



AMITY LIMITED

Unit 1, Dodworth Business Park, Barnsley, South Yorkshire, S75 3SP
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LEKSOL AL

Azeotropic Precision Cleaning Solvent

A new solvent alternative that eases the transition away from CFC and HCFC circuit board cleaners.

- Fast Drying
- Low odour
- Non-flammable
- Excellent Solvency

General Information

Leksol AL is a new alternative to CFC and HCFC circuit board cleaners. With the look and feel of CFC cleaners, it is a true drop in replacement for old style ozone depleting solvents such as Freon TF and Genesolv 2004

Non-flammable with a low odour, Leksol AL is an excellent alternative that has a near zero, ozone depletion and global warming potential.

Applications

Leksol AL is a patent pending, non-flammable, precision cleaner with a moderately low boiling point, which evaporates quickly. This makes it ideal for difficult cleaning situations where solvent entrapment is a concern. Powerful enough to clean without scrubbing, it is safe for fragile circuits such as read-write heads in disc drives. The fast evaporation also helps in repair environments or when cleaning optics, importantly, it is the only alternative that can be used in old style vapour degreasers without retrofitting.

Leksol AL easily removes both polar and non-polar contamination such as grease, dust, light oil, and Rosin fluxes. It is suitable for all types of electronics and even clean hybrids and tightly packed *surface mount assemblies*. It will also not leave residues, as it is an extremely high purity solvent. In short, Leksol AL is a very cost effective, precision cleaner that is environmentally safe and is not covered under NESHAP regulations.



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Compatibility

Leksol AL generally will clean all common components, although some plastics and elastomers will need to be tested for compatibility before using Leksol AL. It is safe for cured epoxies, flux laminates, and solder masks, metals and their alloys. Whilst this product can replace CFC's it may not be suitable universally. Users should test before using it on soft or sensitive plastics and elastomers.

Health and Safety

Leksol AL is based on n-Propyl Bromide, plus performance enhancing stabilisers. It is recommended that a 100ppm-workplace exposure limit be maintained. It is not flammable and is neither a known or suspected carcinogen.

See Material Safety Data Sheet for details.

As always, good chemical management requires users to be trained in safe and efficient handling of the product. Always use care when operating a vapour degreaser and maintain good ventilation when using this product. Take care to control the solvent and you will minimise hazards and waste.

ELECTRONICS PLASTICS COMPATIBILITY

POLYMER	SOAK TEST (1 HOUR)	VAPOUR TEST (2 MINUTES EXPOSURE)
Polyurethane	compatible	compatible
Polyester	compatible	compatible
Isoprene (natural rubber)	compatible	compatible
PVC	compatible	compatible
Aramid	compatible	compatible
Cellophane	compatible	compatible
Polycarbonate	incompatible	incompatible
Polystyrene	incompatible	incompatible
FRP-Epoxy	compatible	compatible

GENERAL TEST

A circuit board with a clear acrylic coating and over 300 different components was immersed in the solvent and in the vapour, when checked, no sign of attack was visible.



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Technical summary of soldering fluxes and residue cleaning

This paper will provide a basic review of fluxes use for soldering electronic components to printed circuit boards. Information is provided about flux types, uses applications, and residue cleaning. This information will help anyone understand the types of fluxes in a specific application and how to pick an appropriate cleaning agent to remove the residues properly.

Introduction

The purpose of the flux is to clean surfaces that are going to be joined together to enhance wetting by solder in the molten state. To accomplish this, the flux must be able to de-oxidise metal surfaces at high temperatures without decomposition.

Important types of solder fluxes.

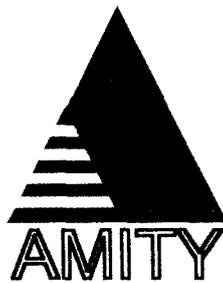
Fluxes fall into two categories, rosin based and so called water soluble (the flux itself is not water soluble, however the residue left after soldering is.) There are two important specifications for fluxes used in electronics. ANSI/IPC-SF-818 and MIL-F-14256E

ANSI-IPC-SF-818 spells out 3 assembly classes; class 1 is consumer products, class 2 is general industrial, class 3 is high reliability and military electronics. Both specifications are similar in terms of tests and test methods required characterising flux and fluxing performance, although there are some language differences.

