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Equipment Review Required When Preparing Chlorinated or Brominated Solvent Degreasers for Use with Fluorinated -Tran Dichloroethylene Solvent Systems

Most vapor degreasers that use trichloroethylene (TCE) or n-propyl bromide (NPB) solvents can be modified for use with safer, fluorinated, vapor degreasing solvents.

The first step in making such a change should be a consultation with the degreaser manufacturer to determine what specific changes are required. Several factors must be considered when converting a vapor degreaser. A degreaser diagram is also provided for clarification when needed.

Clean, passivate, and inspect.

Degreasers that have been in service with chlorinated or brominated solvents for several years may have significant organic residues present. They may also have "gone acid" sometime in their past. A conversion to a fluorinated / trans-dichloroethylene solvent provides an ideal opportunity to inspect the degreaser. Rust is an indication (as stainless steel will not rust) that the system has previously been acid and requires neutralization and passivation. Neutralization of an acid degreaser is necessary to ensure that the passivation step will be effective. See "General Neutralization of Vapor Degreasers" by ChemLogic if you have a vapor degreaser with even a small amount of rust in the tank.

Drain and remove all solvent from the vapor degreaser and ensure that filters are removed, and any ancillary tanks are drained. Remove contamination with disposable rags and use a small quantity of the new solvent to clean out any pockets of solvent or hidden tubes or hidden tank bends. Be sure to open the entire unit to the air and use fans to help evaporate the solvent. Possibly use aerosol cans of the new solvent to flush out lines or tubes, if it is available.

While the degreaser is opened up without solvent, inspect areas of the machine, such as the water separator, for signs of the most serious corrosion. Look at the weld joints in the corners because that is usually the most susceptible to acid attack. Also take this opportunity to inspect the electric heaters and replace them if necessary. Heating coils that sit inside the solvent may develop a pin-hole "hot spot" over time that could cause solvent degradation. If the heating elements have not been replaced in 5 years or longer, it is prudent to change them at this step in the process.

Reduce heat input.

Fluorinated – trans-dichloroethylene based solvents have a lower boiling point and a lower heat of vaporization than n-propyl bromide (NPB), trichloroethylene (TCE) and perchlorethylene (PERC). Hence, they require less heat to operate. You may need to

disconnect one or two of the electrical heating elements. Consult the manufacturer of the vapor degreaser to be sure. If the current system uses steam, a steam pressure reduction will be required, or hot water may be substituted in some cases.

If the system is electrically heated, input may be reduced 20-30% with a heat flux not to exceed 20 watts per square inch. This will be automatically controlled by the thermostat in most cases. Heaters in perchloroethylene degreasers require special attention, as often the heat flux densities are high enough to thermally decompose chlorinated or brominated solvents. In either case, heat should be sufficient to result in at least one "turnover" of the rinse sump once per hour, or enough heat to distill an equivalent volume of solvent that is contained in the rinse or condensate sump.

Provide adequate freeboard.

Freeboard is defined as the height of the degreaser wall above the normal operating vapor level, which is usually the center of the primary cooling coils to the top edge of the degreaser. The ratio of freeboard to the smallest width of the degreaser opening should be at least 1.00 for economical and safe operation with fluorinated-trans-dichloroethylene solvents at normal condenser temperatures. If the freeboard-to-width ratio is less than 1.00, stainless steel sidewalls should be fabricated and a gasket installed to increase the ratio. The condensing temperature can also be lowered to reduce the solvent vapor diffusional losses to a minimum. Most vapor degreasers manufacturing since 2010 should have adequate freeboard.

Consider freeboard "vapor-trap" chillers.

Freeboard chillers provide two main functions in a vapor degreasing process: decreasing the humidity and the temperature of the air above the vapor blanket. By doing both of these things, diffusive losses of solvent are minimized. Freeboard chillers should be placed above the condensing coils, as placing freeboard chillers near the top of the degreaser will limit their effectiveness. In addition, a condensate trough should be placed below the freeboard chillers to collect the condensed water and send it to a water separator. Some degreasers have a separate water separator for the freeboard coils, because it mostly traps humidity in the air. It is not recommended to send a large volume of water to the primary water separator.

Readjust safety devices.

Fluorinated trans-dichloroethylene based solvents boil at much lower temperatures than NPB or TCE. The settings on the temperature sensing devices (thermocouples) must be lowered to account for the lower boiling point. These controls are located inside the electrical panel and are typically changed by simply turning a knob or making another simple adjustment. Depending on the year or model of your degreaser, it may not have all of the control settings. See the last page for the settings based on the type of solvent that you are using in your degreaser.

Provide proper materials of construction.

