Asahi Glass Co., Ltd.

ASAHIKLIN AK-225T

INTRODUCTION

AK-225T is a mixture of AK-225, ethanol, hydrocarbon and stabilizers. This blend was developed for those customers needing a more aggressive defluxer than AK-225AES. It has proven to be effective in preventing the formation of white residues and removing ionic contamination from printed circuit boards and other electronic devices. AK-225T has no flash point. However, since it is a blend, it could become flammable if greater than 15% by weight hydrocarbon concentrates in the boil sump of a degreaser or 20% by weight of the solvent evaporates. It is important to maintain the composition of AK-225T at or below this concentration by routine monitoring of the liquid in the water separator.

PHYSICAL PROPERTIES

Physical properties of AK-225T are shown in the following table.

Table 1. Physical Properties of AK-225T and AK-225AES

	AK-225T	**AK-225AES**
Boiling Point (°C)	54	52
Freezing Point (°C)	-139	-138
Density (g/cm^3, 25°C)	1.34	1.49
Viscosity (cP, 25°C)	0.61	0.61
Surface Tension (dyne/cm, 25°C)	17.6	16.8
Vapor Pressure (mmHg, 37.8°C)	427	405
Latent Heat of Vaporization (cal/g, b.p.)	47.2	40.6
Relative Evaporation Rate (Ether=100)	72	81
Specific Heat (cal/g•°C, 25°C)	0.32	0.27
Solubility of Water (wt%, 25°C)	0.33	0.33
Solubility in Water (wt%, 25°C)	0.062	0.053
Flash Point (°C)	None	None
Flame Limit (vol% in air)	5-10	None
KB Value	63	41
Solubility Parameter	7.3	7.1
Ozone Depletion Potential (CFC-11 = 1.0)	0.03	0.03
Global Warming Potential (CO_2=1.0, 100yr ITH)	370	370

CONTAMINATION LEVEL CONTROL

To maintain effective cleaning in a vapor degreaser, it is important to keep contamination levels in the boil sump below 10% by weight. Contamination is monitored by measuring the specific gravity and boiling point of the solvent. Figures 1 and 2 offer typical specific gravity and boiling point curves which are used to determine when the boil sump should be recharged. When first utilizing AK-225T it is recommended that the boil sump be monitored weekly to insure that is operating within the recommended guidelines. However, workloads vary from user to user and the frequency of monitoring can be shortened or extended based upon individual needs.

As in any solvent system contamination such as flux will accumulate and it is important to maintain the pH of the system above 5. If the pH of the solvent in the water separator falls below 5 then the boil sump should be drained and recharged with fresh solvent.

Table 2. Effect of AK-225T and AK-225 AES on Unstressed Plastics for 5 Minutes at the Boiling Point.

	AK-225T			AK-225 AES		
	Weight Change (%)	Linear Swell (%)	Extractables (%)	Weight Change (%)	Linear Swell (%)	Extractables (%)
Polyvinyl chloride (rigid)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Polyvinyl chloride (plasticized)	2.7	0.6	2.0	2.1	0.4	0.7
Polyethylene (HP)	<0.1	0.1	<0.1	0.1	0.2	<0.1
Polyethylene (LP)	0.5	0.4	<0.1	0.4	0.5	0.1
Polypropylene	0.1	0.1	<0.1	0.1	0.5	0.1
Polystyrene	3.5	0.2	0.1	0.8	0.3	<0.1
Polymethyl methacrylate (Acrylic)	Crack	Crack	Crack	Crack	Crack	Crack
Polycarbonate	0.2	<0.1	<0.1	<0.1	<0.1	<0.1
Polyacetal	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Polyphenylene oxide	0.9	<0.1	0.3	0.1	0.2	0.1
Phenolic	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
ABS	2.4	0.2	<0.1	1.1	0.1	0.1
Nylon 6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nylon 66	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Polyester (FR)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PTFE	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PCTRE	0.1	0.2	<0.1	<0.1	<0.1	<0.1
Epoxy (FR)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Table 3. Effect of AK-225T and AK-225 AES on Unstressed Plastics for 3 Days at the Boiling Point.