A. Rosin Fluxes

Rosin based fluxes are made from Rosin which is extracted from pinesap. The purified product is known as "water white Rosin". The active ingredient is an organic acid, adietic acid and may contain homologs such as dehydro adietic acid and levopomeric acid (1,2). In addition to Rosin other activators may be present at different levels to increase the ability to clean and de-oxidize. Activators are compounds that decompose at soldering temperatures, yielding ammonia and hydrochloric acid in the process. Flux activity is categorized as R (Rosin only), RMA (Rosin mildly activated) and RA (Rosin activated). A low boiling solvent such as isopropanol is used as the carrier, so this group is flammable.

In addition to the Rosin activator ratio, the solids content (specific gravity) of the flux can be varied. A higher solids content will be used for boards with a high density of connections and visa-versa.



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Type R containing only Rosin is the least active and is recommended for surfaces, which are very clean to start with. It leaves virtually no residue behind, Leksol solvent works well to remove this type of flux.

Type RMA contains a small amount of additional activator to enhance cleaning and de-oxidation, leaving only a minimum amount of inert residue behind. A characteristic of RMA fluxes is that the remaining residue is non-corrosive, tackiness free, and exhibits a high degree of freedom from ionic contamination after cleaning. Leksol will remove this type of flux.

Type RA is the most active of the Rosin fluxes, and leaves the most residue, however the residues can be removed with appropriate flux cleaners. Leksol AL will remove the ionic residue from this type of flux.

These three fluxes (R, RMA, and RA) are the only ones specified for Mil spec work (MIL-F-14256E and ANSI/IPC-SF-818 class 3)

B. Water soluble fluxes

The so-called water-soluble fluxes are divided into two categories, organic and inorganic, based on composition. Organic fluxes are more active than RA Rosin is and the inorganic fluxes are the most active of all.

Choice of fluxes

The following are factors that can effect the choice of flux for a given application.

1. Specification

Specifications such as ANSI/IPC-SF-818 or MIL-F-142561 may dictate the type of flux, but other factors can affect choice also.

2. Board type

Board type such as single or double sided, multi-layer, and connection density will all influence the flux solids content needed. A lower solids content for simple boards and a higher solids content for more complex boards.



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3. Method of mounting

The method of mounting components, such as PTH or SMT (surface mount technology) can influence choice of flux, because of the difficulty in cleaning flux residues from underneath SM components. Flux manufacturers have developed special products that leave very little corrosive or conductive residues, if any. These do not normally require cleaning.

4. Solderability of metals to be joined.

Most of the metals of concern in electronics fall within 2 categories, easy to solder and less easy to solder. However it can be seen that metals which exhibit good corrosion resistance because of inherently tight oxides, such as stainless steel, require the strongest or most active flux.

5. Materials compatibility with the Activator.

There are halogen and ammonia free fluxes for materials that require active fluxes, but that are not compatible with halogens or ammonia fumes.

6. Soldering method.

Most fluxes are formulated to be applied as foam in automated systems prior to wave soldering. There are fluxes that can be applied by brushing, or dipping for hand soldering. Solder creams and solder preforms contain flux in their make up.

C. Post soldering cleanliness considerations.

It is important to remove any contamination from a board regardless of where it comes from, whether flux or processes. Residues left on a board, especially ionic, can cause electrical shorts or corrosion. The bad components in some fluxes are the activators, which are ionic in nature. Although Rosin fluxes (types R, RMA and RA) may additionally leave behind Rosin, which must be removed also. It is best to use a solvent based cleaner such as Leksol or Leksol AL to remove residues left behind for these types of flux.

Non Rosin fluxes (organic or inorganic) may require appropriate water based cleaner, but depending on the nature of the flux residue, either Leksol or Leksol AL or sometimes a water based cleaner is necessary.



