



Tri-V™ Chemistries Frequently Asked Questions

1. What is Tri-V and what does it do?

Tri-V Cleaning Solutions were developed to offer an alternative to users of solvents for vapor degreasing, ultrasonic cleaning, and soak and wipe applications. Tri-V solvents are powerful cleaners that have a comparative cost to current materials, such as n-propyl bromide, without the toxicity concerns. These new cleaning solutions are safer than the three most common industrial solvents (nPB, TCE, and Perc), while offering superior cleaning performance in removing oils, greases, fluxes, silicone oils, dirt and contaminants.

2. Why should I use Tri-V? What are the benefits of Tri-V?

Features

- **Non-flammable and near-azeotropic**
- **Stabilized for metals**
- **Low heat of vaporization**
- **Safer than most common industrial solvents**
- **Powerful cleaner**
- **Available in aerosol or liquid**
- **Evaporates fast, leaves no residue**
- **Non-ozone depleting**

Benefits

- Tri-V can be used in vapor cleaning, ultrasonic cleaning, soak and wipe applications
- Tri-V is compatible with sensitive metals such as aluminum, magnesium, titanium, and brass
- Tri-V require less energy in vapor degreasers
- The TWA TLV of Tri-V is better than n-propyl bromide, (nPB), trichloroethylene (TCE), perchloroethylene (Perc) & Methylene Chloride
- Tri-V can easily remove a variety of soils including greases, fluxes and oils
- One cleaner can be used throughout your process, whether it involves vapor degreasing, ultra-sonic cleaning, soaking or rework and maintenance cleaning
- Minimizes processing time and down time
- Tri-V is not impacted by Montreal Protocol, so no phase-out date

3. What's makes Tri-V™ unique?

Tri-V formulations were created to specifically offer alternatives to the currently used cleaning chemistries, when there are cost or toxicity concerns. The parameters used to develop this material were to offer the strongest, nonflammable cleaning chemistry specifically for vapor cleaning operations, metal cleaning and ultrasonic cleaning. The results of this research are the formulations utilized in the three new Tri-V products.

4. What are these three new products?

Electro-Wash® Tri-V Precision Cleaner - The extra strength, nonflammable cleaner degreaser. This powerful cleaning agent is used to remove flux, oils, dirt, grease, dust, and other contaminants in electronic applications.

<u>Part Number</u>	<u>Size</u>
VVV1614	12 oz /340 gm aerosol
VVV114	1 gal / 3.7 L liquid
VVV514	5 gal / 18.5 L liquid
VVV5514	53 gal / 200 L liquid

Flux-Off® Tri-V Flux Remover -The extra strength, nonflammable solvent that removes heavy and encrusted flux deposits.

<u>Part Number</u>	<u>Size</u>
VVV195	1 gal / 3.7 L liquid
VVV595	5 gal / 18.5 L liquid
VVV5595	53 gal / 200 L liquid

Max-Kleen™ Tri-V Degreaser - The extra-strength, nonflammable heavy-duty degreaser with a high dielectric. Specifically formulated for live circuits, this material combines powerful cleaning with better dielectric breakdown resistance.

<u>Part Number</u>	<u>Size</u>
VVV2279	20 oz /567 gm aerosol
VVV179	1 gal / 3.7 L liquid
VVV579	5 gal / 18.5 L liquid
VVV5579	53 gal / 200 L liquid

5. Are TCE, Perc and Methylene Chloride still available? What about nPB? Is it still available? Why would I want to move away from these materials?

TCE, Perc, and Methylene Chloride already have many restrictions, but they are still currently available for use. In addition to toxicity and carcinogenicity concerns, these materials are considered Hazardous Air Pollutants (HAPs) and water pollutants by the EPA, and are being monitored closely. Initially, nPB was marketed as the replacement for these compounds, but nPB is now under greater scrutiny from OSHA and EPA. While nPB isn't banned at this time, there are a number of alarming documents on the subject:

- OSHA alert on nPB (1-Bromopropane) -
https://www.osha.gov/dts/hazardalerts/1bromopropane_hazard_alert.html

- EPA considering nPB for HAPs (Hazardous Air Pollutants) list - <https://www.federalregister.gov/articles/2015/02/06/2015-01705/petition-to-add-n-propyl-bromide-to-the-list-of-hazardous-air-pollutants>

In a field study, NIOSH (National Institute for Occupational Safety and Health) recommended the replacement of nPB in aerospace vapor-degreasing:

“...Recommendations include, but are not limited to, substitution of nPB solvents with a less toxic solvent...” (source: <http://www.cdc.gov/niosh/nioshtic-2/20031537.html>)

The trend has been for the allowable exposure limits to be lowered more-and-more, which forces companies to employ more safety equipment and ventilation to limit worker exposure.

