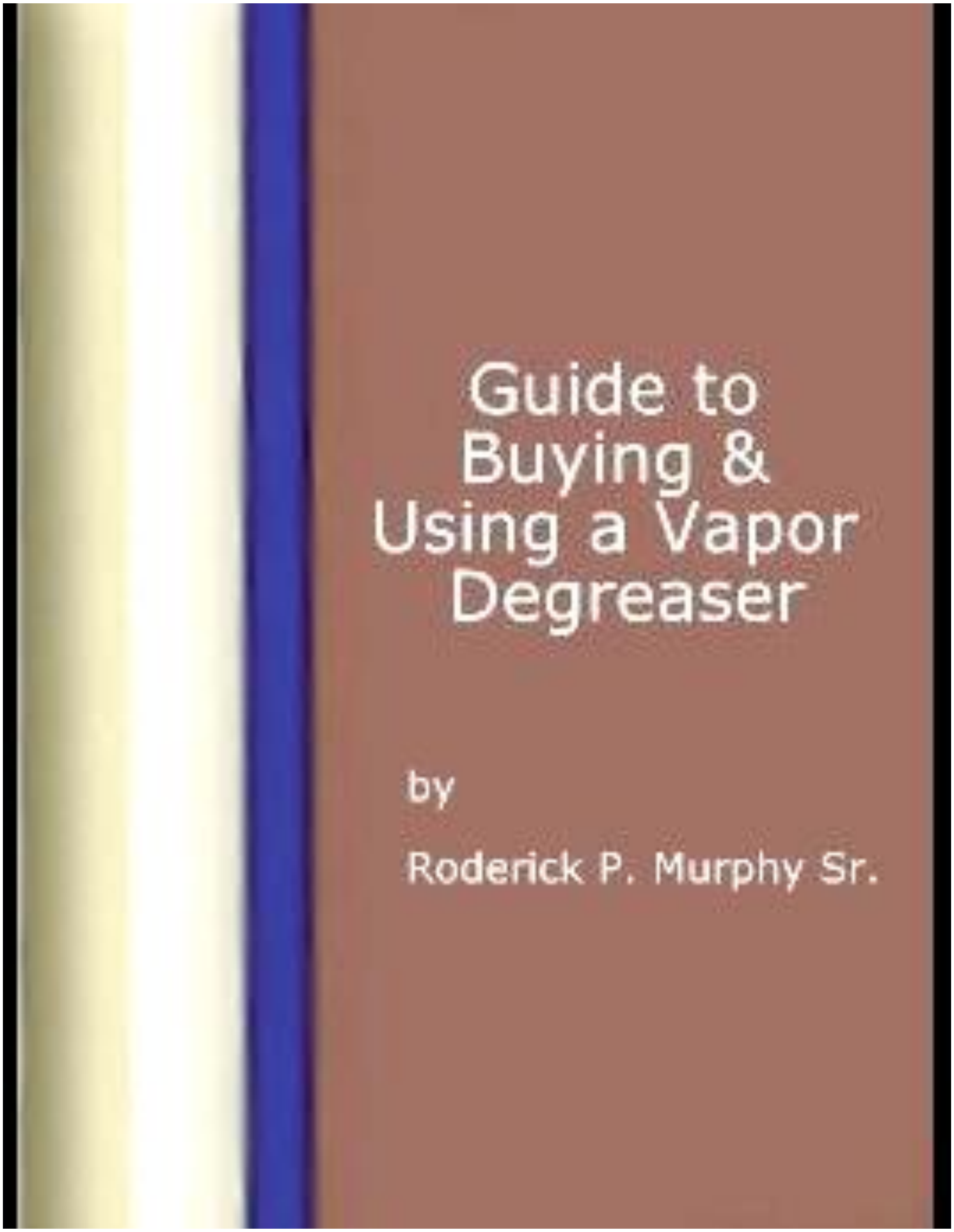

Guide to Buying & Using a Vapor Degreaser

by

Roderick P. Murphy Sr.

Guide to Buying & Using a Vapor Degreaser (Edited 2014)

Roderick P. Murphy, President
Degreasing Devices Co. Southbridge, MA

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Forward

There are reports that the first industrial parts washer was designed in 1912 for Henry Ford to clean Ford automobile parts after manufacturing. Vapor degreasers seem to have been invented in Germany in the 1930s. These machines used a new organic solvent - trichloroethylene. The benefits of these new vapor degreasers proved themselves in the 1930s and still do today. Large volumes of work are processed in small footprint machines that use less energy and result in dry parts that then are clean enough to go on to further finishing such as painting, plating, other processing or final assembly.

Aqueous (detergent & water) parts cleaning usually provides good quality results, but aqueous systems are often large and complex. Simplicity is the hallmark of vapor degreasers therefore they are more consistent, more economical, and provide better cleaning results.

Many different types of manufacturers use solvent cleaning as a solution for their finishing problems. New challenges to manufacturers are met by vapor degreaser makers and the result is the large variety of styles and configurations of machines that are in use today. Today's best available technology (BACT) used in modern degreasers evolved through meeting the needs of many areas of manufacturing. High-volume production in an environmentally safe and stable work place is the standard. For small, large and medium size manufacturers, the advanced design of a today's standard open top degreaser answers the need. No other method produces such volumes of clean parts and takes up less floor space with lower energy costs and with excellent results that are the same, load after load.

Environmental controls and regulations, both national and regional, have been instituted to protect employees and air quality, etc. Equipment manufacturers have responded to those and to OSHA regulations to protect workers. Just about all modern vapor degreasers meet EPA and OSHA regulations.

This E-Book will provide a basic tutoring for engineers, manufacturing personnel and managers who need to research how a vapor degreaser operates and whether it could solve their industrial parts cleaning problems.

Chapter 1

Basic Vapor Degreaser

The minimum that equipment for vapor degreasing must provide is: dimensions, large enough, within a unit for effective cleaning; sufficient contact with the solvent (vapor and/or liquid) to remove soils, and the capability to recycle the solvent for extended and repeated use.

The design of vapor degreasing equipment is determined by the size, shape, and specific heat of the parts to be cleaned, the volume and rate of production; and the type and amount of soils to be removed. These considerations in turn influence the cleaning cycle selected and the method of moving parts through the cycle. Federal, state, and local emissions and other regulations are a further influence, as is on-site availability and economy of heating and cooling sources.

Basic degreaser design

Vapor degreasers vary in size and type from small, manually operated machines to automated, conveyorized systems. The simplest vapor degreaser is a rectangular tank with a sump of boiling solvent in the bottom. The cleaning space, or vapor zone, is just above the boiling solvent. All standard vapor degreasers use low boiling (90 – 170 degrees F.), non-flammable solvents with low viscosities, low surface tensions, high densities, low specific heats and low latent heats.

To confine solvent vapor to the tank and prevent vapor loss to the atmosphere, a refrigerant or water cooled external jacket or internal coils are located above the vapor zone. Clean vapor condensate drips and is then collected in a trough, passed through a water separator to remove excess moisture, and returned to the boiling sump. This provides constant clean solvent for spray wand use. It also concentrates the contaminates (oil, dirt, chips, flux) into the boil sump for easy removal and maintenance. Degreasers commonly are designed with larger condensers than actually required, in order to minimize solvent loss and prevent vapor contamination of the air in the work area.

Three are at least three types of vapor degreasers; vapor/spray units with one sump that use only vapor, immersion units with two sumps plus vapor above and ultrasonic vapor degreaser which is a version of the immersion unit that has ultrasonic transducers underneath the second immersion sump that helps to clean difficult parts.

How does ultrasonics work with vapor degreasers?

Some vapor degreasers have an added option of ultrasonics. An ultrasonic generator and either ceramic piezo-electric transducers or metal magnostrictive transducers are attached to the side or usually the bottom of the tank. This transducer converts one form of energy to another. It also changes size when an electrical signal excites it. When the transducer is excited it increases in size and causes the side or the bottom of the container to move. When an electrical generator emits a high frequency signal, the transducer offsets rarefaction and compression waves in the liquid. With this rarefaction cycle, the liquid is torn apart. Consequently a vacuum cavity is created in the liquid. The cavities fluctuate in size, but when the cavity reaches a certain size, it cannot retain its shape. When this happens, the cavity collapses, creating an extremely high temperature of 5,000 degrees Celsius (9,032 degrees Fahrenheit), and a jet of plasma hits the object in the container. Millions of these bubbles form and collapse every second.

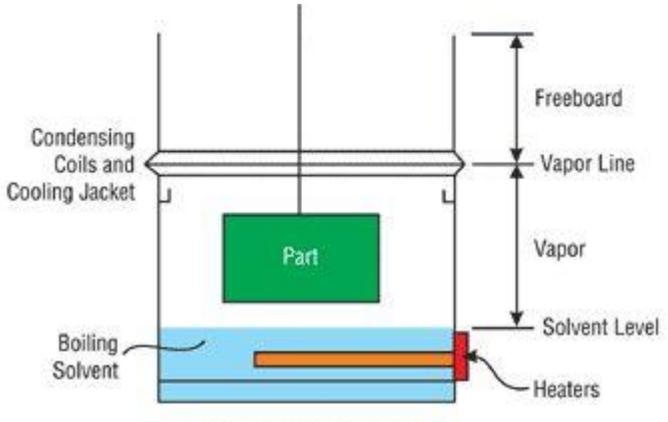
These bubbles are what cleans the object in the vapor degreaser. The jet of plasma that hits the object causes the dirt to come off, and can be increased by adding a cleaning agent to the tank.

Various Vapor Degreaser Applications

Vapor degreasing provides superior cleaning for many parts and assemblies, including:

- Small and/or intricate machine parts.
- Spot free parts cleaning.
- Cleaning parts between laps, seams, spot welds, prior to powder, or other coating.
- Cleaning parts prior to electroplating cycles.
- Removing buffing compound from parts.
- Cleaning tubing
- Prior to soldering, brazing and welding
- Removing flux
- Plastic polishing

The following three U.S. Army drawings show the two basic vapor degreaser designs; vapor/spray (one sump) and immersion type (two sumps).