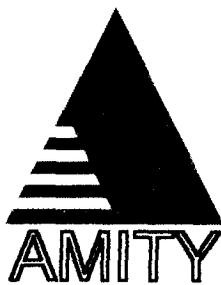
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D. Corrosion

Some thought should be given to possible corrosion from aqueous based flux residue cleaners. For instance in the case of some microwave circuits, brass or aluminium is sometimes used for thick groundplanes. Brass and aluminium are subject to attack from halogen acids and alkaline solutions normally found in aqueous based cleaners. A solvent based cleaner such as Leksol is recommended when brass or Aluminium based substrates are involved.

References

- 1. Kester Product Literature**
- 2. Alpha Metals Product Literature**
- 3. C.F.Coombs jr. Printed circuits handbook 3rd edition McGraw-Hill pp 25 1-8 New York 1988**



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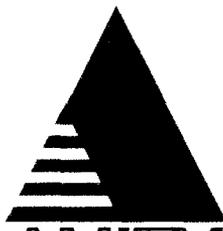
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LEKSOL AL **GENERAL FEATURES**

1. **Leksol AL** is the trade name for a new solvent system that encompasses a multipurpose solvent and a performance enhancing stabiliser package.
2. **Leksol AL** is a high performance substitute for 111 Trichloroethane and other solvents
3. **Leksol AL** has very low global warming potential.
4. **Leksol AL** leaves no residues and is fast drying.
5. **Leksol AL** is non flammable
6. **Leksol AL** is a patented product, all components are EINECS, TSCA, and MITI registered.
7. **Leksol AL** has low toxicity, and is not classified as carcinogenic.
8. **Leksol AL** is not regulated with respect to ODP
9. **Leksol AL** contains no registered HAP's
10. **Leksol AL** is an approved precision cleaner

COST SAVING BENEFITS

1. **Leksol AL** because of its patented stabilisation and performance enhancing system, can last up to 4 times as long in use.
2. **Leksol AL** can be reclaimed and therefore save expensive waste removal costs.
3. **Leksol AL** is up to 33% more efficient than Trichloroethylene, with regards to vapour loss.
4. **Leksol AL** can be used in existing cleaning equipment, saving large investment costs associated with other systems.



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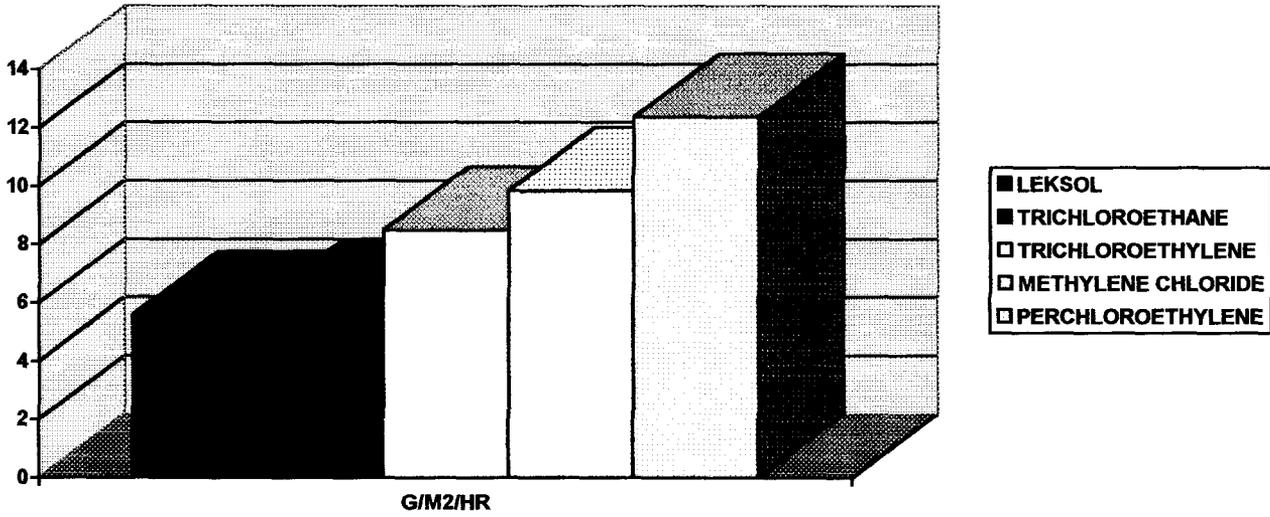
**ECONOMICS OF LEKSOL AL USE
IN VAPOUR DEGREASING
APPLICATIONS**

