

Perchlorethylene



Perchlorethylene or perchlor is a chlorinated solvent produced by PPG Industries and used extensively by dry cleaning plants. Other applications include vapor degreasing, and use as a chemical intermediate and processing solvent. Perchlor is nonflammable, has low toxicity, and has an inherent stability further enhanced by PPG's stabilizer system.

Properties and Characteristics

Perchlor has no flash point and no fire point, which gives it an important advantage over petroleum distillates such as Stoddard solvent for dry cleaning operations. As a result, along with its desirable physical properties, Perchlor has become the largest-volume dry cleaning solvent.

Perchlor is relatively inert, and is inherently more stable than other chlorinated solvents. PPG's perchlor is further stabilized to prevent solvent degradation or decomposition, and corrosion of metal parts and equipment in vapor degreasing. PPG stabilizers are designed to be recoverable along with the perchlorethylene after repeated cleaning cycles, including recovery from carbon adsorbers.

General Applications

In addition to its wide use as a drycleaning solvent, PPG's perchlor is used extensively for vapor degreasing because of its high solvency, non-flammability and high vapor density.

Drycleaning—Perchlor is the preferred solvent because, in addition to its non-flammability, it provides a fast, powerful yet gentle cleaning action with a minimum of mechanical agitation. The result is less fabric wear. PPG's perchlor cleans all natural and synthetic fibers.

Cleaning cycle and drying times are fast with perchlor, and because of its high solvency fewer stains are left for the spotter. Because the solvent is recoverable, it has a long service life.

PPG's perchlor works with any drycleaning detergent, so that the dry cleaner can add detergent or soap and make his own charged system as needed.

Vapor Degreasing—Many industries, including aerospace, appliance and automotive, use perchlor for vapor degreasing of metal parts. Although trichlor has a more general usage for vapor degreasing, perchlor is preferred in some situations because of its higher boiling point (above that of water). Many soils such as waxes and resins must be melted in order for them to be solubilized.

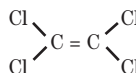
The high boiling point (250°F/121°C) of perchlorethylene enables it to condense more vapor on the metal to be cleaned than other chlorinated solvents, thus washing the parts with a greater volume of solvent. Perchlorethylene cleans longer and removes higher-melting-point pitches and waxes more easily. It is effective with lightweight and light-gage parts

Typical Properties

Perchlorethylene is a clear, water-white liquid at ordinary temperatures. It is completely miscible with most organic liquids. The stabilized product, perchlor, can be used with any of the common construction metals.

Chemical Names Tetrachloroethylene; perchloroethylene

Chemical Formula CCl_2CCl_2



Molecular Weight 165.85

Boiling Point, °F 250.0
°C 121.1

Coefficient of Cubical Expansion expansion average/°C liquid (appl. range) 0.00102
0 to 25