	AK-225T			AK-225 AES		
	Weight Change (%)	Linear Swell (%)	Extractables (%)	Weight Change (%)	Linear Swell (%)	Extractables (%)
Polyvinyl chloride (rigid)	0.6	<0.1	<0.1	<0.1	<0.1	0.2
Polyvinyl chloride (plasticized)	Stiffen	&	Deform	Stiffen	&	Deform
Polyethylene (HP)	6.5	1.9	0.1	3.2	0.7	<0.1
Polyethylene (LP)	14.2	4.1	0.3	8.0	1.5	0.1
Polypropylene	10.0	3.4	0.5	10.0	1.9	0.2
Polystyrene	Dissolve	Dissolve	Dissolve	28.6	0.8	0.9
Polymethyl methacrylate (Acrylic)	Dissolve	Dissolve	Dissolve	Dissolve	Dissolve	Dissolve
Polycarbonate	10.5	0.5	<0.1	7.7	0.4	<0.1
Polyacetal	1.3	0.3	<0.1	1.2	0.3	0.2
Polyphenylene oxide	Crack	&	Peel	13.8	0.6	1.9
Phenolic	-0.8	<0.1	<0.1	-0.6	<0.1	<0.1
ABS	118.8	8.7	1.3	73.4	1.4	0.7
Nylon 6	-0.3	<0.1	<0.1	0.1	0.2	<0.1
Nylon 66	-0.3	0.2	<0.1	<0.1	<0.1	<0.1
Polyester (FR)	4.8	<0.1	0.6	3.0	<0.1	0.2
PTFE	1.5	0.8	<0.1	2.2	0.5	0.2
PCTRE	2.7	0.2	<0.1	2.8	0.4	<0.1
Epoxy (FR)	0.2	<0.1	<0.1	<0.1	<0.1	<0.1

Tables 4 and 5 show the effect of AK-225 T and AK-225 AES on elastomers under normal cleaning conditions (5 minutes at the boiling point) and also under extreme conditions (3 days at the boiling point). Gaskets and/or seals used in cleaning equipment should be made of polytetrafluoroethylene, EPDM or chloroprene. Mechanical pump seals in solvent re-circulation pumps should be polytetrafluoroethylene. Seal-less pumps are ideal.

Table 4. Effect of AK-225T and AK-225 AES on Elastomers for 5 Minutes at the Boiling Point.

	AK-225T			AK-225 AES		
	Weight Change (%)	Linear Swell (%)	Extractables (%)	Weight Change (%)	Linear Swell (%)	Extractables (%)
Polysulfide rubber FA (T)	6.8	1.3	1.0	5.5	2.4	1.4
Natural rubber (NR)	4.4	1.1	0.5	2.9	0.9	0.8
Urethane rubber (U)	10.9	1.6	<0.1	10.9	1.6	0.3
Isobutylene isoprene rubber (IIR)	4.2	0.4	1.1	2.0	0.5	1.7
Polychloroprene (CR)	3.3	0.3	0.5	2.1	0.3	0.8
Fluoroelastomer E (FKM)	2.8	0.6	<0.1	5.4	1.6	0.2
Chlorosulfonated polyethylene (CSM)	3.0	0.8	1.8	1.4	0.4	1.8
Silicone rubber (Q)	34.7	8.7	0.3	32.9	9.8	0.5
Nitryl Rubber (NBR)	11.1	1.2	5.7	11.5	2.9	1.6
Ethylene propylene diene terpolymer (EPDM)	5.7	0.6	1.4	2.3	-0.1	1.5

Table 5. Effect of AK-225T and AK-225 AES on Elastomers for 3 Days at the Boiling Point.

	AK-225T			AK-225 AES		
	Weight Change (%)	Linear Swell (%)	Extractables (%)	Weight Change (%)	Linear Swell (%)	Extractables (%)
Polysulfide rubber FA (T)	67.1	14.1	6.2	114.8	24.5	10.4
Natural rubber (NR)	23.5	6.1	2.9	26.4	7.2	4.9
Urethane rubber (U)	105.4	21.4	0.2	170.2	32.3	0.2
Isobutylene isoprene rubber (IIR)	9.2	-0.2	14.4	6.6	-0.4	14.1
Polychloroprene (CR)	21.6	3.8	7.3	26.6	4.1	7.7
Fluoroelastomer E (FKM)	106.3	18.8	2.0	65.6	20.6	1.9
Chlorosulfonated polyethylene (CSM)	1.1	-3.1	17.4	1.4	-2.0	17.3
Silicone rubber (Q)	199.8	41.5	2.2	201.0	31.2	2.0
Nitryl Rubber (NBR)	102.5	21.7	11.4	160.9	31.9	13.4
Ethylene propylene diene terpolymer (EPDM)	9.5	-0.1	14.4	8.2	0.4	14.0

AK-225 is compatible with common metals. Table 6 shows the effect of AK-225T and AK-225 AES on common metals after 7 days exposure at the boiling point.