1. Typical vapor degreaser

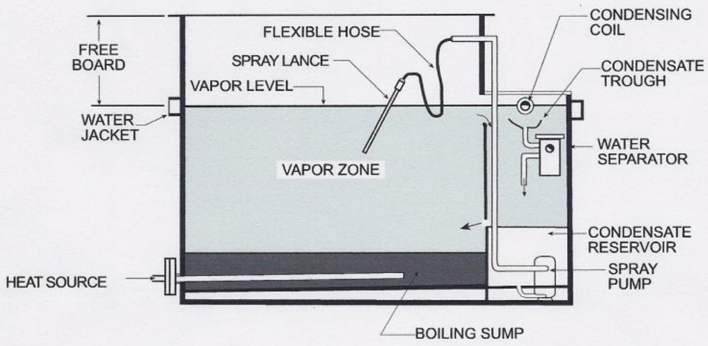


Figure 2 Offset Condenser Vapor-Spray-Vapor Degreaser

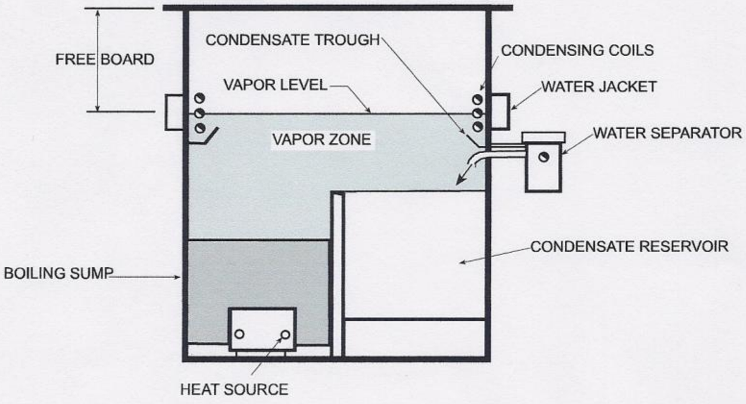


Figure 4 Liquid-Liquid-Vapor Degreaser, 2 Compartment

Chapter 2

Buying a Vapor Degreaser

The number of vapor degreaser manufacturers has waxed and waned in this new era of bankruptcies, mergers, additional federal and regional emissions and other pertinent regulations. Some of the older well known names, BRANSON, BARON BLAKESLEE, ULTRONIX, GRECO BROS., SONICOR, and ULTRAKOOL remain in the business; some with different ownership. There are a small number of manufacturers that specialize in vapor degreasers that use flammable solvents like IPA, acetone, cyclohexane, etc.; PERO CORP., TIYODA-SEREC, FORWARD TECHNOLOGY, etc. Some of the older vapor degreaser makers have gone out of the business; TALLY, LENAPE, DELTA, DETREX. As in other industries, the number of American vapor degreaser manufacturers diminished in the last decade.

In the USA there are a few wholesale dealers specializing in used vapor degreasers. Such dealers can provide late model, good condition vapor degreasers with EPA required retrofits at half the cost of a new degreaser or less. Some specialty dealers are veterans* in the business and can provide helpful advice also.

* www.degreasingdevices.com

Freeboard function and design

The sides of the vapor degreaser tank extend above the condenser (cooling coils). This area is called freeboard. Its purpose is to shield the vapor zone from air currents that could cause turbulence and resultant vapor loss. Since excessive solvent vapor loss also contributes to atmospheric contamination, freeboard height is subject to federal and state and regional regulations; the EPA requires that the freeboard height be at least the same as the width of the tank (narrowest dimension) or “100% freeboard”.

Freeboard & Primary Cooling Coils

Storage tank

Most degreasers have a separate storage tank for clean, distilled solvent, This provides a supply of contaminant- free solvent for immersion degreasing or spraying.

Sizing the equipment

Equipment sizing for an open-tank degreaser represents a balance between process requirements and solvent conservation. There must be sufficient working area in the vapor zone to avoid a piston action that will pump solvent vapors out of the machine as work is immersed and removed. An open-tank degreaser requires at least 50 percent greater working area than the dimensions of the largest workload. Beyond satisfying this requirement, tank size should be kept to a minimum to avoid excessive vapor loss through evaporation

To further control vapor loss, environmental regulations as well as economic considerations dictate a freeboard design with an adequate ratio of freeboard height to tank width. Federal and state regulations require that the freeboard height be at least equal to the width of the tank, i.e. 100% freeboard. In 1994 the Environmental Protection Agency (EPA) promulgated a complicated set of related regulations called NESHAPS. Dow Chemical, a manufacturer of vapor degreaser solvents has an excellent article on federal and regional emissions control vis a vis vapor degreasers. See page 8.

Heat requirements

Heat input requirements for vapor degreasing are determined by the weight and specific heat of the work (which has to be heated to the solvent boiling point), radiation losses from the tank walls, solvent distillation, and the solvent used.

Heating the work

The number of BTUs required hourly to maintain the solvent at boiling temperature can be calculated by multiplying the pounds/hour of work to be cleaned by the specific heat of the metal and the difference between ambient temperature and the boiling point of the solvent in degrees Fahrenheit. A safety factor of 50 percent is usually added.

For large workloads, added heating coils can be provided to minimize temperature swings. It is important to maintain a constant vapor level to minimize vapor loss; therefore sufficient heat input should be available to raise the workload surface temperature to the vapor temperature as quickly as possible.

Radiation losses

If radiation losses from bare tank walls become excessive, it can be reduced by insulating the tank walls. Radiation losses will vary with the boiling point of the solvent. High heat perchloroethylene degreasers should be insulated on the outside for operator safety and to reduce radiation loss.

Heating for solvent distillation

The heat required to produce clean distillate for spraying or multiple immersion chambers should be included in determining total heat input required.

Heat sources

Heat input for vapor degreasing can be supplied by electricity, steam, or gas or by a heat pump. Most systems recently manufactured are electrically powered.

Electricity

Immersion heaters with a heat density of about 20 watts/sq. in. are generally used in electric heating installations. It is important that the liquid solvent level be kept above the immersion heater, since an exposed heating element will elevate surface temperature and result in solvent decomposition and burnout of the heating element. A low-liquid-level shutoff will provide warning.

Steam

Immersed steam coils are generally used to supply heat to the solvent; other methods include plate coils or steam-jacketed tank bottoms. Steam pressures required to achieve the boiling point for clean solvent range from 5-15 psig for TCE and 50-65 psig for perc. As the contamination level of the solvent increases, its boiling temperature increases accordingly, as does the steam pressure required to maintain the same rate of distillation.

Hot water

Pressurized hot water pumped through immersion coils is another heat source for vapor degreasers. Water temperatures and pressures commonly used are 250°-300° F (121°-1490° C) at 25-70 psig for trichlorethylene, and 300°-325° F (149°-1630° C) at 70-105 psig for perchloroethylene.

Gas

Gas heating is less rarely used for vapor degreasing tanks. Immersion coils are employed and fuel input is generally sized at twice that required for steam to allow for combustion inefficiency and flue stack losses.

Materials Handling

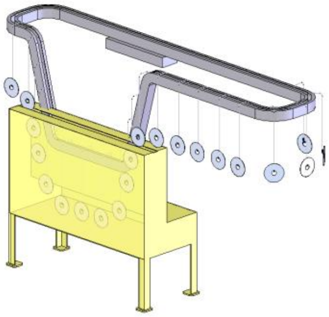
Vapor degreasing, is adaptable to a wide range of part sizes and production requirements, from large parts lowered by hoist to batch cleaning in racks or baskets to high volume automated installations.

Manual operation

Large, heavy parts, and assemblies are commonly handled by hoists, which should be limited to a maximum vertical travel of 11 ft/min. (Required by NESHAPS) to avoid vapor disturbance. Part size must also be considered in relation to tank area, with sufficient clearance to avoid a piston action of vapor being pushed out, as the part is lowered and raised. The part area should not exceed 50 percent of the tank area.

Batch production should be handled in racks or baskets, with the same caution about overall basket size to avoid pumping. Since the rack or basket must be heated along with the work, rack weight should be kept to a minimum.

Automated systems



Monorail conveyors are particularly suited to high-volume applications where parts can be suspended from hooks or hangers. Vertical travel should be restricted to a maximum speed of 11 ft/minute. The system should be designed so that the conveyor travels above the vapor zone; automatic lubrication should be provided as alternative.

Crossrod conveyors are used to degrease small parts in baskets, which can he designed to rotate to facilitate drainage. The crossrod conveyor incorporates two parallel strands of chain connected at intervals by rods, from which the baskets are suspended.

Old Crossrod Vapor Degreaser

Ferris wheel or Carousel. As the name implies, this design rotates the work in a number of baskets attached to a wheel-like assembly. The design is enclosed except at the operator station where work is loaded and unloaded. Variations of immersion and spray can be included in the cleaning cycle, as well as rotation of the baskets.

Vibra conveyor: This high-capacity design is particularly effective in cleaning small metal parts such as fasteners, screw machine products and small die castings. A combination of solvent action and vibration is responsible for its effectiveness in cleaning hard-to-remove solids. The parts are directed to the bottom of a spiral elevator which is actuated by a vibrator drive. The vibrating action moves the parts upward along the spiral through solvent and vapors where soil is flushed away and the parts dried.

Elevator conveyors are batch-type, and incorporate a platform - usually made of open rollers - to lower and raise the work. The design can be adapted to provide closed operation. Care should be taken to provide sufficient clearance between the elevator platform and the tank walls to avoid pumping.

High Vacuum Vapor Degreasers (HVVD) use solvent for cleaning parts in a vacuum chamber. Unlike conventional vapor degreasers, HVVD units do not allow the solvent and air to mix. They are usually more economical to use because the cooling requirements are much reduced and lose almost no solvents by emissions. Such HVVD ordinarily have fire suppression systems and can use IPA, acetone, cyclohexane or other flammable solvents. Although substantial savings in solvent use and energy costs are inherent, a large deterrent to HVVD’s growth among industrial users is its high. up-front capital expense.

Chapter 3

Solvent Information

Solvent manufacturers have worked hand in hand with vapor degreaser manufacturers to provide safe, effective and non-flammable solvents to use in vapor degreasers. Trichloroethylene (TCE) was the first extensively used chemical in the early years. Perchlorethylene and methylene chloride (MC) followed. Then lower boiling, precision solvents such as chlorofluorocarbons (Freon) and the trichlorethylene substitute 1,1,1 trichloroethane (TCA) were introduced. The current, most popular vapor degreaser solvent seems to be normal propyl bromide (nPB) which has many brand names. That solvent and a large variety of other, newer solvents gives many choices for vapor degreasers users. Vapor degreasers usually can be adjusted to use virtually all of theses new or old solvents.

Unlike aqueous solutions (detergent & water), vapor degreaser solvents have a low viscosity and low surface tension. That means that the solvent flows into tiny crevices and apertures and cleans them out unlike water which like a child's bubble blower, forms bubble/barriers over the apertures and crevices,disallowing entry and cleaning. Also unlike small footprint vapor degreasers, aqeuous systems require auxiliary equipment like a dryer, an oil water separator and possibly a water deionizer plus wastewater systems.

The choice of the right vapor degreaser solvent is not an easy one. Below are several factors.

- Is the solvent compatible with the substrate to be cleaned and can it dissolve the contaminant?
- Is the solvent and equipment safe for the worker?
- Does the solvent and amount to be used comply with local, state, and federal regulations and company policy?
- Does the solvent, process, and equipment match the required production rate and product flow?
- Is the solvent and equipment within budget?

Each of the solvents listed in Table I are commercially available and are acceptable as vapor phase solvents. This list is not inclusive by any means. Several solvent suppliers provide excellent solvents that are an azeotrope or blend of the listed solvents for specific purposes. As an example, the HFC, HFE solvents can be blended with trans-1, 2 dichloroethylene where additional solvency is required. These solvents are used in a wide range of applications and a review of the properties will assist in choosing the right solvent for a specific application.