Freezing Point, °F -8.2
°C -22.3

Pounds per Gallon at 68°F (20°C) 13.57

Kilograms per Liter at 20°C 1.63

Refractive Index, n_D²⁰ 1.5053

Dielectric Constant at 1000 cps and 25°C 2.365

Specific Heat at 20°C cal/(g)(°C) or Btu/(lb)(°F) 0.205

Flash Point (Tag open cup) None

Fire Point (Tag open point) None

Heat of Vaporization at 760 mm Hg, cal/g 50.1
Btu/lb 90.2

Vapor Density at 121.1°C and 760 mm Hg, g/l 5.22
lb/ft³ 0.326

Specific Gravity of Vapor (air = 1) 5.83

Vapor Pressure at 20°C, mm Hg 14.2

Evaporation Rate at 77°F(25°C) (ether = 100) 9
gal/(ft²)(day) 0.15

Flammability Nonflammable

Viscosity at 20°C, cps 0.88

Solubility at 25°C, g perchlor/100 g water 0.015
g water/100 g perchlor 0.0105

Azeotrope with Water, Boiling Point, °F 189.2
°C 87.7

Azeotropic Water Content, wt % 15.8

Permissible Exposure Limit (8-hour TWA) ppm 25

Specification and Typical Analysis, All Grades

	Specification	Typical Analysis
Appearance	Clear, free of suspended matter	Clear, free of suspended matter
Color, APHA	15 maximum	8
Spot Test	No spot or stain	No spot or stain
Specific Gravity, 20°C/20°C	1.623 to 1.628	1.624
Nonvolatile Residue, wt %	0.0025 maximum	0.0003
Free Chlorine	None	None
Moisture, ppm maximum	30	25
Distillation Range (100%), °C	120.0 to 122.0	120.8 to 121.6
°F	248.0 to 251.6	249.4 to 250.9
pH	Drycleaning 6.5-7.5 Degreasing 8-9	Drycleaning, 6.8 Degreasing, 8.4
Acid Acceptance, as NaOH, % minimum	Drycleaning N/A Degreasing 0.02 Heavy Duty Degreasing 0.10	N/A 0.03 0.11

that warm up to the temperature of a lower boiling-point solvent and therefore stop condensing liquid on the parts before cleaning is complete. Perchloroethylene is particularly effective in fine orifices and spot-welded seams.

Perchloroethylene forms an azeotrope with water that has a boiling point below that of water, while perchlorethylene itself has a higher boiling point than water. As a result, perchlorethylene allows a vapor degreaser to function as a drying device for metal parts and to remove water films from metals without degradation of the solvent.

Chemical Processing—Perchlor serves as a carrier solvent for fabric finishes, rubber and silicones; and as an extractive solvent. It is used in paint remover formulations and in printing inks. It serves as a chemical intermediate. Perchlor also is often used as a component of “safety” solvent blends. When used for this purpose it is important to determine the flash point of the mixture as it is to be used before using or selling, since an insufficient quantity of perchlor will not raise the flash point of the mixture.

Catalyst Regeneration—Perchlor is used in the petroleum refinery industry as a source of HCl, a promoter, which helps in the regeneration of catalyst in both catalytic reformer and isomerization operations. Product sold into this operation is a purer, less stabilized grade than most grades as the product has to meet UOP specifications to preclude the poisoning of the valuable platinum catalyst.

Product Grades

Drycleaning Grade—Formulated especially for drycleaning operations, this grade incorporates a stabilizer that is completely removed from garments and leaves no residual odor. Stabilizers are recoverable with the solvent after distilling. Solvent removed from carbon absorbers also is suitable for reuse in dry cleaning. Drycleaning grade is not suitable for vapor degreasing.

Degreasing and General Purpose Grade—This grade is suited for many vapor degreasing, cold cleaning and drycleaning applications. It incorporates stabilizers to protect the solvent against degradation or decomposition caused by such contaminants as metal chips and fines, acids, alkalis and oxidants.

Heavy-Duty Degreasing Grade—Perchlor HD is a much more heavily stabilized solvent intended for more rigorous production vapor degreasing. It is not recommended for drycleaning or general solvent use.

The stabilizers incorporated in perchlor HD are designed to protect against contaminants such as metal chips, fines, acid soils and oxidants. It is particularly suitable for degreasing metals that corrode and stain easily such as aluminum, magnesium, zinc, copper and their alloys. Perchlor HD's special stabilization gives users increased protection against stainless steel pitting and corrosion.

Catalyst Grade—Minimally stabilized and developed for use in catalyst regeneration in the refinery industry.

Government Specifications

The various PPG grades meet the chemical and physical requirements of the current version of Federal Specification O-T-236, Technical Grade. In addition, Perchlor HD grade meets the same Federal Specification requirements for Degreasing Grade B and ASTM D-4376. PPG Drycleaning Grade meets ASTM-4081.

Health Hazards

Perchloroethylene is a central nervous system depressant. Acute inhalation overexposure can cause irritation of the respiratory tract, dizziness, nausea, headache, loss of coordination and equilibrium, unconsciousness and even death in confined or poorly ventilated areas, such as tanks or pits. Adrenaline should not be administered to a person overcome by perchlorethylene.

