

ELECTRO CLEAN EF

ELECTRO CLEAN EF is a NON-CFC Precision Cleaning Solvent and DROP-IN REPLACEMENT for 1:1:1 Trichloroethane. **ELECTRO CLEAN EF** is an EXCELLENT alternative to discontinued, flammable, combustible and or Chlorinated Solvents, i.e. 1:1:1, CFC-113, MEK, Acetone, Safety Solvent, Oxsol, TCE, methylene chloride and also HCFC's.

ELECTRO CLEAN EF is an EXCELLENT SOLVENT on oils, greases, waxes, resins, epoxies, polymers, rubber, etc.

ELECTRO CLEAN EF is a NON-FLAMMABLE, FAST DRYING, no Residue, no Chlorine - very high solvency alternative to 1:1:1 Trichloroethane and chlorofluorocarbons. Based upon new halogenated hydrocarbon chemistry that has low toxicity and outstanding cleaning power at a lower cost than other alternative solvents.

ELECTRO CLEAN EF does not affect aluminum, magnesium or ferrous metals as well as most plastics and elastomers. Works extremely well in vapor degreasers, ultrasonic cleaners and film cleaning equipment. **ELECTRO CLEAN EF** will work for any application that 1:1:1 has been used for in the past.

*Economical and Efficient Vapor Degreasing with **ELECTRO CLEAN EF** Solvent*

ADVANTAGES

High Solvent Power

ELECTRO CLEAN EF is as strong or stronger than 1:1:1 Trichloroethane and is much stronger than Perchloroethylene. This solvent power enables it to perform effectively to remove all greases, fats, oils, waxes, resins, gums and rosin fluxes generally encountered in any metal working, electronic, precision or film cleaning application.

Inertness to Metals and Plastics

ELECTRO CLEAN EF will clean parts without dulling, corroding, oxidizing or staining more plastics and metals than any other solvent available.

Low Toxicity

ELECTRO CLEAN EF is not a carcinogen such as many other vapor degreasing solvents.

Low Latent Heat

This property assures more of **ELECTRO CLEAN EF** solvent is vaporized per unit of heat input, thereby reducing the cost of vaporizing the solvent.

High Vapor Density

This property of **ELECTRO CLEAN EF** assures ease of solvent vapor recovery and provides effective control of solvent vapor level by means of condensing coils or thermostats. **ELECTRO CLEAN EF's** high vapor density reduces the amount of solvent transfer lost through work transfer and air disturbance of the vapor blanket.

Low Cost

ELECTRO CLEAN EF is low in cost compared to alternative solvents used for similar applications.

Non-flammability

The elevated temperature involved in vapor degreasing require the use of a non-flammable solvent. **ELECTRO CLEAN EF** has no flashpoint when measured by standard laboratory methods.

Low Boiling Point

The low boiling point of **ELECTRO CLEAN EF** makes it an excellent choice for cleaning printed circuit boards, electronic components, electric motors, and other temperature sensitive items.

Wide Range of Applications

ELECTRO CLEAN EF can be used in other applications such as aerosols, coatings, adhesives and cold cleaning where its high solvency and non-flammable properties are important. **ELECTRO CLEAN EF** is an environmentally friendly, new solvent alternative developed for a variety of applications to meet customer requirements.

- * Near “zero” ozone depletion and minimal global warming potential.
- * Chemically stable and nonflammable making it an ideal solvating agent.
- * Performance advantages such as high solubility with alcohols and hydrocarbon.

Physical Property Data

Property	EC EF	1:1:1	TCE	PERC	METH CHLO	AK-225
Bp (°C)	71	74	87	121	40	54
Sp.Gravity, 25°C	1.35	1.32	1.46	1.61	1.33	1.55
Viscosity (cps)	0.49	0.79	0.54	0.84	0.43	0.59
Vapor Pressure, 23°C	110.8	100	57.8	14.2	349	283
Sp. Heat (cal/g/°C)	0.27	0.25	0.22	0.2	0.28	0.24
Latent heat Vap. (cal/g)	58.8	57.5	57.2	49.5	78.7	34.6
Sol. in H2O (ppm wt.)	0.24	0.07	0.11	0.015	0.14	0.033
Sol. for H2O (ppm wt.)	0.05	0.05	0.03	0.0105	0.17	0.031
S. Tension (dynes/cm)	25.9	25.6	26.4	32.2	28.2	16.2
Flash pt. (TCC, °C)	None	None	None	None	None	None
Flammable Units (vol.%)	4-7.8	7-13	8-10.5	None	12-19	None
Hildebrand parameter	18.2	17.4	18.8	19	19.8	NA
KB number	125	124	129	90	136	31
Dielectric constant	8.07	7.24	3.4	2.27	9.08	4.12
Photochemical reactivity (VOC)	Yes*	No	Yes (0.066)	No (0.005)	No (0.008)	No
ODP (CFC-11=1.0)	0.002 - 0.026	0.12	0.005	0.005	0.007	0.03
Atm. lifetime	11 days	5.4 yrs	6-8 days	5-6 months	5-6 months	2.7-7.9 yrs
GWP (100 year, CO2=1.0)	0.31	110	Negligible	Negligible	0.02	370
*App submitted for VOC exmp.						