Table 6. Effect of AK-225T and AK-225 AES on Metals after 7 Days at Boiling Point.

	AK-225T			AK-225 AES		
	Wt Change (mg/dm^2•day)	Cl (ppm)	Corrosion	Wt Change (mg/dm^2•day)	Cl (ppm)	Corrosion
Steel (SPCC-SB)	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Stainless Steel (SS-304)	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Magnesium	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Aluminum	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Zinc	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Silver	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Copper	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Nickel Silver	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Phosphorous bronze	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Brass	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Tin	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Solder	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Tin Plating	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Cadmium Plating	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Nickel Plating	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Nickel-Chrome Plating	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.
Aluminite	N.D.	N.D.	N.A.	N.D.	N.D.	N.A.

Note: N.D. – Not Detectable Detection Limit of Weight Change: <0.1mg/dm^2•day
Detection Limit of Cl Ion: <0.1ppm
N.A. – Not Apparent Detection Method: Visual

COMPOSITION CONTROL

AK-225T is a blend and therefore may experience compositional changes over time due to differential evaporation rates of the components. AK-225T will become flammable if the weight of hydrocarbon in the boil sump exceeds 15% by weight. To insure safe operation of the vapor degreaser samples of the mixture should be taken periodically from the water separator and the specific gravity of the sample measured. Figure 3 indicates the range for safe operation. If the specific gravity falls outside of this range then the boil sump should be drained and recharged with fresh solvent or AK-225AES should be added to bring the composition within recommended operating parameters. Initial monitoring should be done three times a week. Monitoring frequencies may be extended depending on the operating characteristics of individual equipment. Sampling of the solvent for the measurement should be done shortly before the end of the operation or at least three hours from beginning the operation so that the solvent reaches equilibrium.

MEASUREMENT METHOD

Sampling

Samples of the solvent should be taken from the boil sump drain for contamination measurements and from the water separator or distillate for measuring composition. To insure representative samples drains and/or tubing should be purged. After specific gravity measurements are completed, the sample effluent should be returned to the boil sump.

Specific Gravity Measurement

The specific gravity of the sample may be measured with an automatic specific gravity meter with a hydrometer, or by the following calculation:

Specific Gravity = Weight of the solvent (grams) / Volume of the solvent (ml)

Boiling Point Measurement

Measure the temperature of the solvent in the boil sump with a thermometer.

pH Measurement

Put 30g of the solvent and 30g of deionized water with a pH of 7 in a separatory funnel. Shake the funnel vigorously for about 30 seconds. Let the funnel set for a few minutes and decant the water. Measure the pH of the water with a pH meter or litmus paper.

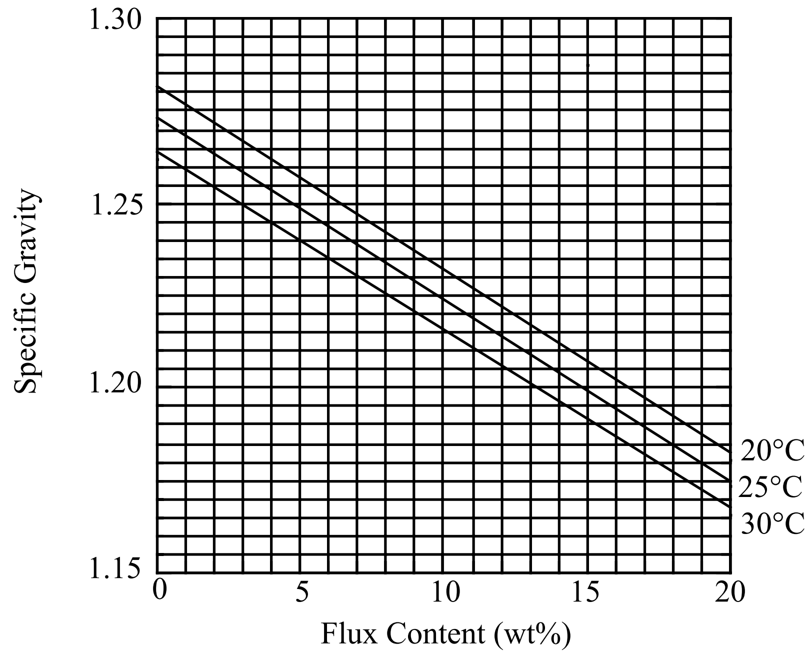

Fig. 1 Relationship between flux content and specific gravity of AK-225T in a boil sump