CONSUMPTION

Solvent consumption and energy requirements, as well as the price of the solvent, are considerations to be taken into account when choosing a solvent for use in vapour degreasing applications. The consumption rates for solvents are affected by such factors as vapour load, cleaning cycle, work load, and type of materials to be cleaned. Vapour loss varies from solvent to solvent; the reason Leksol loses fewer vapours than many others, is because of its lower vapour pressure. High vapour loss could also expose workers to potentially toxic fumes, as is the case with solvents, which have lower exposure limits i.e. <100 ppm

The figures for consumption are based on tests in an idling open top degreaser having a 24 ins by 58 ins opening.

CONSUMPTION (GRAMS PER SQUARE METER PER HOUR)



This chart clearly shows that **Leksol** is **33%** more efficient than Trichloroethylene, and slightly **better** than Trichloroethane.



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ECONOMICS OF LEKSOL AL USE IN VAPOUR DEGREASING APPLICATIONS

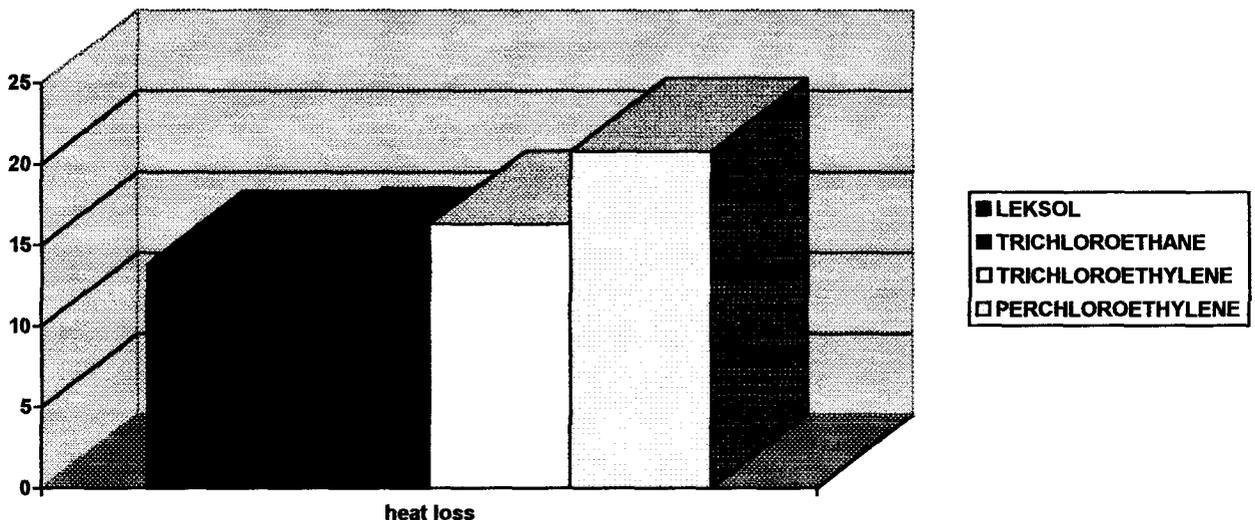
ENERGY

Considerable energy is consumed to bring a solvent to its boiling point; **Leksol** has a lower boiling point than most commonly used alternatives, and, a lower latent heat capacity. In addition, it requires less energy to provide adequate cooling capacity for vapour condensation.