Today's vapor degreaser solvents are ozone-safe, relatively non-toxic and non-flammable and more cost effective than aqueous systems.

EPA & Montreal Protocol Solvent Phase-Outs

In 2015 some vapor degreaser solvents will be phased out. HFC-225 is a precision solvent for high-end cleaning. It will be banned for usage, according to the Clean Air Act under the Montreal Protocol. HCFC-225 is a mixture of two isomers, HCFC-225ca and HCFC-225cb. A common source of HCFC-225 is from Asahi Glass Company as Asahiklin AK-225, a precision cleaning solvent. AK-225 has many unique properties, including its ability to form azeotropes (mixtures that act as one chemical, with unique and constant physical characteristics), good solvency, and thermal stability (which makes it good for use in vapor degreasing). AK-225 is nonflammable. Due to the ozone depleting potentials of HCFC-225ca and HCFC-225cb, 0.02 and 0.03, respectively, it is now being phased out.

A proposed U.S. Environmental Protection Agency (EPA) ban on the use of n-Propyl Bromide (nPB) for some purposes is causing some vapor degreaser users to search for an alternative. DuPont™ Vertrel and Honeywell's Solstice are two solvents vying to be the replacement for what may be the end of nPB for vapor degreaser use. Both are much more expensive and much lower boiling than nPB.

Some Solvent Manufacturers

Dupont Vertrel
http://www2.dupont.com/Vertrel/en_US

Honeywell Soltice
www.honeywell-solvents.com.

Dow (Chlorinated Solvents)
http://www.dow.com/gco/index.htm

Petroferm (nPB)
www.cleanersolutions.org/downloads/msds/609/LENIUM%20ES%20TDS.pdf

http://www.petroferm.com/uploads/Vapor%20Degreasing%203-09.pdf

AKA 225
www.agc.co.jp/english/chemicals/gas/e_solvents/e_225_6.html

TABLE I—Solvent Properties

Property	Trichloro-ethylene	Methylene Chloride	Perchloro-ethylene	N Propyl Bromide	AKA 225	HFE 7100	HFC 4310	Water
Boiling Point (F)	188	104	250	156	129	140	129	212
Weight (lb/gal)	12.10	11.00	13.48	11.13	12.9	13.0	12.95	8.3
Kauri Butanol Value (solvent power)	130	136	90	129	31			
Heat of Vaporization (Btu/lb)	103	142	90	106	62	54	56	1000
Heat of Vaporization (Btu/lb)	1246	1560	1200	1180	800	675	730	8300
Vapor Density (Air = 1.0)	4.45	3.30	5.22					
Specific Heat	0.225	0.280	0.205					
Surface Tension (dynes/cm)	31.6	28.2	32.3	25.9	16.2		14	72.8
SNAP Approval	yes	yes	yes	no	until 2005	yes	yes	n/a
VOC	yes	no	no	yes	no	no?	no?	n/a
HAP	yes	yes	yes		no			n/a
Upper Ozone Depleter	no	no	no		yes			n/a

Chapter 4

Safety & Controls

In addition to operating controls specific to the heating system selected, certain safety controls are common to all heating methods. A coolant flow switch and temperature control are required to shut off the heat source if coolant flow is insufficient. A sump thermostat should be set to cut off heat supply if the sump temperature exceeds recommended maximum for the solvent used. Further protection against inadequate cooling is provided by a vapor thermostat, discussed under **Vapor Control.** All shutoff controls should require manual resetting. See "**Sizing the equipment**" above for information on EPA (NESHAPS) and OSHA regulations requiring these safety controls plus some other things.

Heat safety controls

Steam: A pressure regulator is required that is suitable for the solvent used. A pressure gauge and relief valve should be installed on the low-pressure side. Steam traps should be provided to receive condensate from the steam coils and return it to the boiler.

Gas: Automatic pilot protection should be provided to shut off all gas within 45 seconds of pilot failure. Dissolved oil and grease raise the boiling point of the solvent, and this temperature rise should be limited by a thermostat. Thermostatic protection against low liquid level, which might expose the gas immersion coil, also is required. Open flame gas heated degreasers could be dangerous if exposed to chlorinated solvent vapor.

Electric: A low-liquid-level device, either thermostatic or of the mechanical float type, is required to prevent solvent decomposition due to exposed heating elements.

Zytron Temp. Controller

Warning

An exposed gas or electric heating element will result in excessive surface temperature of the heating element, with consequent solvent decomposition and the formation of toxic gases. The reaction also can result in an acid degreaser and an attendant danger of fire. To insure a minimum level of solvent, a low-liquid level shutoff should be used.

Sump thermostat

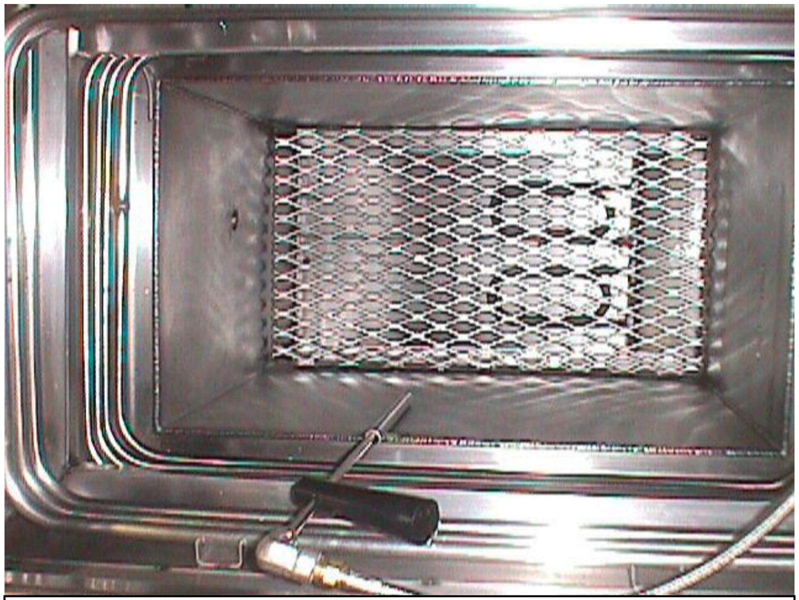
A sump thermostat set to the recommended limit for the solvent used should be coupled to a shutoff valve with manual reset. Recommended sump thermostat settings are: for methylene chloride (MC) - 195° F (91° C) for trichloroethylene (TCE) and 260° F (127° C) for perchloroethylene.

Vapor control

Control of the vapor level is the key to successful degreaser operation. Vapor control is accomplished by the flow of cooling water or refrigerant through coils inside the tank or through a jacket around the outside of the tank.

Cooling coils

Cooling coils are positioned to control the vapor level, allowing clearance below the work and a vapor layer above the work. Cooling refrigerant or water temperature above the vapor line should be higher than the dew point of the surrounding air to avoid condensation of atmospheric moisture. This can be helped by directing refrigerant or water flow through the cooling coil from the bottom to the top.



Primary & Freeboard Cooling Coils

Waterjacket

In addition to or instead of cooling coils, a cooling jacket around the outside perimeter of the degreaser tank can be used to cool the wall below the freeboard and condense the solvent.

Conversions Fahrenheit to Celsius

A temperature on the Celcius scale is converted to a temperature on the Farenheit scale, and vice versa, by using the relations:

Farenheit temperature = (Celcius temperature x 1.8) + 32

Celcius temperature = (Farenheit temperature - 32) / 1.8

Vapor thermostat

Should the vapor level rise above the cooling coils, this sensor will respond to the vapor temperature and shut off the heat source. The thermostat requires manual resetting.

Typical settings are; 160° F (71° C) for trichloroethylene (TCE) and 180° F (820° C) for perchroloethylene. Required by NESHAPS.

Most vapor degreasers have some or most of the safety controls listed below:

SVC Safety Vapor Control

Turns off the heat if the solvent vapors rise above the solvent condensing coils.

Suggested set-point: approx. 15^0F below solvent boil temp. Sensor location: top of cooling coils.

HTC High Temperature Control

Turns off the heat if the solvent level drops below the top of the heater elements (protects elements) or with increased solvent contamination. Check this level daily. Drain and clean sump. Clean element and probe. Tip of sensor probe must be clean and in close contact with element.

Suggested set-point: approx.20^0F above solvent boil temp. Sensor location: clamped to top of heat element.

LTC/S Liquid Temperature Control/Sensor (optional)

Turns off the heat it the temperature of the liquid solvent increases because of build up of alcohol or other contaminations in the boil sump. When using an alcohol blend solvent, the alcohol level could increase to a flammable point. This control turns off the heat before the solvent blend becomes flammable. Drain and recharge with fresh solvent.

Suggested set-point: approx. 7’F above solvent boil temp Sensor location: in boil sump liquid.

RT Refrigeration Thermostat

During night time mode (heat off), this control causes the refrigeration compresser to turn on and off. This maintains a consistent temperature at the cooling coils. It automatically resets as the sensed coil temperature goes above and below the set point temperature. During machine operation (heat on). the heat of vapors at the coil (and sensor), causes the compressor to remain on.

Suggested set-point: approx 50 F Sensor location: clamps to cooling coil.

VU/TN Vapor Up Thermostat (optional)

After you turn heat on (press Operate switch), the solvent will boil into a vapor. When the vapors fill the tank to proper level (mid way up cooling coils), the Vapor Up light illuminates. This shows the machine is ready to operate. This circuit also disables the spray circuit until vapor is up (DO NOT spray above vapor line). The vapor line may drop (light off) when you lower parts into unit. It should re-establish (light on) within 5 minutes.

Suggested set-point: approx. 5-15F below solvent boil temp. Sensor location: below cooling coils.

Water separation

Water contamination of the solvent may originate from condensation of atmospheric moisture, from the surfaces of parts being cleaned, or from leakage of condenser water.

Caution

Excess water in a chlorinated solvent can cause corrosion of parts and equipment. In particular, 1,1,1-trichloroethane is subject to hydrolysis *in the presence of excessive water, resulting in the formation of acidic materials.TCE, MC and perchloethylene and normal propyl bromide are all susceptible to "going acid" under bad maintenance conditions. 7he acidic solvent is corrosive and may cause equipment damage. To avoid this, guidelines for the design and operation* of a *water separator should be carefully followed.*

Water in the solvent is usually evidenced by spots appearing on metal being cleaned. These may be rust-colored if some corrosion has already occurred. After the solvent evaporates, spots may be visible on the cleaned work. Another indication of excess water is the formation of a dense white fog in the vapor zone, called "ghosting". The density of the cloud varies directly with water concentration. A properly designed water separator located on the condensate return line will keep solvent moisture content at a low level. Water-contaminated solvent enters the separator through a pipe below the liquid level. Above the solvent, the solvent/water interface, the floating water flows out. Solvent, since it is heavier than water, is drawn off through a pipe below the interface. Since the separation is accomplished by gravitational settling of the heavier solvent, the separator should be designed to provide adequate retention time. A minimum retention time of five minutes is recommended for chlorinated solvents. In addition, a deep tank is more efficient than a shallow design because it minimizes the area of the solvent-water interface. Since water is not as soluble in methylene chloride, perchloroethylene or TCE, the water separator for methylene chloride, perchloroethylene or TCE may be somewhat smaller. Separation is further improved by lowering the temperature of the condensate in a heat exchanger either before *it* enters the water separator or in the separator. Water separators operate most efficiently when the solvent temperature is below 100° F (38° C) for TCE and perchloroethylene.

