# Ethylene Glycol

INEOS Oxide

## Technical Data Sheet

Ethylene glycol is a colourless, odourless, involatile, hygroscopic liquid. It is characterised by two hydroxyl groups, which contribute to its high water solubility, hygroscopicity and reactivity with many organic compounds.

Major applications for ethylene glycol are as an intermediate for the manufacture of polyester resins, fibres and surface coatings, as well as an antifreeze in the automotive industry.

Synonyms for the product are monoethylene glycol (MEG), 1,2-ethanediol and dihydroxyethane. Its Chemical Abstracts Service (CAS) Number is 107-21-1.

## Commercial Information

### Specification

INEOS ethylene glycol conforms to the following specifications :

| | | Technical grade | Polyester grade |
|---|---|---|---|
| Acidity as per cent acetic acid max. | | 0.005 | 0.002 |
| Diethylene glycol | % max. | 0.5 | 0.05 |
| Water | % max. | 0.2 | 0.05 |
| Water solubility | miscible in all proportions at 25°C | | |
| Colour | Hazen units max. | 15 | 5 |
| Suspended matter | | substantially free | substantially free |
| Ultraviolet transmittance | | | |
| at 220 nm | % min. | | 75 |
| at 240 nm | % min. | | 85 |
| at 275 nm | % min. | | 95 |
| at 350 nm | % min. | | 99 |
| Iron | ppm max. | | 0.1 |
| Chlorides | ppm max. | | 0.2 |

Test methods are available on request.

### Supply

Ethylene glycol can be supplied either in bulk or in packages.

### Packages

Technical grade ethylene glycol is normally supplied in mild steel drums. Polyester grade ethylene glycol is normally supplied in epoxy coated mild steel drums.

Weigh/Volume Relationship
1 metric tonne is equivalent to approximately 890 litres at 20°C.

A 210 litre drum contains approximately 234 kg.

### Storage

Ethylene glycol can normally be stored in mild steel vessels. However, where trace iron contamination or slight discoloration is critical, lined steel, aluminium or stainless steel vessels are recommended. If a low water content is required over a long storage period, a nitrogen blanket can be used to exclude atmospheric moisture. Alternatively a desiccant unit can be installed on the tank vent line to dry incoming air.

The liquid has a relatively high freezing point (-13°C) and if outside storage is contemplated in an extremely cold climate, it may be advisable to place a heating coil in the bottom of the storage tank. Hot water or low-pressure steam are the most desirable heating mediums, however care must be taken in such an application because excessive temperatures can cause degradation of the glycol.

## Industrial applications

The main use of ethylene glycol is as a raw material in the production of polyester resins. These are later used to manufacture fibres and films. The fibre uses are multiple, but can be divided into three main end-uses: industrial, home-textiles and clothing textiles. Films are used in photography, medicine, printing and more recently in packaging (PET bottles).

The low volatility and the high water solubility of ethylene glycol have led to its widespread use in antifreeze solutions, de-icing fluids, refrigerants and heat transfer agents. Its hygroscopic properties give rise to many applications as humectant, softener and plasticiser. Its good solvent properties and low volatility lead to significant usage as a coupler and as components of hydraulic fluids. Glycol derivatives are used as resins, plasticisers and emulsifying agents.

Ethylene glycol has low volatility and low molecular weight. It is therefore widely used in automobile antifreeze and coolants. Its solvent property makes it useful to dissolve many inhibitors in brake and shock absorber fluids, hence counteracting rubber swelling and inhibiting foam forming.

In the aircraft industry, ethylene glycol is an ideal base for aircraft and runway de-icing fluids. The former is specially designed for defrosting the wings and fuselage of aircraft, whereas the latter for de-icing airport runways. The high efficiency of these fluids is attributed to their quick penetration and breaking of the bond between the packed ice and the surface of the object.

Ethylene glycol is often used as an antifreeze in asphalt-emulsion paints, carbon dioxide pressure type extinguishers and wet sprinkler systems.

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Inhibited aqueous solutions of ethylene glycol are commonly used as heat transfer solutions: as low temperature coolants in refrigeration systems and as high temperature coolants in electronic tubes.

Ethylene glycol reacts with dibasic acids to form alkyd-type resins, which are widely used in rubber, adhesive and surface coating industries.

Polyester resins of ethylene glycol are of great interest in the laminating process of glass fibres, asbestos, cloth and paper.

Ethylene glycol is an ideal humectant for textile fibres, paper, leathers, adhesive and glue. Its use helps to make these products softer, more pliable and more durable.