Stainless steel is preferred for surfaces that contact vapor degreasing solvents. Zinc or galvanized surfaces cannot be used because they react with many solvents in the presence of free water or alcohol to form acids. Components such as ells, unions, nipples, water separator coils, and spray lance nozzles should be checked and replaced if made of galvanized material. There may be situations where copper or brass can be substituted for stainless steel. The equipment manufacturer can best determine which parts need to be changed to provide compatible materials of construction.

Use suitable pumps.

Stainless steel centrifugal pumps having low net positive suction heads should be used to avoid cavitation and vapor lock. High-quality, glass-filled, mechanical seals of nylon, Viton®, or tetrafluoroethylene (Teflon) should be used.

An electric drum pump will make the filling and removing of solvent much faster. One recommended drum pump is the Serfilco ODP-S with a stainless steel pump tube. Contact SERFILCO at 847-509-2910.

Use eye protection and half-face respirators.

While removing and handling the solvents and working on the equipment, the use of a respirator is required. One type of half-face respirator is manufactured by 3M and is used in conjuction with the organic solvent absorption cartridge. These are the 3M Gas / Vapor Cartridge No. 6001 and the 3M Half Mask No. 6000 HF.

Consult the Safety Data Sheet (SDS) for More Information.

Review the SDS for your new solvent and consult your technical representative if you should have any questions on how to proceed. www.chemlogic.us

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TEMPERATURE SETTINGS FOR VARIOUS SOLVENTS FOR USE IN VAPOR DEGREASING PROCESSES

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Solvent Name	Manufacturer	Boiling Point (°F) sea-level	Liquid Temperature Controller LTC (°F)	Heater Temperature Controller HTC (°F)	Safety Vapor Controller SVC (°F)	Vapor Up Temperature VU (°F)	Primary Coil Refrigeration Temperature RT (°F)	Free Board Coil Refrigeration Temperature (°F)
FORMULA =>		**BP**	**BP + 5**	**BP + 10**	**BP – 10**	**BP – 10**	**40 to 45**	**-20 to -10**
AeroTron	Reliance Specialty Products	109	114	119	99	99	40 to 45	-20 to -10
AeroTron AV	Reliance Specialty Products	116	121	126	106	106	40 to 45	-20 to -10
AeroTron 100	Reliance Specialty Products	116	121	126	106	106	40 to 45	-20 to -10
EnSolv	Envirotech International	160	165	170	150	150	40 to 45	-20 to -10
EnSolv A	Envirotech International	156	161	166	146	146	40 to 45	-20 to -10
EnSolv NEXT	Envirotech International	104	109	114	94	94	40 to 45	-20 to -10
NEXT	Envirotech International	94	99	104	84	84	40 to 45	-20 to -10
NEXT 5408 / 3000	Envirotech International	94	99	104	84	84	40 to 45	-20 to -10
ENTRON	Reliance Specialty Products	159	164	169	149	149	40 to 45	-20 to -10
ENTRON CE	Reliance Specialty Products	154	159	164	144	144	40 to 45	-20 to -10
FluoSolv AP	NuGenTec	109	114	119	99	99	40 to 45	-20 to -10
FluoSolv CAS	NuGenTec	135	140	145	125	125	40 to 45	-20 to -10
FluoSolv CX	NuGenTec	108	113	118	98	98	40 to 45	-20 to -10
FluoSolv CX-500	NugenTec	102	107	112	92	92	40 to 45	-20 to -10
FluoSolv DX	NugenTec	106	111	116	96	96	40 to 45	-20 to -10
FluoSolv FR-110	NuGenTec	115	120	125	105	105	40 to 45	-20 to -10
FluoSolv NC786	NugenTec	102	107	112	92	92	40 to 45	-20 to -10
FluoSolv TEN-X	NuGenTec	100	105	110	90	90	40 to 45	-20 to -10
MX2501	Kyzen	111	116	121	101	101	40 to 45	-20 to -10
Novec 72DE	3M	111	116	121	101	101	40 to 45	-20 to -10
Novec 73DE	3M	118	123	128	108	108	40 to 45	-20 to -10
Opteon SF79	Chemours	116	121	126	106	106	40 to 45	-20 to -10
Tergo MCF	MicroCare	117	122	127	107	107	40 to 45	-20 to -10
Vapor Solv	Brulin	94	99	104	84	84	40 to 45	-20 to -10
Vertrel SDG	Chemours	109	114	119	99	99	40 to 45	-20 to -10
NPB	Various	160	165	170	150	150	40 to 45	-20 to -10
PERC	Various	224	229	234	214	214	40 to 45	-20 to -10
TCE	Various	188	193	198	178	178	40 to 45	-20 to -10
trans DichloroEthylene	Various	118	n/a	n/a	n/a	n/a	n/a	n/a