Flux: Asahi Chemical Research Laboratory Co., Ltd. AGF-200J-3S

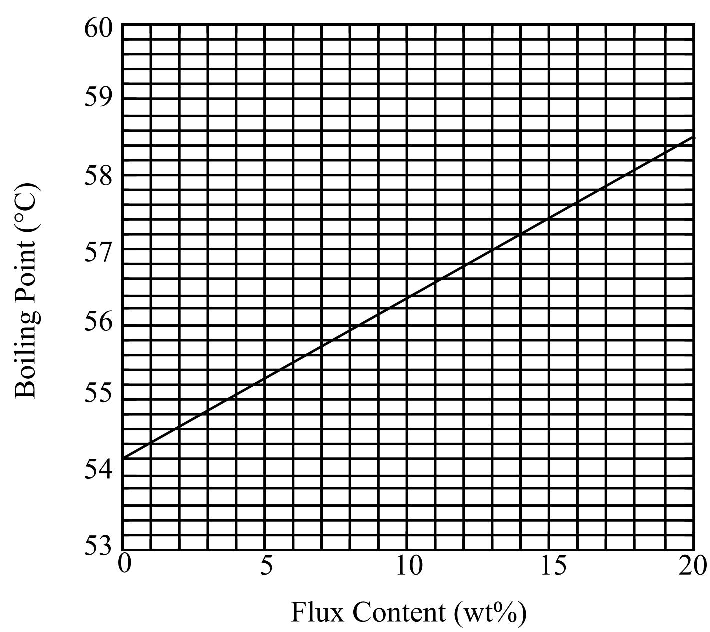

Fig. 2 Relationship between flux content and boiling temperature of AK-225T in a boil sump

Flux: Asahi Chemical Research Laboratory Co., Ltd. AGF-200J-3S

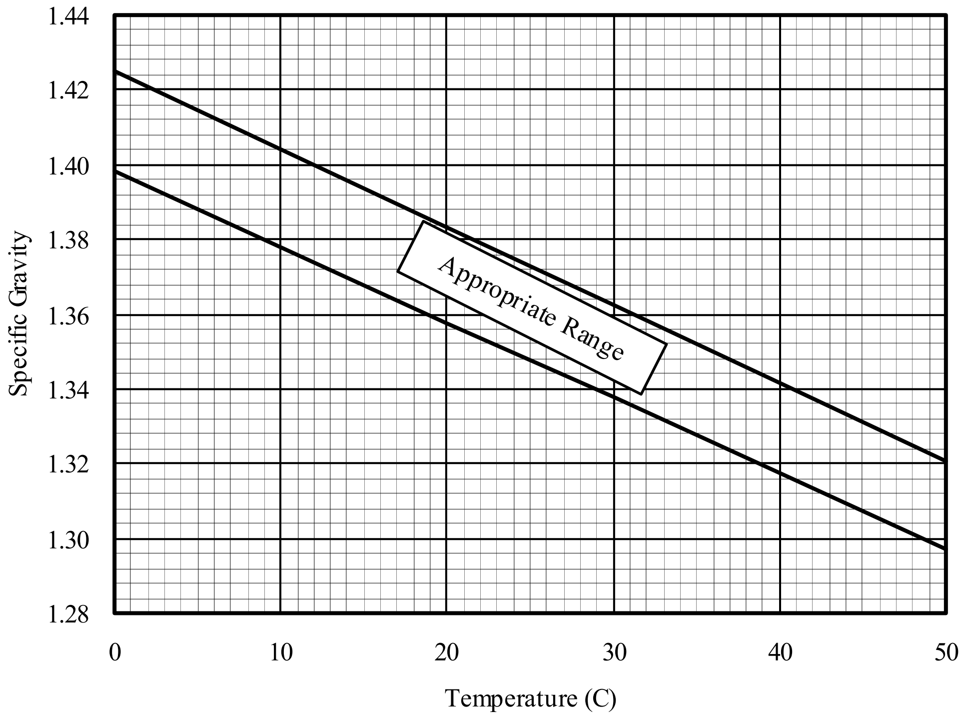

Fig. 3 Relationship between temperature and specific gravity of the solvent in a water separator.