Chronic inhalation overexposure may damage the liver and kidneys. Perchloroethylene has been studied extensively for cancer both in the U.S. and Europe by government, industry and academia in multiple species and biological test systems. A recent National Toxicology Program (NTP) study has determined that there is clear evidence of carcinogenicity (liver) in both male and female mice, clear evidence of leukemia in male and female rats and some evidence of carcinogenicity (kidney tumor) in male rats. The NTP study exposed rats to 200 and 400 ppm and mice to 100 to 200 ppm in a lifetime study. At the present time the International Agency for Research on Cancer (IARC) lists perchlorethylene in Group 2A. There is no documented evidence that perchlorethylene causes an increased cancer incidence in humans. In an exhaustive epidemiology study sponsored by NIOSH no increased risk of cancer in dry cleaning workers was noted. However, it is strongly suggested that perchlorethylene users review their health programs, “tighten up” their operations, and institute good operating and house-keeping practices designed to limit employee exposure as much below OSHA permissible exposure limits as practical.

The U.S. Occupational Safety and Health Administration (OSHA) had lowered the permissible exposure limit (PEL) for perchlorethylene from 100 ppm to 25 ppm for an 8-hour time-weighted average (TWA) 29 CFR § 1910.1000 (March 1, 1989). OSHA's limits also include a short term exposure limit, or STEL of 200 ppm for 15 minutes. These PELs were overturned by a legal challenge and the currently enforceable OSHA limit is 100 ppm.

The American Conference of Governmental Industrial Hygienists (ACGIH) currently recommends a threshold limit value (TLV) of 50 ppm for 8-hour TWA and 200 ppm for a 15-minute STEL. PPG's internal permissible exposure limit is 25 ppm TWA (8-hour) with a STEL of 200 ppm.

Swallowing perchlorethylene could cause illness. Ingestion of substantial quantities could be fatal. Small amounts of perchlorethylene splashed into the eyes may result in pain and irritation. While irritation usually disappears within a few hours, there is considerable discomfort. Carefully fitted chemical safety goggles should be worn where there is danger that perchlorethylene may be splashed into the eyes.

Prolonged or repeated contact with perchlorethylene may cause skin irritation. Since perchlorethylene is a good oil or grease solvent, it removes oils and greases from the skin, and, in some cases may cause dermatitis. Protective clothing, such as gloves or aprons, should be made from neoprene, polyvinyl alcohol or Viton® A fluoroelastomer. Clothing which becomes soaked with perchlorethylene should not be worn until it is thoroughly dried. Additional information is contained in the Material Safety Data Sheet (MSDS).

In Case of Emergency

In case of an emergency, call the PPG Industries Emergency Response Center at 412-434-4515. In Canada, call Canutec at 613-996-6666.

Handling and Storage

Perchlor has no flash point, fire point or autoignition temperature. However, when exposed to open flames, hot glowing surfaces or electrical arcs, perchlor liquid or vapor can decompose to form toxic and corrosive acid fumes. More information on bulk and drum handling and storage appears in the manual *Bulk Handling and Properties of PPG Chlorinated Solvents*, form 1116.

Packaging and Shipping

Perchlor is shipped in 55-gallon drums, tank trucks and tack cars. Single-compartment cars are available with nominal capacities of 10,000 and 20,000 gallons. Perchlor is shipped from the Lake Charles, La., plant and from terminals at Bayonne, N.J., Chicago, Ill., and Long Beach, Calif.

Customer Service

Samples are available on request. For more information regarding PPG's perchlorethylene, contact our customer service department by calling **800-CHEM-PPG (800-243-6774)**.

PPG's technical and product safety staff is available to provide additional information on technical issues, applications, handling and storage, and health and safety concerns.



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The products mentioned herein can be hazardous if not used properly. Any health hazard and safety information contained herein should be passed on to your customers or employees, as the case may be. PPG Industries also recommends that, before use, anyone using or handling this product thoroughly read and understand the information and precautions on the label, as well as in other product safety publications such as the Material Safety Data Sheet.

Like all potentially hazardous materials, this product must be kept out of the reach of children.