Construction materials

While stainless steel is the preferred material of construction for degreaser tanks, resin-coated mild steel is satisfactory. Metal accessories preferably should be stainless steel, brass or bronze. Aluminum or magnesium should not be used as materials of construction. Zinc-plated or galvanized steel is not suitable for use with chlorinated solvent.

Caution

Do ***not*** *use* ***aluminum*** *as a construction material. Chlorinated solvents may react with aluminum when in constant contact, resulting in solvent decomposition and consequent equipment damage from the acidic products of decomposition.*

Warning

In a closed system, methylene chloride may react with aluminum components and decompose. The resultant generation of heat, pressure and explosive gases may rupture the equipment with explosive-like force, causing injury to nearby personnel. Do not use aluminum piping, pumps or other components.

Aluminum & Titanium Dust Cause Trouble in a Vapor Degreaser

Chapter 5

Degreaser Installation

Location of a vapor degreaser usually is dictated by its position in the production sequence, but available space or environmental problems within the plant may influence this decision. Consideration also should be given to proximity of other processes, such as paint finishing where solvent vapors could have an effect on the work.

Space requirements

Because of the short cycle time involved in vapor degreasing and the compact design of the equipment, vapor degreasers require a minimum of space. Ceiling height ordinarily is not a problem. Where parts with long vertical dimensions must be cleaned and ceiling height is a restriction, the degreaser can be installed in a pit.

Clearance

There should be sufficient clearance around the machine to allow access to cleanout doors and to permit removal of heating elements.

Elevation

For a manually operated, open-top degreaser, the top of the tank should be 48” above floor level or the operating platform; or a railing provided at this level. The 48” height is considered adequate to protect against accidental falls and to provide a safe breathing zone.

Locating a degreaser in a pit

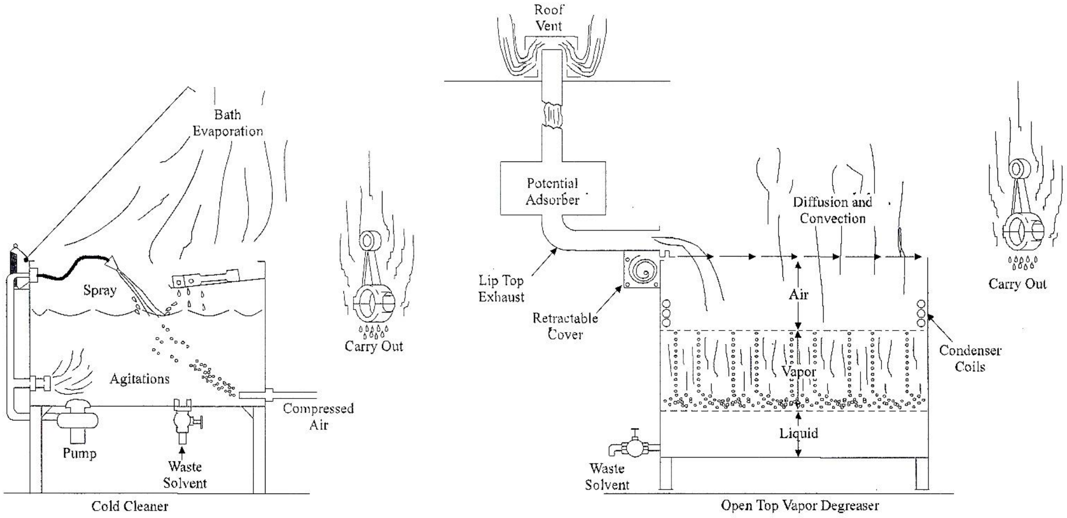
Degreasers installed in pits require clearance similar to those at floor level for access and maintenance. A 48” high rail should surround the pit, and the open tank area covered by grating. Regional emissions control regulatory agencies do not like the installation of vapor degreasers into pits.

Warning

Solvent vapors are heavier than air, and presents a hazard in a pit or other low-lying area. Exposure to high concentrations of chlorinated solvent vapors causes depression of the central nervous system, which can result in unconsciousness or death. Safe entry procedures must be followed if it becomes necessary to enter a pit where high concentrations of solvent vapor may be present.

Drafts

Until EPA’s NESHAPS, normal air circulation was considered beneficial in dissipating the small quantities of solvent vapor usually encountered in degreaser operation. Accordingly, former recommendations required degreaser locations where there was sufficient ventilation to maintain vapor concentration in the air below accepted Time-Weighted Average (TWA) values. Since the 1994’s NESHAPS, required design of vapor degreasers has been tightened so that solvent emissions should be minimum. However, cross-drafts can scoop solvent vapors from the degreaser, and cause excessive vapor loss. The degreaser should not be located where it can be affected by drafts from windows, doors, fans, unit heaters, ventilators, or adjacent spray booths. If necessary, the tank should be enclosed with walls.



Cold Cleaner

Open Top Vapor Degreaser

Emission Points

Avoid open flames and hot surfaces!

Caution

Do not install a vapor degreaser *near gas heated ovens, space heaters, open flames or hot surfaces above 750 °F (399 °F); or near welding or heat treating operations. Solvent vapors may decompose upon contact with hot surfaces or open flames, producing acidic products which can cause corrosion of surrounding structures.*

Warning !

Arc welding should not be attempted near vapor degreaser. *Ultraviolet radiation from the arc welding may cause decomposition of solvent vapors and the generation of a strong* *disageeable odor together with the localized formation of toxic gases, These gases could cause personal injury to the welder.*

Gas-heated degreasers

Gas-heated degreasers must not be located in a room where the general mechanical exhaust system produces a negative pressure unless a powered exhaust device is provided to remove all products of combustion. Open flame gas jets are a possible danger when exposed to chlorinated solvent vapors.

Chapter 6

Degreaser Operation

Before attempting startup or operation of vapor degreasing equipment, an operator should be thoroughly familiar with the operation, control and maintenance of that particular machine. The manufacturer's operating instructions should form a part of his training, and the operating instructions should be permanently positioned in a conspicuous location on the machine.

The operator should be equally familiar with recommended safety practices as well as the hazards related to the solvent being used. Operating temperatures and pressures and thermostat settings for vapor degreasers and stills are available from degreaser manufacturers, used equipment dealers and chemical distributors.

Degreaser startup

The following general procedure is recommended when starting the vapor degreaser:

1. Turn on condensing water, and check to make sure that it is flowing properly.
2. *or* Turn on self-contained, refrigerated units and the chiller goes on before anything else automatically.
3. Actuate all control devices and check periodically to insure proper operation. This includes the automatic heat shutoff thermostat above the condensing zone, maximum surface temperature controls on heating elements, and maximum solvent temperature control in cleaning compartments. Usually all these safety controls go on when the main switch is thrown.
4. Add solvent in all compartments as necessary.
5. Check to make sure that degreaser covers, which should have been in place during idle period, remain so during startup.
6. Turn on heat supply and, if degreaser is steam-heated, check settings to conform with those recommended for the solvent used. Electrically heated units go on with main switch.
7. As degreaser reaches operating temperature, adjust heat so that upper level of vapor zone is at the midpoint of the condenser coils. Maximum operating efficiency and minimum solvent loss are obtained when vapor generation is balanced by condensation from the work load and condensing coils.
8. When the vapor zone has reached the condenser coils, check to insure that condensed solvent is flowing to the water separator, and through it to the proper degreaser compartments. The ideal is when the solvent is dripping heavily from the cooling coils back into the underneath trough.
9. Check all thermometers and gauges to insure that readings are in the proper operating range.
10. Start cleaning cycle.
11. Check water flow through condenser, and cooling water temperature, which should be 90°-120° F (32°-49° C) at the discharge outlet of the water coils. This range will

provide effective cooling and minimize atmospheric condensation. Refrigerated units have settings (e.g.TCE at approx. 50°F.).

Given a specific heat input, a degreaser will vaporize solvent at a given volume and rate, and this establishes the number of pounds per hour of work that can be cleaned effectively. Exceeding the capacity of the degreaser will cause fluctuations in the vapor level, which increase solvent consumption and may result in poor cleaning and longer cleaning cycles.

The following are some guidelines for efficient vapor degreaser operation:

Work positioning

Parts should be racked so that there is complete contact with the solvent throughout the cleaning cycle. and thorough draining in each phase. Solvent trapped in pockets or recesses will result in excessive solvent dragout, which increases cleaning costs, and in atmospheric contamination. Used condensate should not drip from one part to another.

Various Parts Baskets

Entry and removal rate

To avoid vapor disturbance and consequent solvent loss and atmospheric contamination, the maximum vertical travel rate for entry and removal of work is 11 ft/minute. This maximum hoist rate is required by NESHAPS.

Vapor contact time

The workload should be kept in the vapor zone until its temperature reaches that of the surrounding vapor and condensation ceases. If removed earlier, work may not be fully cleaned; and if drying is not complete there is a consequent loss of solvent.

Work transfer and spraying with the vapor zone

Transfer of work between compartments of the degreaser, and work spraying should be done below the vapor level to minimize vapor disturbance. Spraying should be done as low as possible in the vapor zone and in such a manner that it does not deflect solvent out of the degreaser. Local or state regulations may require a spray control-switch to shut off the spray pump if there is an excessive drop in the vapor level,

The spray should be clean distillate or only lightly contaminated. Maintaining the temperature of the solvent below its boiling point will lower the surface temperature of the work, and allow the pure vapor in the final cleaning cycle to condense on and rinse the work.

Solvent contamination level

The solvent contamination level in the degreaser sump should never be allowed to exceed 25 percent, and should be maintained below this level. 15% contamination is an even better preventive maintenance target at which to change solvent.

5 Gallon Solvent Cans

A vapor degreaser delivers its greatest output and economy when the solvent is clean, because the effectiveness of the process depends on the ability of the unit to provide a constant supply of clean solvent vapor. As contamination increases cleaning efficiency is reduced.

Excessive solvent contamination will lead to solvent breakdown, insufficient vapor generation, sludge formation and the baking of sludge on the tank bottom and heating element. In addition, the boiling temperature of the oil-solvent mixture rises to a level where it reduces cleaning effectiveness.

Maximum recommended sump temperatures are approximately 193° F (89° C) for TCE, and 256° F (124° C) for perc.

Water contamination

Sources of water entry into a degreaser should be identified and eliminated so far as possible to avoid equipment corrosion, spotting of work, and increased solvent use.

Adding solvent to the degreaser

When solvent is added to the degreaser, care should be taken to avoid agitating the vapor zone. Pumping the solvent into the degreaser, rather than pouring directly from drums, will minimize disturbance, Makeup solvent ordinarily is added to the clean rinse compartments or the condensate tank.