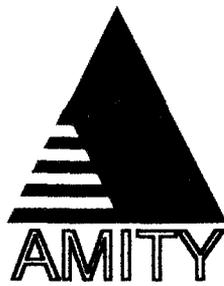
Heat loss from the degreaser also needs to be taken into account, and because it has a lower boiling point, heat loss is correspondingly less.

The figures for energy usage are based on cleaning 5 loads of steel (100 lbs. each) and provided with 20 gallons of solvent spray per hour.

ENERGY REQUIREMENTS (KILOWATT HOURS)



Leksol can enable savings in energy usage of up to 34% when compared to Perchloroethylene



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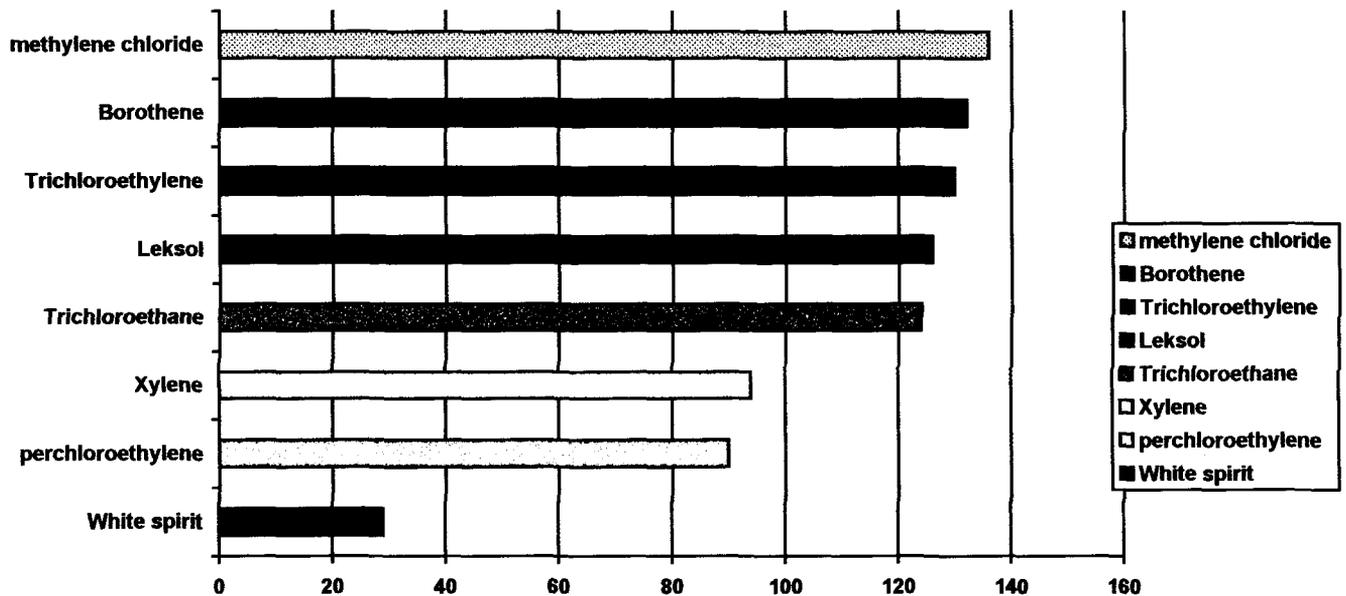
LEKSOL AL

CLEANING PERFORMANCE

KAURI BUTANOL VALUES

The KB value is a measure of a solvent's ability to clean. Higher values clean more effectively.

The maximum possible KB value, is a solvency power of 140.



The chart shows that **Leksol AL** is similar to Trichloroethylene in solvency cleaning power. **Leksol AL** also has the added benefit that it doesn't have the toxicological problems that are associated with Trichloroethylene and Methylene chloride, making it a safer solvent for cleaning operations.



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LEKSOL AL

SPECIFICATION

PROPERTIES

DESCRIPTION A clear liquid with a characteristic odour, free from foreign matter.