It is also a stabiliser to prevent gel formation and viscosity changes in water dispersions of urea-formaldehyde and melamine-formaldehyde.

Nitrated ethylene glycol is an important component of explosives. It depresses the freezing point and makes the explosive safer to handle in cold weather.

High purity ethylene glycol (iron and chloride free) is used as a solvent for ammonium perborate, a commonly used conductor in electrolytic capacitors. It is relatively non-volatile and non-corrosive to aluminium.

## Properties

### Physical properties

Ethylene glycol is a colourless, odourless, hygroscopic liquid. The figures given below are for pure ethylene glycol and values for the commercial product may differ slightly from these.

| | | |
|---|---|---|
| Molecular mass | | 62.07 |
| Freezing point | °C | -12.6 |
| Boiling point | °C | 197.3 |
| Critical temperature | °C | 382 |
| Critical pressure | Bar | 48.6 |
| Critical volume | litre/kg mole | 172 |
| Heat of formation ideal gas at 25°C | Mj/kg mole | -388.12 |
| Heat of formation liquid at 0°C | Mj/kg mole | -455.52 |
| Flash point (open cup) | °C | 116 |
| Flammability limits lower | % | 3.5 |
| Auto ignition temperature | °C | 400 |

Values for heat capacity, viscosity, thermal conductivity, density, coefficient of cubical expansion, enthalpy, vapour pressure, latent heat of evaporation and surface tension of the liquid at saturation pressure over a wide range of temperatures are given below:

### Liquid properties at saturation pressure

| T | Heat capacity | Viscosity | Thermal conductivity | Density | Coefficient of cubical expansion | Enthalpy | Vapour pressure | Latent heat of evaporation | Surface tension |
|---|---|---|---|---|---|---|---|---|---|
| °C | kJ/kg°C | mPa.s | watt/metre°C | kg/litre | (°C)-1 | kJ/kg | Mbar | kJ/kg | Dyn/cm |
| -40 | 2.150 | 1431 | 0.241 | 1.152 | 0.00063 | -87.904 | 0 | 1140.7 | 51.8 |
| -20 | 2.196 | 218.7 | 0.247 | 1.139 | 0.00063 | -44.591 | 0.001 | 1125.3 | 50.3 |
| 0 | 2.267 | 57.25 | 0.252 | 1.126 | 0.00063 | 0 | 0.009 | 1109.0 | 48.8 |
| 20 | 2.354 | 21.0 | 0.256 | 1.113 | 0.00063 | 46.194 | 0.071 | 1091.7 | 47.3 |
| 40 | 2.450 | 9.644 | 0.259 | 1.098 | 0.00064 | 94.226 | 0.397 | 1073.5 | 45.7 |
| 60 | 2.547 | 5.186 | 0.261 | 1.084 | 0.00065 | 144.19 | 1.743 | 1054.0 | 44.1 |
| 80 | 2.642 | 3.128 | 0.262 | 1.070 | 0.00067 | 196.09 | 6.302 | 1033.4 | 42.5 |
| 100 | 2.733 | 2.057 | 0.261 | 1.055 | 0.00070 | 249.85 | - | 1011.4 | 40.8 |
| 120 | 2.818 | 1.445 | 0.259 | 1.040 | 0.00074 | 305.36 | - | 987.87 | 39.0 |
| 140 | 2.900 | 1.069 | 0.256 | 1.024 | 0.00078 | 362.55 | 127 | 962.67 | 37.2 |
| 160 | 2.982 | 0.825 | 0.251 | 1.008 | 0.00084 | 421.36 | 281 | 935.56 | 35.3 |
| 180 | 3.069 | 0.659 | 0.244 | 0.991 | 0.00090 | 481.86 | 571 | 906.27 | 33.4 |
| BP | 3.154 | 0.555 | 0.237 | 0.975 | 0.00097 | 535.66 | 998 | 878.94 | 31.7 |

## Health, Safety and Environmental Data

Monoethylene glycol is classified as “Harmful” under the EEC Dangerous Substances Directive (67/548/EEC) as implemented in the UK as SI-1984/1244 (The Classification, Packaging and Labelling of Dangerous Substances Regulations). The fatal dose for humans is around 100 ml.

Precautions should be taken to avoid contact with the eyes and skin by wearing goggles and PVC or rubber gloves. Avoid inhalation of mist or vapour by the installation of appropriate ventilation.

A Material Safety Data Sheet has been issued describing the health, safety and environmental properties of this product, identifying the potential hazards and giving advice on handling precautions and emergency procedures. This must be consulted and fully understood before handling, storage or use.

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