Shutting down the degreaser

When not in production, degreasers normally are shut down for economy. Some low boil solvents may evaporate without on demand refrigeration. The following steps are a guideline:

1. Stop degreaser operation and remove work.
2. Shut off heat supply.
3. Allow vapor level to drop below condenser area.
4. Shut down water supply to condenser.
5. Turn off control devices and auxiliary equipment.
7. Cover open-tank degreasers.

Caution !

Do not mix different chlorinated solvents or add one solvent to another without technical assistance, as this may result in an adverse reaction. Above certain concentrations, 1,1,1-trichloroethane can trigger decomposition in TCE and cause an acid formation, if added to perc. Mixing small amounts of TCE in perchrolorethylene also can result in acid formation.

Caution !

Do not allow aluminum parts to remain immersed overnight or for long periods in chlorinated solvent. This may cause solvent decomposition, resulting in the formation of corrosive acids and consequent equipment damage. This is called stacking corrosion.

Chapter 7

Solvent Recycling & Conservation

Conservation efforts are directed at minimizing solvent vapor loss; solvent reclamation lowers operating costs by providing maximum utilization of the solvent through the higher cleaning efficiency obtainable with clean solvent. Another benefit is staying below the regulators' "radar screen".

Solvent conservation

Solvent conservation prevents the unnecessary loss of solvent vapor to the atmosphere. Conservation is important economically in reducing solvent consumption; it is equally important in minimizing air contamination and worker exposure to solvent vapors.

In addition to good work practices, several devices can be installed easily on a vapor degreaser to minimize solvent vapor loss to the atmosphere. Some of these may be required by some state or regional regulations beyond EPA's NESHAPS guidelines.

Tank covers

Flexible or rigid covers should be placed over open-tank degreasers during any periods that the degreaser is not in use. Covers can be manually or power-operated. EPA now requires sliding covers rather than lift-off type covers.

Greco Bros. Vapor Degreaser with Automated Hoist & Covers

Refrigerated freeboard coils

Located around the inside perimeter of the degreaser tank above the condenser, refrigerated coils create a cold air inversion blanket which helps to confine the vapors to the condenser area. The coils are supplied from an external refrigeration unit. Since the refrigerated coils will condense or freeze atmospheric moisture, a drain trough should be located under the coils, leading to a water separator with sufficient capacity to handle the additional water.

Activated carbon adsorbers

This method employs a lip exhaust to collect vapor-laden air from the degreaser. The vapor-air mixture passes through an activated carbon bed, which traps the solvent. The solvent is recovered by steaming the bed, then condensing the solvent and steam. A water separator recovers the solvent, which is then directed to a storage tank.

Baron Blakeslee Carbon Adsorber

Solvents may lose a substantial amount of stabilizer with carbon adsorption. Adsorbers for TCE, methylene chloride, perchloroethylene or normal propyl bromide should be made of stainless steel.

Solvent reclamation

Solvent reclamation offers substantial savings in operating costs by significantly extending the life of the solvent. The solvent is reclaimed by distillation and can be accomplished internally, using the degreaser as a still; or on a continuous basis in a separate, dedicated recovery still. Oil, grease and dirt are separated from the solvent as it is distilled. The pure solvent vapor is condensed, passed through a water separator, and is ready for reuse. Distilled solvent should be check for stabilizer content before use.

Except for relatively low-volume production, internal vapor degreaser distillation may not be suitable because it involves taking the degreaser out of service during the distillation procedure. In addition, the distillation leaves a heavy concentration of sludge in the bottom of the degreaser. A dedicated still, properly installed will be more efficient (possibly 20% better) than the working degreaser. Also a still is used more often and the still bottom sludge doesn’t build up and usually a still drain is a convenient waist-high instead a degreaser’s toe-high drain. See External Distillation below.

Warning !

As previously stated, exposure of the heating element during distillation will result in excessive surface temperature of the heating element and the production of toxic gases. In addition, the high temperatures will damage the solvent to the extent that the reaction can result in an acid degreaser with the consequent danger of fire and injury to personnel.

Internal distillation

When permitted by production schedules, the degreaser itself can be used to reclaim solvent on a batch basis. Distillation is accomplished by boiling the sump, and the distillate is collected in a separate receiver.

Liquid levels must be monitored when using the degreaser as a still to avoid exposure of the heating element and consequent overheating of the element. The liquid level must be kept at least 1.5” above the heating element.

If solvent vapors are still present when this level is reached, the remaining concentrate may be removed to a drum and added during the next cleanout period. Fines, chips, and sludge should be removed with a hoe or similar tool and disposed of in compliance with regulations.

Warning !

Fire Hazard

As the liquid becomes concentrated during distillation, a fire hazard exists in electrically and gas-heated degreasers if the temperature of the oil contaminants reaches its flashpoint. To avoid this, bottom thermostats should be set to the proper temperature for the solvent used, and should be tested frequently.

Thermostats on gas and electric degreasers should be set to shut off at 195° F (91° C) for TCE and 260° (127° C) for perchloroethylene.

Caution !

Do not inject steam into the boiling chamber, as excessive water may cause equipment damage.

Vapor thermostat setting should be 160° F (71°C) for TCE and 180° F (82° C) for perc.

External distillation

An external solvent recovery distiller combines a heat source to vaporize the contaminated solvent, a condenser and a water separator. The unit should be equipped with the same safety and operating controls as the degreaser, and similar operating practices should be followed.

A separate solvent recovery still offers a number of cost-saving advantages. The degreaser can operate for extended periods without shutdown for cleanout. Degreasing efficiency is enhanced because the solvent is maintained relatively free of contaminants. Operating temperatures generally are lower because of less contamination, which reduces energy requirements. In addition, the external still offers a higher rate of solvent recovery than is obtainable with distillation in the degreaser.

A solvent recovery still may be connected directly to a large degreaser, or operate independently as a free-standing unit processing solvent in batches that are collected from a number of degreasers.

Where the still is connected to a single degreaser, it operates continuously. The unit receives solvent from the most heavily contaminated section of the degreaser, and returns distillate to the degreaser rinse compartment or to a storage reservoir. The solvent level in the still is maintained by an automatic level control switch which actuates a transfer pump.

Solvent contaminants accumulate in the still and periodically it is necessary to shut down the unit for concentration and disposal of the soils. Concentration will recover a substantial portion of the solvent contained in the sludge. Additional solvent can be recovered by steam sweeping, which is the injection of live steam into the boiling chamber above the solvent toward the end of distillation. The steam forms a lower-boiling azeotrope with TCE and perchloroethylene which allows maximum solvent recovery.

Baron Blakeslee Still #MRR10

Caution !

Do not use steam sweeping with 1,1,1-trichloroethane. This may cause a hydrolytic reaction which will result in solvent breakdown, formation of corrosive acids, and lead to equipment damage.

Warning !
Fire/Toxic Gas Hazards Residue concentrations may present a fire hazard, or danger from toxic gases, or both. They must be handled and disposed of in accordance % with proper safety procedures to avoid fire or toxicity hazards to personnel.

Residue concentrations for degreaser sumps or external stills should be handled and disposed of in accordance with local and state regulations concerning hazardous wastes. Handling and removal should follow established safety procedures. Residues should be cooled to room temperature; if removed while hot, ventilation should be adequate to minimize atmospheric contamination and resultant toxicity hazards.

Operation of an external still

Basic procedure for startup and operation of an external still is similar to that for a degreaser, following these steps:

1. Open the valve to supply condensing water or turn on refrigerated unit's main switch.
2. Check settings of control devices, then actuate. Set thermostat settings for chlorinated solvents.
3. Close drain valve.
4. Fill still with solvent to operating level.
5. Check water flow through condenser, and cooling water temperature which should be at 90°-120° F (32°-49°C) at the discharge point.
6. Concentration of contaminants will raise the boiling point of the solvent.
7. When solvent temperatures approach the level of the still sump thermostat settings for the solvent being distilled, distillation normally will end.
8. For TCE and perchloroethylene only**,** initiate steam sweeping by closing the steam coil inlet valve and slowly opening the steam injector valve. Be careful to avoid foaming of the concentrated material. Optimum solvent recovery is achieved when the flow of distillate ceases. Close steam injector valve.
11. Shut off heat supply.
12. Deactivate control devices.
13. Cool residue, and dispose of in accordance with applicable environmental regulations. (See Disposal of solvent wastes)

What are the advantages of waste solvent reclamation (distilling)?

1. Substantially reduces hazardous waste disposal costs.
2. Reduces and simplifies regulatory reporting.
3. Minimizes on site storage of hazardous wastes.
4. Equipment pays for itself in a matter of months.
5. Improves control of purity of solvents.
6. Preferred method of disposal by the EPA.
7. Improves control over hazardous waste liability.
8. Reduces need for purchasing new solvents.

<u>So I recommend buying a still. (RPM)</u>

Chapter 8

Degreaser Maintenance and Cleaning

Degreaser maintenance includes both regularly scheduled procedures to keep the degreaser at optimum operating efficiency, and the periodic major cleanouts required to maintain contamination at an acceptable level.

Routine maintenance

A good routine maintenance program anticipates problems and helps to prevent major work stoppages. Routine maintenance is basically good housekeeping, and pays dividends in reduced solvent losses and faster, more effective cleaning.

You Didn't Do It Right If Your Hands Aren’t Dirty

Warning
Fire/Explosion Hazard Excessive amounts of aluminum or zinc chips or fines can, under certain circumstances, cause a violent chemical reaction which may further result in ignition of the oils in the degreaser sump.

Nearby personnel would be subject to injury from either or both occurrences. To prevent this, fines and chips should be removed daily.

Some recommended procedures follow. Most of these should be performed daily; checking of temperatures, liquid flows, and steam pressure (where used) even more frequently.
1. Insure that all compartments of the equipment are maintained at proper operating levels.
2. Clean liquid-level sight glasses and porthole glasses.
3. Check solvent pumps, gasketed closures, transfer lines, and other connections for leaks.
4. If steam is used for heat input, check steam pressure and steam traps.
5, Check sump temperature to determine contamination level.
6. When starting up for the day, check the time required for the vapor level to rise to the midpoint of the condenser coils and hold steady. As work is introduced, observe whether the vapor zone maintains its level or drops substantially. Excessive heating time or vapor level drop may indicate need for degreaser cleanout.
7. Check condensate trough.
8. Check solvent flow from the water separator back to the degreaser. Reduced flow may indicate not only a blockage but also diminished vapor generation.
9. Check water drain on water separator.
10. Check temperature of condenser coolant (water cooled units) at exit point; maintain between 90° and 120° F (32°-49°C)
11. Since solvent vapors remove lubricant from conveyors, lubricate frequently.

Cleaning the degreaser

[redacted]

Periodically, thorough cleaning of the degreaser is essential to maintain safe working climate and to realize both maximum vapor degreasing effectiveness and economy. The operation must be carried out by personnel adequately trained in cleanout practice, the toxicology and handling of chlorinated and other vapor degreaser solvents, and the proper use of protective equipment. A written procedure must be established and adhered to, which should include work orders detailing all preparatory and cleanout steps to be taken, and safety precautions to be followed.