SPECIFICATION

Density	1.30-1.35 g/ml @ 20 Deg C
Acid acceptance value	0.17% NaOH min

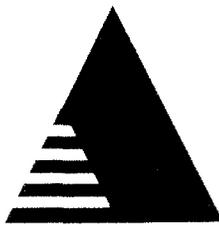
MAXIMUM LEVEL OF IMPURITIES

Residues	< 30 ppm
Water	450 ppm
Alkalinity (as NaOH)	<10 ppm
Acidity (as HCl)	<10 ppm
Stability	passes Aluminium test.

DISTILLATION RANGE

At 760 mm Hg 5-95%	66-72 Deg C
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Special note: This is a specially stabilised vapour-cleaning grade, it is a harmful substance and should be stored in a well-ventilated place.



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PACKAGES

Leksol is compatible with most types of packages but is available in the following standard pack sizes

200 litre HDPE drums net wt 607 lbs.

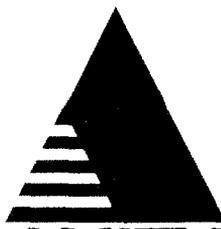
5 gallon pails of 55 lbs.

Leksol can also be supplied in IBC's and bulk tankers

TRANSPORT DETAILS

TRANSPORT REGULATIONS

Product is not regulated for transport



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ATMOSPHERIC LIFETIMES

CFC's general	100 years
111 Trichloroethane	6.5 years
Methylene chloride	6 months
Perchloroethylene	84 days
Trichloroethylene	6 weeks
<u>Leksol</u>	<u>11 days</u>

PHYSICAL PROPERTIES

LEKSOL AL	
Chemical formula	product is stabilised with a performance enhancing package
molecular weight	not applicable
specific gravity	1.32 gms/cc at 25 Deg C
boiling point	69 Deg C
Freezing point	-110 Deg C
Specific heat (cal/Deg C)	0.25
Heat of vaporisation (cal/GM)	57 (102.3 BTU/LB)
vapour density	4.3
vapour pressure	110.8 mm Hg at 20 Deg C
viscosity	0.42 centipoise at 25 Deg C
flash point	None (ASTM D56)
decomposition temp	204.4 Deg C
Auto ignition temperature	490 Deg C
Dielectric strength (ASTM D817-85)	24KV
Refractive index	1.48 at 25 Deg C
KB Value	120
solubility in water	2.4 gms/litre



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LEKSOL AL TOXICITY DATA

PRODUCT	LD50 (RATS) ppm	MEL ppm	CARCINOGENICITY	RISK PHRASE
LEKSOL AL	4260	100 (OEL)	NO	R20
TRICHLOROETHYLENE	2688	100 (UK) 50 (Ger.) 25 (Fra.)	IIIB IIIA (Ger.)	R40 R40
PERCHLOROETHYLENE	2629	50	IIIB	R40
METHYLENE CHLORIDE	1600	100 25(USA)	IIIB	R40

OEL	OCCUPATIONAL EXPOSURE LEVEL
MEL	MAXIMUM EXPOSURE LEVEL
R20	HARMFUL BY INHALATION
R40	POSSIBLE RISK OF IRREVERSIBLE EFFECTS
IIIA	A KNOWN HUMAN CARCINOGEN
IIIB	FOUND TO CAUSE CANCER IN ANIMALS A SUSPECTED HUMAN CARCINOGEN

This table clearly shows that Leksol AL is the safer product.



