



The lead-free ELSOLD alloys are particularly suitable as replacement for conventional lead-bearing alloys having been used up to now for wave and dip soldering. Due to the purity of the raw materials used the impurity levels of the finished products are much lower than the limits admitted by the relevant norms. This leads to a longer useful life of the solder bath and to a marked reduction in the dross formation.

Due to their special manufacturing process ELSOLD lead-free solder alloys substantially reduce solder defects like bridges and icicles when compared to competitive products. This results in less rework and thus leads to a higher productivity in the printed circuit board assembly

### ■ Alloys

ELSOLD standard lead-free alloys are available in 3 groups:

#### Tin Silver Alloys: ELSOLD TS

Trade Name	Sn %	Ag %	Density g/cm <sup>3</sup>	Melting Point / Range °C
ELSOLD TS35	96,5±0,5	3,5±0,2	7,35	221
ELSOLD TS38	96,2±0,5	3,8±0,2	7,36	221 - 238
ELSOLD TS50	95,0±0,5	5,0±0,2	7,39	221 - 240

#### Tin Copper Alloys: ELSOLD TC

Handelsname	Sn %	Cu %	Density g/cm <sup>3</sup>	Melting Point / Range °C
ELSOLD TC07	99,3±0,5	0,7±0,2	7,32	227
ELSOLD TC30	97,0±0,5	2,8 - 3,0	7,35	230 - 250

#### Tin Silver Copper Alloys: ELSOLD TSC

Handelsname	Sn %	Ag %	Cu %	Density g/cm <sup>3</sup>	Melting Point / Range °C
ELSOLD TSC3005	96,5±0,5	2,8 - 3,0	0,5±0,2	7,37	217 - 219
ELSOLD TSC3507	95,8±0,5	3,5±0,2	0,7±0,2	7,40	217 - 219
ELSOLD TSC3807	95,5±0,5	3,8±0,2	0,7±0,2	7,40	217

· Other lead-free alloys on special request.

· The alloys meet the requirements of norm (DIN EN) ISO 9453 , respectively the internal ELSOLD work norms, if not included in official norms.

· The real impurity levels are much lower than the limits allowed by (DIN EN) ISO 9453. For typical values please refer to the table on page 2. 

### ■ Available Forms and Shapes:

Description	Dimensions mm	Weight / Unit kg
Ingots with suspension eyelets	50 (W) x 18 (H) x 600 (L)	Approx. 3,4
	50 (W) x 20 (H) x 490 (L)	Approx. 3,2
Triangular bars	8 (W) x 10 (H) x 400 (L)	Approx. 0,160
Clippings	8 (W) x 10 (H) x 30 (L)	Bulk
1-kg Bars	20 ( W) x 20 (H) x 335 (L)	Approx. 1,0

### ■ Impurities of Lead-free Solder Alloys

Element	Maximum per DIN EN 61190-1-3 (%)	Typical level as supplied by ELSOLD (%)	Level recommended for replenishing or replacement (%)	Critical Level (%)	Comments
<b>Sn</b>	Nominal Content ± 0,5%	Nominal Content	- / -	- / -	
<b>Ag</b>	Nominal content ± 0,2 or 0,05 for Ag-free alloys	Nominal content or 0,05 for Ag-free alloys	- / -	- / -	Silver does not affect the characteristics of the solder up to approximately 2%. Beyond this level the solder surface becomes grainy and rougher.
<b>Cu</b>	Nominal content ± 0,2 or 0,05 for Cu-free alloys	Nominal content, or 0,006 for Cu-free alloys	0,9	1,1	Cu leaching from the board surfaces and component leads increases the copper concentration. Replenishing with SnAg or Sn99.9 is recommended over 0,9%. Some processes may run with higher Cu concentrations, however, at higher temperatures.
<b>Pb</b>	0,1	0,05	0,1	0,1	RoHS Limit is 0,1%. Soldering problems (formation of low-melting PbBi phases) should not normally occur under 0,3% lead content.
<b>Zn</b>	0,001	0,0008	0,002	0,004	Zinc is generally accepted as cause of bridges and icicles. From 0,004% up grainy appearance and – in the worst case – a reduction of mechanical stability can occur.
<b>Cd</b>	0,002	0,0002	0,003	0,005	Cd causes bridges and icicles.
<b>Sb</b>	0,1	0,015	0,1	0,2	Possibly negative effect on spreading of solder.
<b>As</b>	0,03	0,005	0,03	0,06	Arsenic can have a negative impact on wettability from approximately 0,03% up.
<b>Fe</b>	0,02	0,003	0,03	0,04	Grainy appearance of the solder surface is possible from Fe concentrations of 0,03% and more.
<b>Bi</b>	0,1	0,004	0,2	0,4	In low concentration levels Bi has a positive influence on the solderability and fatigue behaviour. In the transition phase to lead-free alloys, however, care has to be taken since even small concentrations in the solder may lead to low-melting phases.
<b>Al</b>	0,001	0,0002	0,002	0,005	Even small concentrations can increase the dross formation.
<b>Ni</b>	0,01	0,001	0,05	0,1	High concentrations can increase the dross formation. Low concentrations help to achieve finer grain structure and slow down copper dissolution.
<b>In</b>	0,1	0,004	- / -	- / -	Negative effects are not known.
<b>Au</b>	0,05	0,0005	0,08	0,1	The solder viscosity increases from gold concentrations of 0,1% and higher. The solder joints become dull.

### ■ Application

Due to the low density of the lead-free alloys they show a different behaviour when the boards leave the wave. Relevant changes to the angle (approximately 2° more) have to be made.

Depending on the exact alloy used the recommended operation temperature should be adjusted between 250 and 275 °C

To reduce dross formation, especially for those processes run in normal atmosphere, we recommend to use deoxidation tablets made from Sn99P1. These tablets provide an optimum surface tension of the solder bath and further reduce the formation of icicles.

ELSOLD offers a whole range of efficient ELFLUX fluxes for the optimisation of your soldering process. For details please review the relevant product data sheet.

### ■ Shelf Live

The material can be stored practically without limitation if kept in a clean and dry place in a moderate climate.

### ■ Marking

ELSOLD lead-free bars are marked with the ELSOLD Smiley in order to avoid mixing with lead-bearing material.



### ■ Service

In order to facilitate the change-over of your soldering process to lead-free technology ELSOLD offers you to analyse your solder samples. Normally you will have the results within 48 hrs from receipt of your sample.

We will also take care of the correct disposal of your unusable solder material and will credit you the remaining value after deducting the disposal and handling cost. A minimum quantity of 250 kgs should be collected before shipping it to ELSOLD. Your contact at ELSOLD will gladly consult you.

### ■ Safety and Health

Please consult the material safety data sheet for details.