External preparation and cleaning

With many open-top degreasers, it may be possible to remove dirt, sludge, and metal chips from outside of the degreaser, following these recommended procedures. For larger equipment, the following steps are to be taken prior to entering the degreaser:

1. Remove solvent from degreaser, or distill as much solvent as possible observing the recommended 1.5” minimum liquid level above heating elements.
2. Turn off heat supply and allow degreaser to cool. Keep water flowing or refrigeration operating.
3. When sump cools, turn off water supply.
4. Drain residues. If still warm, provide additional ventilation.
5. Ventilate equipment thoroughly to remove residual solvent as completely as possible.
6. Carefully remove thermometers and safety devices to avoid damage to them during cleanout.
7. Disconnect heat-supply line fittings.
8. Disconnect solvent lines leading to degreaser and water separator.
9. Remove cleanout ports and heating elements.
10. Lock off all power to pumps and conveyors.
11. Remove dirt, sludge, and metal chips from the bottom of each compartment as thoroughly as possible without entering the equipment.

At this point, if it is necessary to enter the degreaser, the following safety procedures must be observed.

Warning

Exposure to high concentrations of solvent vapor may result in unconsciousness or death. Personnel must not enter an atmosphere with a high concentration of solvent vapors unless safe entry procedures are followed, including the use of self-contained breathing apparatus together with backup personnel

Safety procedures for entering a degreaser

The following procedures *must* be observed when it is necessary to enter the degreaser:

1. The entire system must be drained.

2. All access ports must be removed or locked in an open position.
3. All solvent vapors must be expelled.
4. Purge the degreaser with forced air directed toward the bottom of each compartment.
5. Using proper instrumentation, measure the air quality inside the degreaser.6. The person entering the degreaser must wear a harness and lifeline and NIOSH/ MSHA approved self-contained breathing apparatus of a pressure-demand type with full facepiece
7. A second person should hold the free end of the lifeline, must be similarly equipped for degreaser entry, and must be able to communicate at all times with the first person when the first person is inside the degreaser.
8. A third person must be within audible hailing distance. The second person should *not* enter the degreaser unless absolutely necessary to remove the first person, and *must not enter before the third person has been alerted.* The third person must *not* enter the degreaser.

Internal cleaning procedures

Brush out the condensate trough and check to make certain that there are no obstructions to condensate flow.

2. Brush cooling coils, walls, and compartment floors to remove accumulated rust and scale. Take care to avoid damaging corrosion-resistant finishes.
3. Brush down rusted areas; inspect and lubricate conveyor system or internal drive mechanism as required.
4. Scrape and brush heating elements free of all caked sludge to assure efficient heat transfer.

Routine Maintenance

Further equipment cleanout should include:

5. Clean out condensate lines from the collection trough outlet to the water separator, and from the water separator to the discharge point in the degreaser.
6. Clean out the water separator and remove any sludge that may have accumulated in the bottom.
7. Clean strainers, filters, sight glasses, and porthole glasses before reassembly.
8. Clean and check controls, indicators and regulators before reassembly. Adjust if necessary.
9. While unit is down, it may be a good time to perform other maintenance, including a check of doors, pipe fittings, gauges, and other trouble spots for leaks. Solvent-resistant gaskets and sealing compounds should be used to help prevent solvent loss.
10. Reconnect heat input.
11. If manual cleanout is insufficient, the degreaser may be cleaned with a hot solution of soda ash and water. Fill the unit with water to a level about 4 to 6 inches above the heating element, and add one pound of soda ash per five gallons of water in the degreaser. Heat this solution for one-half hour. The sides and all compartments should be thoroughly washed, after which the unit should be drained, rinsed well, and dried.
12. Turn on water supply to condensers and heat exchangers and inspect for water leaks. Repair any leaks.

13. Fill all compartments to normal levels with solvent, and start the degreaser.

Treating an acid degreaser

Treatment of an acid degreaser consists of neutralizing the acid solvent, draining the degreaser, cleaning the unit manually, and neutralizing with a heated soda ash solution.

Warning !

Fire/Explosion Hazard *An acid degreaser presents the potential of fire and explosion with consequent personal injury. A continuing acid reaction results in the formation of toxic gases including hydrogen chloride, and possible violent exothermic reaction with iron oxides and aluminum when present in the sump. The acid degreaser should be neutralized immediately, following recommended procedures.*

The following steps should be employed:

1. Turn off heat.
2. Add soda ash to sump in a solution of one pound of soda ash to 5 gallons of water, and agitate as much as possible while solvent is cooling. **Baking soda can also be used**
3. When solvent is cool, remove from degreaser.
4. Following the procedure outlined in the previous section, remove as much sludge as possible from outside of the degreaser.
5. If it is necessary to enter the degreaser, the safety precautions outlined in the previous section must be observed.
6. Fill the degreaser with water to a depth of 4-6 inches above the heating elements, and add soda ash at the rate of one pound per 5 gallons of water in the sump.
7. Heat the soda ash solution and boil if possible. Wash all parts of the degreaser that were in contact with the acid solvent including water separator, condensate reservoir and plumbing to and from.
8. Drain degreaser and dry completely.
9. Add fresh solvent.
10. Determine cause of acid generation and take action to prevent future occurrence.

Disposal of solvent wastes

Sludge from a vapor degreaser or from a solvent still may be stored in drums until ready for disposal. Drums should not be tightly sealed, especially those that contain sludge with aluminum residues. Prior to disposal, drums should be stored outdoors and away from any combustible materials or source of combustion. Solvent wastes normally consist of chlorinated solvent, oil, tar, metal particles, buffing compounds, and other contaminants. Chlorinated solvents are considered hazardous wastes under the Resource Conservation and Recovery Act. Therefore any waste containing chlorinated solvents must be disposed of by approved incineration. Before disposing of wastes containing chlorinated solvents, every effort should be made to recover as much of the solvent as possible by distillation. A solvent recycling firm should be considered. It is the responsibility of the generator of any waste to ensure that disposal is carried out in accordance with the Clean Air Act, Clean Water Act, the Resource Conservation and Recovery Act, and all relevant state or local laws and regulations regarding disposal.

Warning !
Do not add dry soda ash to an acid degreaser. This may cause flashing from the degreaser, and consequent injury as nearby personnel are exposed to the eruption of hot solvent and corrosive acid. Soda ash must always be added in a water solution,

Warning !
Do not add soda ash solution to boiling solvent or to solvent that is above the azeotropic temperature of 149' F (65' Q. This may cause flashing from the degreaser, with a consequent eruption of hot solvent. Allow solvent to cool, or carefully dilute with water to reduce temperature.

Warning !
Explosion Hazard
Do not add sodium hydroxide (NaOH) or other strong alkalies to an acid degreaser This can result in a violent chemical reaction and there is even the possibility of an explosion, with consequent danger of injury or death to nearby personnel. Use only a soda ash or sodium bicarbonate solution.

Chapter 9

Trouble Shooting

Water separator: Insure that separator is clean and that water flow through separator is unhindered.
Condensing coil: Check temperature of discharge water. It should range between 90° and 120° F (32°-49° C) to avoid condensing atmospheric moisture.
Water on incoming work: Determine whether parts entering degreaser are wet or carrying water-based cutting, oils.
Collection trough: Check installation and performance.
Freeboard chiller: Freeboard refrigerated chillers should have separate collection trough and water separator.

Poor cleaning action

Ineffective cleaning of the work generally is a result of insufficient contact with the solvent and/or solvent vapor. Following are some common contributory conditions:
Cause: Vapor immersion and/or rinse cycle too short.
Correction: Leave work in vapor zone until all condensation stops.
Cause: Vapor level too low for adequate cleaning; and rinse.
Correction: Check heat input to insure sufficient vapor generation.
Cause: Vapor level collapse because of too heavy a load. If temperature of work increases, oils may bake on parts.
Correction: Follow degreaser equipment manufacturer's guidelines on loading.

Low acid acceptance

Solvent stabilizers are effective in the industry in resisting acid formation and solvent decomposition, even after repeated distillation. However the original acid acceptance of solvents will gradually decline, depending on production volume and the type of work being cleaned. Periodic addition of make-up solvent restores acid acceptance.

Occasionally a degreaser becomes acid, creating a situation that requires immediate action and which could result in a safety hazard.

High solvent consumption - excessive vapor odors.
Cause: Solvent dragout.

These problems usually are related: excessive vapor odor is an indication of vapor loss to the atmosphere. If the cause of pronounced vapor odors is located and corrected, solvent consumption will be reduced. A detection meter will help locate the source of vapor loss.

Correction: Rack parts for complete drainage; eliminate pockets and recesses.

Cause: Vapor level too high.
Correction: Check vapor thermostat and sump temperature; check and adjust heat input to maintain vapor level at midpoint of condenser coils. (Refer to recommended vapor thermostat and sump temperature.)
Cause: Entry and removal; rates too fast.
Correction: Entry and exit rates should not exceed 11 ft/minute. Faster speeds pull vapors out of degreaser.
Cause: Insufficient clearance between basket and degreaser walls; causes piston effect as work is lowered and raised.
Correction: Work should not exceed 50 % of degreaser surface area.
Cause: Solvent loss from spraying,
Correction: Keep nozzle at least 6 inches below vapor level; use only enough pressure to wash the work.
Cause: Drafts which sweep vapor from degreaser.
Correction: Avoid open doors and windows; shield degreaser from other drafts such as exhausts.
Cause: Solvent evaporation from open tank.
Correction: Cover degreaser when idle or shut down. Cover water separator if open-tank construction.
Cause: Leaks.
Correction: Locate source with detection equipment. Check valve packing nuts, pump packing, sight glasses, piping, and gaskets.
Cause: Insufficient freeboard height allows vapors to escape to atmosphere.
Correction: Freeboard height should be at least 100 percent of tank width.
Cause: Insufficient condensation.
Correction: Insure that water is flowing through cooling coils before turning on heat input to sump; confirm that water temperature at condenser outlet is between 90°-120° F (32°-49°C).
Cause: Vapor level collapse. Too heavy a load will cause vapor collapse, creating air-vapor mixture that is pushed out of degreaser.
Correction: Check equipment rating; do not overload degreaser.
Cause: Insufficient cycle time; work emerges dirty and wet, carrying solvent into atmosphere.
Correction: Wait until all condensation stops before removing work from degreaser.
Cause: Absorbent materials.
Correction: Do not use degreaser to clean clothing or leather goods; do not use wood or other absorbent materials in baskets.
Cause: Excessive moisture. Water in sump forms azeotrope with MC, TCE and perchloroethylene which has a lower boiling point than solvent, causing vapor loss to atmosphere.
Correction: See following section on moisture contamination.

Moisture Contamination

Excessive moisture in the solvent can cause spotting and corrosion of the work as well as damage to the equipment.