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LEKSOL AL COMPATIBILITY

METALS

METAL	CORROSION % SOAK TEST	CORROSION % VAPOUR TEST	TEST SAMPLE USED
3003H14 ALUMINIUM	NONE	NONE	PANEL
BERYLLIUM	NONE	TRACE	RIBBON
BORON	NONE	NONE	DISC
NAVAL BRASS	NONE	NONE	PANEL
BRONZE	NONE	NONE	PANEL
CALCIUM	4.9	7.3	DISC
CHROMIUM	NONE	NONE	DISC
COPPER	NONE	NONE	PANEL
INCONEL	NONE	NONE	PANEL
IRON	NONE	NONE	DISC
LEAD	NONE	NONE	DISC
MAGNESIUM	NONE	NONE	RIBBON
MANGANESE	NONE	NONE	DISC
MOLYBDENUM	NONE	NONE	DISC
NICKEL	NONE	NONE	PANEL
COLD ROLLED STEEL	NONE	NONE	PANEL
IRON PHOSPHATED STEEL	NONE	NONE	PANEL
ZINC PHOSPHATED STEEL	NONE	NONE	PANEL
3042B STAINLESS STEEL	NONE	NONE	PANEL
TIN	NONE	NONE	DISC
TITANIUM	NONE	NONE	PANEL
VANADIUM	NONE	NONE	DISC
ZINC	NONE	NONE	DISC
ZIRCONIUM	NONE	NONE	DISC



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GENERAL

LEKSOL AL will remove all the following: -

ALCOHOL'S
CHLORINATED OILS
ESTER OILS
FLUORINATED GREASES
HALOGENATED GREASES
HALOGENATED OILS
HIGH MOLECULAR WEIGHT HYDROCARBON GREASES
KETONES
LOW MOLECULAR WEIGHT HYDROCARBON OILS
MINERAL OILS
MOLYBDENUM DISULPHIDE
PARAFFIN'S
SILICONE GREASES AND LUBRICANTS
SILICONE OILS
SYNTHETIC OILS
TOLUENE



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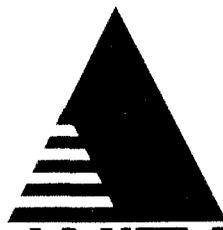
LEKSOL AL

LEKSOL OIL CONTAMINATION

This chart is relevant to Vapour Degreasing applications

Wt. Oil	Specific Gravity (g/ml)	Boiling Temperature Deg F.
5	1.30	162
10	1.28	166
15	1.25	172
20	1.22	177
25	1.19	182
30	1.16	187
35	1.13	193
40	1.10	198

This chart details the relevant boiling temperatures of Leksol and Leksol AL high performance cleaning solutions, when contaminated with oil in general use.



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**CHANGEOVER FROM TRICHLOROETHYLENE TO
LEKSOL AL IN A VAPOUR PHASE DE-GREASER**

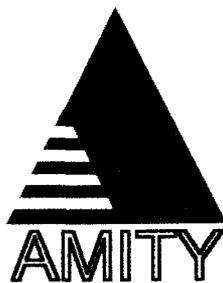
PREPARATION SHEET

1. Distil used Trichloroethylene solvent in the de-greaser by boiling the material in the sump and collecting the distillate in a separate receiver.
2. Turn off the source of heat to the de-greaser and allow cooling.
3. Drain the de-greaser **not forgetting liquid held in the water separator and auxiliary piping**. Sludge removal should be done externally.
4. Ensure the vapour de-greaser is dry and fully ventilated to remove residual solvent.

WARNING: At no time should any operator enter a vapour de-greaser without full protection and proper supervision through the company's health and safety representative.

5. Adjust thermostats as follows: - Bottom 72 Deg C
 Top (safety) 50 Deg C
6. **Neutralise acid concentrations as follows:**
 - (a) Fill the vapour de-greaser with water to a level 4 to 6 inches above the heating surfaces.
 - (b) Add one pound weight of sodium carbonate (soda ash) powder to each 5 gallons of water in the de-greaser.
 - (c) Heat the soda ash solution while circulating water through the condensing coils.
 - (d) Thoroughly wash all internal sides of the vapour de-greaser.
 - (e) Drain; rinse well and thoroughly dry.

You are now ready to add LEKSOL AL and start up.



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RECOVERY PROCEDURE

Leksol AL has the ability to be recovered after use, thus saving the user from much of the expense involved with purchasing more product and disposing of the used product. The following procedure should be used when recovering the product, and reprocessing in order to be able to use it again.

