# Perchloroethylene
## An Alternative Solvent to 1,1,1-Trichloroethane in Vapor Degreasing

Perchloroethylene is widely regarded as one of the most stable of the chlorinated solvents. It has had a long history of use in vapor degreasing. Its higher boiling point provides for more solvent condensation and cleaning time for each degreasing cycle. Its stability in the presence of moisture allows its use in drying operations.

Perchloroethylene is often chosen for applications where its high boiling point (250°F) and greater volume of condensate are of advantage. These include removal of high melting point pitches and waxes (such as those used before ultraviolet light inspections or electroplating), removal of buffing or drawing compounds, removal of large quantities of water in solvent drying operations, and straight vapor cleaning of light-gauge metal parts.

### Advantages

***Stability:*** Perchloroethylene is significantly more stable than 1,1,1-Trichloroethane, particularly in its stability in the presence of aluminum. Perc is also significantly less sensitive to water contamination, and can in fact be used in the presence of free water in some degreasing operations.

***Recoverability:*** Perchloroethylene vapors can be recovered in conventional carbon adsorption equipment available on the market today. Dry-cleaning operations routinely recover perchloroethylene by this route with recovery rates in excess of 90% of the solvent vapors reaching the adsorber.

***Ozone Depletion:*** Perchloroethylene is not regulated as an Ozone-Depleting Substance, and has no assigned ODP value.

***Compatibility:*** As a chlorinated solvent, perchloroethylene can often be used in the same process as 1,1,1-Trichloroethane. With some modification, it may permit the use of existing equipment.

***Volatile Organic Compound:*** The EPA recently published a notice exempting perc from its definition of VOCs (61 FR 4588, 2/7/96), based on EPA testing which indicated that perchloroethylene is negligibly photochemically reactive. Individual state or local agencies may now exempt perc from regulation as a VOC.

### Limitations/Concerns

***Carcinogenicity:*** Perchloroethylene has been categorized as a 2A probable carcinogen by IARC, and appears on the NTP Carcinogen list. It also appears on some state lists, including the California Proposition 65 list. It is important to note, however, that perc is not regulated as a carcinogen by OSHA.

***Air Toxic:*** As a designated Hazardous Air Pollutant, the use of perchloroethylene is subject to National Emission Standards (NESHAP) based on Maximum Achievable Control Technology (MACT). These regulations became effective in 1995, and affect cleaning operations using chlorinated hydrocarbons.

***Worker Safety:*** The ACGIH TLV-TWA for perchloroethylene is 25 ppm. Existing degreasing operations have demonstrated that this level can be achieved using existing technology and protective measures.

***Operating Temperature:*** The higher boiling point of perchloroethylene requires high pressure steam (50 psig) to operate the degreaser. In addition, parts leaving the degreaser are normally too hot for immediate manual handling. The higher operating temperature may result in higher operating costs and slower throughput. In some cases, lower boiling contaminants may be redeposited on parts.

## Conversion of a Vapor Degreaser to Perchloroethylene

Vapor degreasers using perchloroethylene may require more careful operating practices to ensure that personnel are not exposed to solvent vapors in excess of the recommended ACGIH TLV of 25 ppm. In addition, solvent emissions must be minimized in order to comply with federal, state, and local regulations. This may require the addition of emission control equipment.

Conversion of a vapor degreaser from 1,1,1-trichloroethane to perchloroethylene requires a complete cleanout, followed by adjustment of several operating controls. The following steps should be followed as an initial part of the conversion.

1. Drain and Clean the degreaser.

A. Shut off heat supply and allow solvent and equipment to cool.

B. Drain all solvent from the degreaser, including the water separator and all piping.

C. Turn off cooling water.

D. Thoroughly clean the equipment. Vapor degreasers are considered to be Permit-Required Confined Spaces by OSHA. Entry into, and work within these spaces must be done in accordance with the provisions of 29 CFR 1910.146.

E. Remove all insoluble residue from the bottom of all sections of the degreaser, i.e., sump, clean solvent reservoir, and water separator. Also wipe or brush residues off the walls of the equipment. Clean heating coils down to bare metal and test steam coils for any leaks.

F. If the previous operation has any history of acidity problems, a thorough neutralization by flushing with sodium carbonate solution should be accomplished. This solution can be mixed by adding ½-1 pound of sodium carbonate (Soda ash) per gallon of water. After neutralization, the sodium carbonate solution must be completely flushed out of the unit and the unit completely dried.

2. Set the safety control thermostat (located just above the cooling coils) to 180°F. This control is designed to cut off the heat input if the solvent vapors rise above the cooling coils.

3. Adjust the boiling sump safety thermostat to cut off at 260°F. This will shut off the heat input when the solvent becomes contaminated, or with electrically heated degreasers, if the coil is exposed to air.

4. The heat supply will need to be increased significantly to maintain the solvent vapor level at the midpoint of the condensing coils. In addition, heat input must be adequate to avoid collapse of the solvent vapors when work is introduced into the degreaser.

   For steam operated equipment, a steam pressure of 50 psig will be required. If this type of steam is available, the degreasing equipment must be inspected for compatibility with the higher pressure. Steam traps should be checked for proper operation at this pressure, and replaced if necessary. Heating coils should be inspected for leaks at this higher pressure prior to addition of solvent to the machine. If high pressure steam is not available, the degreaser may be converted to use electrical heat.

   Electrically heated units using perchloroethylene may require as much as twice the heat input required for 1,1,1-trichloroethane. Depending on the equipment involved, this may be accomplished by the addition of larger heating elements, by rewiring existing elements or by adjustment of controls.

5. Cooling coils and water jackets should be checked to ensure circulation of cooling water. Cooling water flow must be sufficient to maintain solvent vapors at the midpoint of the cooling coils under idling conditions. The temperature of the water exiting the coils should be in the range of 100-120°F.