6. How does Tri-V compare with n-propyl bromide? How about TCE, perchloroethylene and methylene chloride?

Tri-V was developed to replace nPB, TCE and Perc, and it compares very favorably. The cleaning performance will be very similar to those more toxic solvents, without the toxicity. As a comparison, nPB has a TLV of 10 ppm, with a proposal to drop it to 0.1 ppm, compared to 200 ppm for Tri-V. See the chart below. See the chart below.

PHYSICAL PROPERTIES	Tri-V	n-Propyl Bromide	Trichloroethylene	Perchloroethylene	Methylene Chloride
Flash Point (ASTM D56-05)	None	None	None	None	None
KB Value (ASTM D1133-13)	100	125	129	90	136
Dielectric Strength (kV) (ASTM D877)	23	5	30	45.7	24
Surface Tension (dynes/cm) (ASTM D3825-90)	22	24	29	32	27
Boiling Point	118°F (48°C)	158°F (70°C)	189°F (87°C)	250°F (121°C)	104°F (40°C)
Vapor Pressure (mm Hg) @ 20C	268	111	58	14	355
Heat of Vaporization (cal/g)	68	59	57.2	50.1	75.3
Solubility in H ₂ O (g/100g H ₂ O)	negligible	0.24	0.11	0.015	1.7

ENVIR. & HEALTH REGULATORY	Tri-V	nPB	TCE	Perc	Methylene Chloride
Ozone Depleting Potential (ODP)	0	Minor	0	0	0
Global Warming Potential (GWP)	Low	0.31	0	0	0
Volatile Organic Compounds (VOC Federal)	Yes	Yes	Yes	No	Yes
Threshold Limit Value (ppm) (TLV)	200	10	10	25	25

7. What are the differences between Tri-V and our other cleaning solutions? How do I choose which chemistry is right for us?

The Tri-V cleaning chemistries are all very strong cleansers, among the strongest currently available in our line. Whenever trying to determine which chemistry is right for your applications, remember to ask the following questions:

- What am I trying to remove from the surface? Oils greases, particles or fluxes?
- What was the operating environment of these parts? High temperatures, corrosive environment, or oil mists?
- Are there any problems with taking the parts off-line? What cleaning processes do we currently have access to? Are there any environmental issues that need to be addressed? Flammability issues that may be of concern?

- What are these parts made of? Plastics, metals, or ceramics? Are any of the components incompatible with any solvents?
- How clean do these parts need to be post cleaning?

Once we have a general idea as to the soils, processes and constraints of the cleaning process, we can look at the attached reference charts to help choose the right cleaner for the application.

8. Is Tri-V™ the right product to replace AK225?

Tri-V is not recommended as a drop-in replacement for AK225. In many cases, Tri-V will clean better than AK225, but other considerations including plastic safety, boiling points, and VOC concerns may call for a different cleaning solution, such as one of the new **Delta™** products, which were specifically developed by Chemtronics to replace AK225.

9. Is Tri-V safe for plastics, such as those found on plug connectors?

Tri-V is not recommended for plug connectors, ice cube relays, or other areas where a polycarbonate, styrene or solvent-sensitive components are found. For these application we recommend the plastic safe contact cleaner **Pow-R-Wash™ Delta**, or the plastic safe circuit cleaner **Electro-Wash® QD**.

10. How do I use the Tri-V products?

Using Tri-V products is easy. When using in vapor cleaning or ultrasonic cleaning applications, charge the solvent into an empty, clean vessel or sump. Vapor-degreaser temperatures should be set at 118°F (48°C) to start for Electro-Wash and Flux-Off Tri-V, 108°F (42°C) for Max-Kleen Tri-V, and adjusted to achieve a rolling boil. Heating ultrasonic should be set well below boiling point to minimize solvent loss. Submerge the part to be cleaned in either the vapor phase of the vapor degreaser or the liquid of either. Once the surface is dry perform an inspection to insure complete cleaning. Tri-V can also be used as a cold soak, or as a warm solvent soak.

11. How do I determine if this is the right product for my application? How can I get a test sample for evaluation?

Contact our technical service hotline at 800-645-5244 x 137 for application specific recommendations. We will be able to offer expert guidance for any of your requirements. For availability, pricing, or other requirements, contact a Chemtronics Sales Manager, or Chemtronics Customer Service, at 800-645-5244 x 154.