1. The equipment required consists of a large distillation vessel of minimum size 5000litres, fitted with a distillation column (of 5 or more theoretical plates), a condensing system, and a collection vessel. Whilst the Leksol is not flammable the minor components can be so the distillation unit should be flameproof. A blending vessel is then required.
2. The distillation vessel should be filled to its nominal working capacity and heat slowly applied till product starts to distil. There will be some light fractions, which will distil first; these should be disposed of according to local regulations. When the distillate temperature reaches approx. 69 Deg C then the distillate should be collected for reuse. This will be the main component. When most of this has been distilled the temperature will begin to climb again, once it reaches 75 Deg C the distillation should be stopped and any residues remaining should be disposed of according to local regulations.
3. The main fraction should then be measured i.e. no of litres recovered. Depending on the level of initial contamination and breakdown of product, this could be 75-85% of the quantity charged into the distillation vessel.
4. Check the quality of the main fraction by GLC analysis, it should be 98-99%. Also check for free halogen this should be less than 5ppm. And moisture should be less than 300ppm
5. Mix this main fraction with the stabiliser pack in the proportions

500 kilo stabiliser to 5000 kilo of main fraction. The stabiliser pack can be purchased from Amity Ltd. No other stabiliser must be used or Product will not perform correctly

6. *The product is then ready for re-use.*



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Acid Acceptance method

Amity Ltd's vapour degreasing solvent Leksol is stabilised against acid formulation and solvent breakdown by the addition of small amounts of neutral stabilisers, which act as acid acceptors. By adding a known amount of standard hydrochlorination reagent, the amount of stabiliser present can be determined.

Reagents and Apparatus

All reagents must be reagent grade. ACS specification or equivalent

Sodium hydroxide solution, 0.1 N.

Hydrochlorination reagent, use standard 0.1N Hydrochloric acid (as purchased.)

Iso Propanol

Bromophenol blue indicator, 0.04% by wt.

A 10-ml and a 25-ml pipette.

Erlenmeyer flask, glass stoppered 125 ml.

Burette, 50 ml, calibrated to 0.1 ml

Procedure

1. Pipette 10 ml of the solvent sample into a 125-ml glass stoppered Erlenmeyer flask.
2. Pipette 25 ml of the hydrochlorination reagent and 25 ml of isopropanol into the flask.
3. Stopper and shake thoroughly.
4. Allow standing for 10 minutes.
5. Add 5 drops of Bromophenol blue indicator.
6. Titrate to a light purple end-point using 0.1 N sodium hydroxide.
7. Titrate a blank containing only 25-ml of the hydrochlorination reagent plus 25 ml isopropanol.



AMITY LIMITED

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Calculations

Report acid acceptance as weight percent sodium hydroxide.

$$\% \text{ Acid Acceptance} = \frac{(A-B)(40)(N)}{(S)(1.32)}$$

A = NaOH required for blank titration

B = ml NaOH required for sample titration

N = Normality of sodium hydroxide solution

S = Sample volume, in millilitres

Interpretation of results

1. The acid acceptance considered ideal for Leksol is greater than 0.17%, however the acid acceptance would decrease in normal usage.
2. Values of 0.04% to 0.05% for Leksol are considered borderline.

At values less than 0.04% for Leksol, solvent should be discarded or removed from unit, distilled and blended with virgin solvent at a minimum ratio of 4 parts of virgin solvent to 1 part used solvent.



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LEKSOL AL

DETERMINATION OF ATMOSPHERIC CONCENTRATION

The concentration of Leksol (n-Propyl Bromide) in the atmosphere can be determined by using a Draeger tube. *The determination is qualitative rather than quantitative but will act as a good guide.* Methyl Bromide will register in a similar manner to n-Propyl Bromide.

The tube required is the Methyl Bromide tube, code No CH27301

Range is 5ppm to 50ppm

Cost is approx. \$48 per pack of 10.

See instruction information with tube for details of use.

THIS INFORMATION IS GIVEN IN GOOD FAITH, BUT AMITY IS NOT RESPONSIBLE FOR THE TRANSLATION OF THE TESTS THEMSELVES.