Cleaning Solvent	Kauti-Butanol Number	Boiling Point, °C
ELECTRO CLEAN EF	125	71
1:1:1 Trichloroethane	124	74
Methylene Chloride	136	40
Bromochloromethane	132	68
Trichloroethylene	129	87
Perchloroethylene	90	121
d-Limonene	68	150
Oxsol 100	64	139
HCFC-141b	56	32
CFC-113	32	48
HCFC-225	31	54
VMS OS-10	17	100

Substance	Boiling Point, °F(°C)	Boiling Temp w/25% Mineral Oil, °F(°C)	Steam Pressure Relief Valve Setting PSI (MPA)	Minimum Acid Acceptance (Wt. % as NaOH)
Methylene Chloride	104 (40)	110 (43)	5 (0.035)	0.03
Methyl Chloroform	165 (74)	175 (79)	15 (0.1)	0.03
Perchloroethylene	250 (121)	260 (127)	60 (0.4)	0.01
Trichloroethylene	188 (87)	195 (91)	15 (0.1)	0.03
Trichlorotrifluoroethane	118 (48)	125 (53)	5 (0.035)	N/A
**ELECTRO CLEAN EF	160 (71)	163 (73)	15 (0.1)	0.04

Certain vapor degreasing operations are subject to the requirements of the National Emission Standards for Halogenated Solvent Cleaning (Halogenated Solvent Cleaner NESHAP) as found in 40CFR Part 63, Subpart T. The determination of the applicability of these, or any other state or local requirements is the responsibility of the user. No employee should be exposed to any of the solvents utilized in vapor degreasing operations in excess of either the OSHA Permissible Exposure Limits (PEL), the ACGIH Threshold Limit Value (TLV), or any Manufacturer's Recommended Exposure Limit (MREL).

****ELECTRO CLEAN EF is TOTALLY EXEMPT from ALL NESHAP Regulations.**

METALS & NON-METALS COMPATABILITY

	CORROSION% SOAK TEST (1)	CORROSION% VAPOR TEST (2)	TEST SAMPLE (3)
3003H14 ALUMINUM	NONE	NONE	PANEL
BERYLLIUM	NONE	TRACE	RIBBON
BORON	NONE	NONE	DISC
NAVAL BRASS	NONE	NONE	PANEL
BRONZE	NONE	NONE	PANEL
CALCIUM	4.90	7.30	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	TRACE	DISC
MOLYBDENUM	NONE	NONE	DISC
NICKEL	NONE	NONE	PANEL
1010 COLD ROLLED STEEL	NONE	NONE	PANEL
1010 IRON PHOSPHATED STEEL	NONE	NONE	PANEL
1010 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

PLASTICS COMPATIBILITY

COMPATIBLE

ACETA (DELTRIN)
CHLORINATED PVC
EPOXY
FLUOROETHYLPROPYLENE
HIGH DENSITY POLYETHYLENE
IONOMER RESIN
METHYLMETHACRYLATE
NYLON (POLYAMIDE)
POLYAMIDE
POLYESTER (MYLAR)
POLYETHER ETHER KETONE (ARLON)
POLYETHERIMIDE (ULTEM)
POLYETHYLENE TEREPHTHALATE
POLYIMIDE
POLYOXYMETHYLENE
POLYPPHENYLENE SULFIDE (RYTON)
POLYPROPYLENE
POLYTETRAFLUOROETHYLENE
PVC (RIGID PIPE COMPOUND)
POLYVINYLIDENE FLUORIDE (KYNAR)
VINYLESTER COMPOSITE