Caution

In the presence of excess water, 1,1,1-trichloroethane (EPA restricted along with Freon) is subject to a hydrolytic reaction that results in solvent decomposition and the formation of acidic material. This is highly corrosive and may cause equipment damage. The degreasing operation should be continually monitored for signs of excessive moisture.

Indications of water contamination

The following are some indications of excessive moisture and the corrective action to be taken:

Water spots, equipment rust: Excessive water in the solvent will spot or corrode the work; rust will develop on degreaser walls around cooling coils and condensate trough.

Ghosting: A dense white cloud develops in the vapor zone. Density increases with water concentration.

Important Websites

If you need a vapor degreaser consultant.

http://www.intota.com/expert-consultant.asp?bioID=773088&perID=722612

If you need EPA NESHAP regulations.

http://www.setonresourcecenter.com/environmental/publications/NESHAP/vaporman.pdf

http://www.epa.gov/reg3artd/enforce/mainenf/degreasermactassist.htm

If you need an ASTM publication on vapor degreasers.

Handbook of Vapor Degreasing
ASTM Committee D-26

***Author's note. I believe, in spite of the somewhat bad and unjustified environmental reputation that vapor degreasers acquired in the late 80s and early 90s, there is no better method of cleaning metal and other substrate parts of oil, flux, grease, dirt, wax, etc. With updated equipment and careful operation, there should be no environmental damage done. My company also sells aqueous washers and other types of parts washers but I am "sold" on vapor degreasing.** *Rod Murphy 7/11/2014*

Vapor Degreaser Emissions Regulations

July 2014.
Note. Some solvents are being phased out and banned by EPA and/or the Clean Air Act under the Montreal Protocol. Talk to your solvent distributor about replacement solvents.

There are USA air quality (emissions) regulations and there are Canadian, Mexican, European Union and Asian nations and other emissions regulations. This vapor degreaser regulations web page will treat only the USA and its pertinent regional/states regulations. Also, we will not try to explain California's regulations.

These pages either reproduce EPA regulations verbatim or provide its own opinions on such regulations. No one should act only on those written EPA regulations or this book's opinions. Degreasing Devices Co. Div. Of WCC Inc. does not take responsibility for any decisions made using this guidebook. Instead direct contact should be initiated with regional or national air quality and other government regulators before acting on any written vapor degreaser regulations.

New users of vapor degreasers and others who want to meet the EPA and/or regional emissions control regulations are often confused. There is much misinformation, rumors and a lack of easy access to the authoritative facts regarding the halogenated solvent NESHAPS (National Emission Standards for Hazardous Pollutants). THE NESHAPS are the basis for all states' and regions' emissions control regulations. Some states have added tougher standards than the EPA requires.

We will try to answer the following questions.

1. What does a new vapor degreaser user need to do to be compliant?
2. What solvents are OK?
3. Which government agencies does a user need to placate?

EPA's NESHAPS REGULATION 12/2/1994
What is this regulation?
On December 2, 1994, the Environmental Protection Agency (EPA) published the National Emission Standards for Hazardous Air Pollutants " for Halogenated Solvent Cleaning (59 CFR 61801). The law falls under the authority of Section 112 of the 1990 Clean Air Act Amendments. You can find the regulation in 40 Code of Federal Regulations Part 63, Subpart T.
The regulation focuses on "reducing the emissions of selected halogenated solvents used in parts cleaning. The compliance methods center around best operating practices and pollution prevention techniques.

Who and what is covered?
Owners and operators of degreasers using the following chlorinated solvents: methylene chloride; perchloroethylene; 111 trichloroethane; trichloroethylene; chloroform; carbon tetrachloride. Suspected ozone depleting solvents like freon, 111 trichloroethlene, carbon tetrachloride, chloroform and some others are severely restricted under other Clean Air provisions.
Note: Blended cleaning solvents must contain a total regulated solvent content below 5 percent by weight to be exempted from regulation. To . determine the solvent content, contact your vendor, use your Material Safety Data Sheets, or use EPA Test Method 18.

Navigating the Regulations
The regulation seeks to reduce emissions of the six halogenated cleaners listed in the beginning through better operating practices and pollution prevention techniques. As a result; the law offers several compliance techniques.

Your responsibilities for each technique vary depending on your degreaser. The regu1ation categorizes degreasers in two classes based on machine type: batch vapor and in-line cleaners. See Figures 2 through 6 for examples of each machine.

EPA classifies batch vapor degreasers in two sizes, small and large, based on the machine's solvent/air interface area. Small batch degreasers have a solvent/air interface area less than or equal to 13 ft2 (1.21 m2). Large degreasers have an interface area greater than 13 ft2.

In-line degreasers are either existing or new. They can use either a cold or vapor process to clean parts. Existing in-line degreasers are those for which construction, or reconstruction, began on or before November 29, 1993. EPA classifies all others degreasers as new.

Three primary methods exist for regulatory compliance: Control combinations; Idling Emission, Alternative standards. The specifics of each method depend on your machine type. Carefully consider your operation before making a decision; then choose the method that best fits your situation. Here's a brief overview of each method.

Control combinations: You may choose combinations of control technologies to reduce solvent releases. Your type of degreaser determines which group of control combinations you use. A set of minimum equipment design standards and operation practices accompany this method. Your reporting and monitoring requirements also depend on which group you choose.

Idling emission standards: This technique combines the minimum equipment design and operating practices with emission limits. You may use additional controls and techniques to meet the limits.

Alternative standards: You reach compliance with this method by meeting halogenated solvent emission limits from each machine as calculated on a three-month rolling average basis. You can use any means necessary to meet the emission limits. However, you might need to adopt several pollution prevention techniques to obtain compliance.

Note. EPA allows another route to compliance - the equivalent methods of control. Under it, you can develop your own techniques, using either equipment or workplace practices, to meet compliance. However EPA or your local air authority must approve your procedures. Your application must include a complete description of the equipment or procedure; the proposed equivalency testing procedure; and the date, time and location for the equivalency demonstration. Because every situation is unique, this method is not covered in this manual. Submit the application to your regional office, or contact your local air authority for more information. The state Small Business Assistance Program can assist you in submitting your application.

Compliance Methods

TABLE 2 REQUIRED ELEMENTS FOR EACH COMPLIANCE METHOD

Control Combinations Method

This method requires three items to meet compliance: using a degreaser that meets a minimum equipment design, adopting mandated operating practices, and using a group of control technologies. Equipment design and operating practices lay the groundwork for reducing emissions. Using a combination of controls helps further minimize your solvent emissions. One appealing characteristic of this method is that it has no emission limits. You are only responsible for using a control group and meeting performance and administrative requirements.

EPA uses seven technologies to make up the control combinations. The combinations consist of either two or three control technologies depending on your degreaser. The technologies range from simple and inexpensive to complex and costly. The seven controls EPA used to create the combinations include:

. Working mode cover. Dwell time

. Freeboard refrigeration. Reduced room draft

. Carbon adsorber. Freeboard ratio of 1.0

. Superheated vapor

Some machine types have more control combinations available. The different combinations give you flexibility in picking a compliance method.

Idling Emissions

Emission limits are the basis of this method. The emission rate depends on the machine, and as with the control combinations method, you must use the minimum equipment designs and operational practices prescribed by EPA. However, you can use any additional techniques (controls or operating procedures) to meet the limits. But, you must inform EPA of your method and a procedure to monitor its performance.

Alternative Standards

Like idling emissions, this method is emissions based. However, this method has no equipment or operational requirements. The only requirement is that solvent emissions, based on a three-month rolling average, be kept below certain limits. The machine type determines these limits. Meeting the emission limits may prove challenging to owners and operators of large degreasers.

DETAILS OF CONTROL COMBINATIONS

As mentioned, the control combination method consists of three items to meet compliance:

Installing controls to meet a minimum design requirement;

Adopting certain operating practices;

Using a predefined group of control technologies.

To meet compliance, first, you should meet the required equipment design. Next, train your workers to use the prescribed workplace practices. After implementing workplace practices, choose a control combination and establish a monitoring program to ensure their proper operation. Next, develop a recordkeeping system to track the control's performance. Finally, report the required information to EPA on time.

Minimum Equipment Design

This section describes the minimum design features your degreaser must have. These requirements apply to both classes of batch vapor and in-line degreasers. New machines may have the equipment in place, while older models may need retrofitting. If your machine already has the equipment, ensure that it can meet performance requirements. These are EPA's requirements:

An idling and down time mode cover or reduced room draft;

A freeboard ration of at least 0.75;

An automated parts handling system that moves parts slower than 11 feet per minute (3.4 meters per minute) during the entire cleaning cycle (for example, parts loading through removal);

An automatic shut-off for the sump heater when the solvent level drops to the sump heater coils;

A vapor level control device that shuts off sump heat if the vapor level rises above the primary condenser;

A primary condenser above the vapor zone;

A carbon adsorber if a lip exhaust is used to collect solvent vapors.

NOTE: There are monitoring and record keeping requirements if you use a hoist.

Required Workplace Practices

In addition to the minimum equipment design, EPA requires that users choosing this compliance route adopt certain workplace practices which center around pollution prevention. This list suggests ways to reduce solvent loss, regardless of your compliance method:

Minimize air flow across the opening of the degreaser by covering it during idling and downtime or reducing room draft;

Operate open-top batch vapor cleaning machines so the size of parts or part baskets to less than 50 percent of the machine's solvent/air interface or reduce the entry speed of the parts or part baskets into the degreaser to less than 3 feet per minute (0.9 meters per minute);

Conduct spraying operations within the degreaser ideally, spray within the vapor zone or in a baffled or enclosed area within the machine;

Place parts so they do not capture or trap solvent-for example, orient parts with cavities down to prevent solvent accumulation. Tip or rotate parts to remove excess solvent trapped in recessed cavities or in blind holes;

Allow parts baskets or parts to stop dripping before removing from the degreaser;

Turn on the primary condenser before starting the sump heater;

Turn off the primary condenser after turning off the sump heater and the solvent vapor layer has collapsed;

Use threaded or other leak-proof couplings while adding or removing solvent from any degreaser. Also, place inlets to the solvent sump below the liquid solvent level;

Follow manufacturers' recommendations for maintaining each degreaser and its controls. The EPA must approve any alternative maintenance practice;

Ensure that all degreaser operators can pass the appropriate sections of EPA's written test (see Appendix E). An inspector may request that degreaser operators take the test during an inspection;

Collect and store all waste solvent, still bottoms, and sump bottoms In closed containers. The containers may allow for pressure relief, but liquid solvent should not drain from the container;

Avoid cleaning sponges, fabric, wood, and paper products in a degreaser.

Available Control Combinations

This section presents the control combinations you may use. As mentioned, no emission limit exists with this compliance method. However, properly using each control group will reduce halogenated solvent emissions.

You must know two characteristics of your degreaser to ensure that you pick from the correct pool of control groups. First, know whether you have a batch vapor or in-line degreaser. Second, if you use a batch degreaser, you should know its solvent/air interface area. This is the surface area where the solvent condensate meets the air. If you use an in-line machine, you need to know whether EPA considers it new or existing.

