTMG, wash with soap and water. For eyes, immediately flush with water for at least 15 minutes and call a doctor.

For further information about safety, please consult on SDS.

## 【VIII】 STORAGE AND HANDLING

Since PTMG is hygroscopic and can oxidize, the following attention should be paid.

- PTMG should be stored under a dry nitrogen blanket in completely enclosed vessel.
- In melting solidified PTMG, heat it in an oven at ca. 70°C for 24 hours. Temperatures above 95°C for prolonged storage or localized overheating should be avoided.
- In case of storing PTMG as a liquid, it should be stored below 50°C(40 – 50°C) with dry nitrogen gas seal, and also prevented from localized overheating.
- PTMG should be refrained from repeating of solidification and melting to keep away from degradation.
- Because of causing the cleavage of PTMG, caution should be paid when it contacts with strong acids.

★ FAS PTMG contains anti-oxidant to minimize oxidative degradation.(Without anti-oxidant is available)