NON-COMPATIBLE

ABS
ACRYLIC
CELLULOSE ACETATE
POLYCARBONATE (LEXAN)
POLYETHYLENE TEREPHTHALATE GLYCOL MODIFIED
POLYSTYRENE
POLYVINYL CHLORIDE CLEAR
MOULDING COMPOUND

ELASTOMER COMPATIBILITY

COMPATIBLE

BUTADIENE NITRILE
BUTADIENE STYRENE
BUTYL
CHLOROSULFONATE POLYETHYLENE
EPICHLOROHYDRIN 956
ETHYLENE PROPYLENE
FLUOROELASTOMER (VITON A, B)
PERFLUOROELASTOMER (CHEMRAZ)
POLYETHER URETHANE
POLYSULFIDE
VINYL-METHYL SILOXANE

NON COMPATIBLE

ACRYLONITRILE-BUTADIENE (BUNAN)
ETHYLENE-PROPYLENE (TERPOLYMER)
ISOBUTYLENE-ISOPRENE (BUTYL)
NATURAL RUBBER
POLYCHLOROPRENE (NEOPRENE)
POLYSILOXANE (SILICONE)
POLYURETHANE

NON-HYDROCARBON SOIL REMOVAL CAPABILITY

Grams of non-hydrocarbons per 100 grams of ELECTRO CLEAN EF

Water	Slight
Silicone Oils	90
Salts	Insoluble
Inorganics	Insoluble
Sodium Hydroxide	Insoluble
Sulfuric Acid	Insoluble

HYDROCARBON SOIL REMOVAL CAPABILITY

Grams of non-hydrocarbons per 100 grams of ELECTRO CLEAN EF

Mineral Oils	100
Metal Working Fluids (Synthetic)	85
Paraffinic Wax	100
Chlorinated Oils	100
Ester Based Oils	100
Synthetic Hydrocarbon Oil (naphthenic)	100

Alcohols (methanol, acetone, etc.)	100
Ketons (mek, acetone, etc.)	100
Aromatic Hydrocarbons (toluene, benzene, etc.)	100
Rosin Flux	100

OTHER OILS AND GREASES

Low Molecular Weight Hydrocarbons (oils)	Will Remove
Hight Molecular Weight Hydrocarbons (greases)	Will Remove
Molybdenum Disulfide	Will Remove
Silicone Greases/Lubricants	Will Remove
Fluorinated Oils	Will Not Remove
Fluorinated Greases	Will Not Remove
Chlorinated Oils	Will Remove
Chlorinated Greases	Will Remove
Graphite	Will Remove

ECONOMICS OF ELECTRO CLEAN EF USE

ENERGY

Considerable energy is consumed to bring a solvent to its boiling point. **ELECTRO CLEAN EF** has a boiling point similar to 1,1,1 Trichloroethane but lower than solvents like Trichloroethylene and Perchloroethylene. **ELECTRO CLEAN EF** requires approximately the same energy to bring it to a boil as 1,1,1 Trichloroethane. Heat loss by radiation from the degreaser, which is dependent upon solvent boiling point is taken into account in this comparison. The higher kwh values are for an uninsulated degreaser, the lower value (in parentheses) are for a degreaser with two inches of insulation.

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

Comparison of hourly energy requirements

ELECTRO CLEAN EF	13.8 kwh (7.6) kwh
1:1:1 Trichloroethylene	14.0 kwh (9.1) kwh
Trichloroethylene	16.3 kwh (10.1) kwh
Perchloroethylene	20.8 kwh (11.5) kwh

ELECTRO CLEAN EF uses the least amount of energy compared to the chlorinated solvents.

CONSUMPTION

Solvent consumption and energy requirements, as well as the price of the solvent, are the major economic considerations to be taken into account when choosing a solvent for use in vapor degreasing applications. The consumption rates for solvents are affected by such factors as cleaning cycle, workload, and the type of materials being cleaned. Vapor loss also varies from solvent to solvent. Consumption of **ELECTRO CLEAN EF** is approximately 7 percent less than 1:1:1 trichloroethane. In comparison to the other chlorinated solvents a much larger difference in consumption is realized. Less vapor loss from the degreaser results in lower cost and less exposure to the degreaser operator.

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

	lbs/sq.ft/hr	8 hr. TLV (avg.ppm)
ELECTRO CLEAN EF	0.132	100*
1,1,1 Trichloroethylene	0.142	350
Trichloroethylene	0.201	50
Perchloroethylene	0.293	25

*Workplace exposure limit.