Appendix F contains forms to help you track the parameters that require monitoring. The forms provide guidance only and may not apply to your specific situation.

Tables 3 through 6 provide a matrix of the control options available for each degreaser classification. The tables should help you identify the technologies contained in each control group. Following the tables, you will find details of each control technology, including operating and monitoring requirements.

Compliance Methods

Freeboard refrigeration devices

A freeboard refrigeration device (also called a chiller) is a set of condenser coils in the freeboard region that creates a chilled air blanket to condense the solvent vapor and prevents its escape.

The freeboard refrigeration device must create a cool air zone which is 30 percent or less of the solvent's boiling point. For example, if your solvent boils at 100° F, your freeboard refrigeration device must cool the air blanket to 30° F or less. Table 7 lists the minimum temperatures needed for pure solvents.

Temperature Requirements For Freeboard Refrigeration Devices For Regulated Solvents

Solvent	Boil Temp.	Required Blanket Air Temp.
Methylene Chloride	104 F	31.2 F
Trichloroethylene	189 F	56.7 F

Perchloroethylene 250 F 75 F

If you use a blended cleaning solution of regulated halogenated solvents and other chemicals, use the boiling point provided by the manufacturer on the material safety data sheets.

Check and record the temperature of the chilled region weekly using a thermometer or thermocouple. Measure the temperature in the center of the air blanket while the machine is idling.

Freeboard ratio of 1.0
The freeboard ratio is the freeboard height divided by the smaller interior dimension (length, width, or diameter) of the degreaser. For batch cleaners, the freeboard height is the distance from the solvent/air interface to the top of the idling degreaser. Freeboard height on in-line machines is the distance from the solvent/air interface to the bottom of either the entrance or exit, whichever is lower. Figures 2 through 6 show the freeboard region for both batch vapor and in-line degreasers respectively.

Superheated Vapor
Superheated vapor degreasers heat the solvent vapor above its boiling point to facilitate parts drying and minimize solvent drag-out.

Degreasers equipped with superheated vapor devices must:

. Maintain the solvent vapor at least 10° F above the solvent's boiling point;

. Use the manufacturer's method for determining the dwell time in the superheated vapor zone;

. Ensure the parts remain in the superheated vapor zone for the entire dwell time;

Place parts so they do not capture or trap solvent-for example, orient parts with cavities down to prevent solvent accumulation. Tip or rotate parts to remove excess solvent

Dwell Time
Dwell time is the time parts are held in the freeboard area so that some residual solvent may drain back into the degreaser. This technique reduces solvent drag-out and evaporative losses. Each part will require different dwell times due to its shape and material. As a result, you must determine the dwell time for every unique part you clean if you use this control method.

EPA has developed a procedure to determine the proper dwell time:

1. Use parts or parts baskets that are at room temperature.

2. Clean parts in the degreaser per standard operating procedures.

3. Determine the time for the part(s) or parts basket to cease dripping once placed in the freeboard region.

4. The proper dwell time for parts to remain in the freeboard area is no less than 35 percent of the time determined in step 3.

Example
Plant XYZ separately cleans two parts, A and B, in an open-top batch vapor degreaser using methylene chloride. To obtain compliance, XYZ chooses a control combination that uses dwell time. Thus, the company must determine the proper dwell time for each part type or parts basket. First, XYZ must clean parts A, which are at room temperature, in the vapor degreaser. After the cleaning cycle, an operator places the wet parts into the freeboard area and star1s a timer. When the parts stop dripping, the operator stops the timer. The elapsed time (for example, 10 minutes) is multiplied by 35 percent to determine the proper dwell time.

Proper dwell time = 10 minutes x 35 percent = 3.5 minutes

Thus, the proper dwell time for A parts is 3.5 minutes. This is the minimum time the parts must remain in "dwell." The same procedure is repeated for B parts. If XYZ decides to clean both parts A and B together, they must use the longer dwell time.

Important information about dwell time:

. Document the test used to determine dwell time;
. Measure dwell time monthly to assure you're using the proper time.

Reduced Room Draft

"Reduced room draft" is a method to decrease the air flow across the freeboard area. This minimizes turbulence inside the degreaser. Two methods for reducing room draft are controlling room parameters (i.e., redirecting fans, closing doors and windows, etc.), or either fully or partially enclosing the degreaser. Whatever technique you choose, you must keep the air flow across the freeboard area ill inside the machine to less than 50 ft/min (15.2 m/min). EPA developed the following procedures for each method to determine the air velocity:

Controlling room parameters
. Determine maximum wind speed with an air velocity meter on each of the four corners of the degreaser. Measure the windspeed within 6 inches above the freeboard area;

. Record the maximum reading for each corner;

. Average the values obtained at each corner to determine the average wind speed;

. Lower the velocity if the average wind speed is greater than 50 ft/ min. (for example, redirecting fans);

. Monitor weekly the room parameters established during the initial compliance test to achieve the reduced room draft of less than 50 ft/min.

Enclosures
. Determine the maximum wind speed inside the enclosure with an air velocity meter;

. On a monthly basis:

Monitor the air flow inside the enclosure;

Inspect the enclosure for cracks, holes, and/or other defects.

Carbon Adsorbers

Carbon adsorption is a method of controlling solvent emissions by passing the exhaust from a degreaser through activated carbon. EPA discourages this method because it is a treatment technology. In addition, carbon adsorption can produce other potentially hazardous waste streams, like spent carbon beds saturated with halogenated solvent. As a result, additional waste management costs can occur. You should consider all factors and options before using this control technology.

The allowable limit for the solvent concentration in the carbon adsorber exhaust is 100 parts per million (ppm) by volume. If the concentration exceeds 100 ppm, adjust the desorption schedule, or replace the carbon bed if it is not a regenerative system. Additional operating requirements include:

. Ensuring that the carbon adsorber bed is not bypassed during desorption;

. Locating the lip exhaust so the degreaser's cover closes below the lip exhaust level.

With this control you must measure and record the solvent concentration in the exhaust of the carbon adsorber weekly. Test the concentration with a colorimetric detector tube. The measurement procedure should meet the following criteria:

Sample gas at the exhaust vent of the solvent cleaning machine;

. Ensure that the vapor degreaser is in working mode and venting to the carbon adsorber;

. Be sure the colorimetric detector tube is accurate to +/- 25 parts per million by volume;

. Follow the manufacturer's instructions when using the colorimetric detector tube;

. Provide a sampling port for monitoring within the exhaust outlet of the carbon adsorber. The port should be at least 8 stack or duct diameters downstream from any flow disturbance such as a bend, expansion, contraction, or outlet; downstream from no other inlet; and 2 stack or duct diameters upstream from any flow disturbance such as a bend, expansion, contraction, inlet or outlet.

Covers

Covers keep the solvent vapors inside the degreaser by protecting its openings from air movements. Many different covers exist for use including rolltop, sliding, and biparting. Covering a degreaser is one of the cheapest and easiest ways to reduce solvent losses.

Covers for a degreaser can be independent or part of its design. Any cover must seal the cleaner and prevent solvent vapors from escaping. When using a cover, you must inspect it monthly for cracks and to ensure proper operation. EPA recognizes three types of cover: idle, working, and downtime-mode:

Idling-mode cover: any cover that shields the degreaser openings during the idling mode. You can use an idling-mode cover as a working-mode cover if that definition is also met.

Working-mode cover: any cover that protects the degreaser openings from outside air disturbances during pans cleaning. Working mode covers are opened only during pans entry and removal. You can also use a cover that meets this definition as an idling-mode cover if that definition is also met.

Downtime-mode cover: a cover used when the degreaser is off. It must completely cover the openings of the degreaser

Hoists

A hoist is not an available control method in a control combination. It's required per the mandatory equipment design. The following monitoring and reporting requirements are associated with hoist use:

. Calculate hoist speed by measuring the time it takes for the hoist to travel a measured distance and report it in meters per minute. To convert from feet to meters, multiply the distance in feet by 0.305;

. Check the hoist speed monthly unless:

hoist speed does not exceed 11 feet/minute for one year. If so, you may measure hoist speed quarterly;

you can demonstrate that hoist speed cannot exceed 11 feet/ minute. Then you can measure the speed quarterly.

DETAILS OF THE IDLING EMISSIONS METHOD

This method has a limit on the quantity of regulated solvents emitted from the degreaser while the machine is idling. Figure 7 shows the steps required to meet compliance with this method. Table 8 lists the emission limits for each regulated degreaser.

TABLE 8 IDLING EMISSION RATES FOR EACH DEGREASER TYPE

Degreaser type	Idling emission rate (lbs/hr/ft2)
Small and large batch	.045
I Existing and new in-line	.021

Although this regulatory method is emissions oriented, it still requires the minimum equipment design and operational methods used in the control combinations method. If these techniques do not lower your emissions, you may use any additional controls or procedures necessary to meet the limit.

Your emission limit depends on the area of the degreaser's solvent/air interface. Once you determine the area, multiplying it by the appropriate emission factor gives the maximum hourly emission rate of solvent that the degreaser may emit.

NESHAP (11/10/03) for Halogenated Solvent Cleaning

The EPA released a final ruling concerning The National Emission Standards for Hazardous Air Pollutants (NESHAP) for Halogenated Solvent Cleaning (40 CPR part 63, subpart T), which was proposed on November 29,1993,promulgated on December 2, 1994, and corrected to final rule June 5, 1995.This rule became effective November 10, 2003.

Plants must demonstrate compliance with the emission standards by monitoring their control devices and performing annual emissions testing. This information notifies the EPA when a source becomes subject to the regulations, informs the Agency if a source is in compliance when it begins operation, and informs the Agency if the source remained in compliance during any period of operation.

In the Administrator's judgment, emissions of hazardous air pollutants (HAPs) from halogenated solvent cleaners may cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare. Therefore, NESHAP standards were promulgated for this source category, as required under section 112 of the Clean Air Act. HAP emissions from halogenated solvent cleaners are the result of inadequate equipment design and work practices.

These standards rely on the proper design and operation of halogenated solvent cleaning machines such as working-mode covers, a freeboard ratio of 1.0, and reduced room draft to reduce solvent emissions from halogenated solvent cleaners. Certain records and reports are necessary to enable the EPA to identify sources subject to the standards and to ensure that the standards are being achieved.

Owners/operators of halogenated solvent cleaners must provide the EPA with an initial notification of existing or new cleaning machines, initial statements of compliance, an annual control device monitoring report (owners/operators of batch vapor and in-line cleaning machines complying with the alternative standard), and exceedance of monitoring parameters or emissions.

The records that the facilities maintain indicate to the EPA whether they are operating and maintaining the halogenated solvent cleaners properly to control emissions. In order to ensure compliance with the standards promulgated to protect public health, adequate reporting and record keeping is necessary. In the absence of such information, enforcement personnel would be unable to determine whether the standards are being met on a continuous basis, as required by the Clean Air Act.

The annual public reporting and record keeping burden for this collection of information are estimated to average 14 hours per response. Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and use technology and systems for the purpose of collecting, validating and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

If you got all the way through you won a diploma from Degreasing Devices University!

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