APENDIX: Simulation of Change of Hydrocarbon Concentration in AK-225T

When the solvent composition reaches equilibrium, the relation between the concentration of hydrocarbon in the solvent of the boil sump and that of the water separator is given in Figure 4. The hydrocarbon content in the boil sump tends to increase as indicated in Figure 4. Based on this relationship, changes in hydrocarbon concentration in the boil sump were simulated under the operating conditions listed below. The result is shown in Figure 5. Hydrocarbon content in the boil sump did not exceed 15wt% after one-month operation as shown in Figure 5.

Operating condition: 8hrs/day, 23days/month
Initial charge of solvent: Warm sump 234kg, Rinse sump 163kg, Boil sump 99kg,
Water separator 27kg Total: 500kg

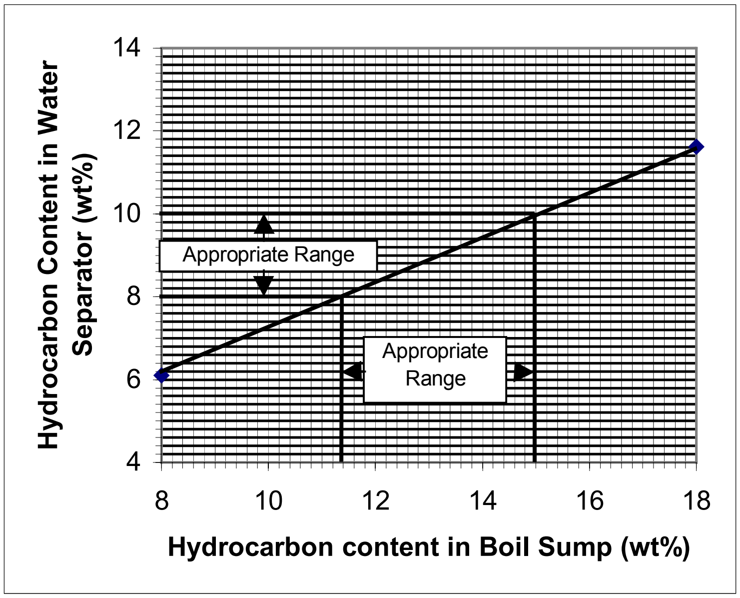

Fig. 4 Relationship between hydrocarbon contents in a boil sump and in a water separator.

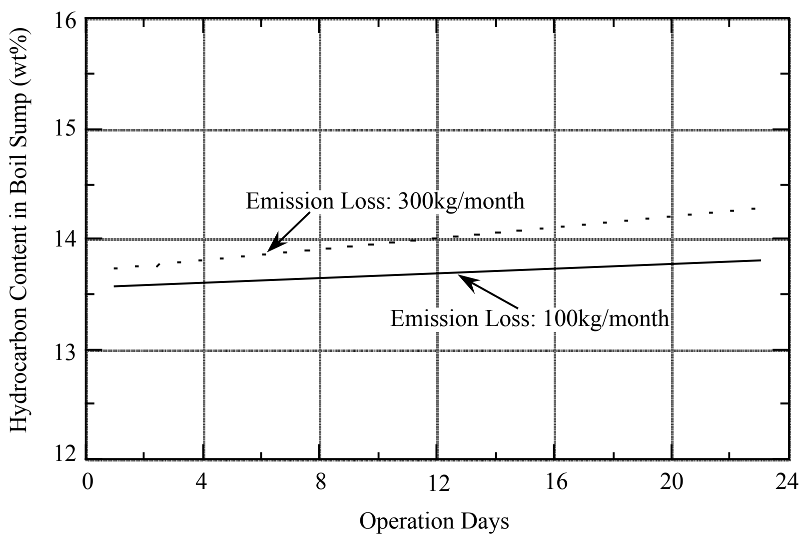

Fig. 5 Simulation result of change of hydrocarbon content in a boil sump