APPLICATION NOTE
Tin-Lead Solder Pot Adjustment

Introduction

In the electronics industry today, many companies are using lead-free solder alloys. However, there are a few sectors in the industry that prefer the reliability and longevity of tin-lead alloys. Although Indium Corporation has a large array of tin-lead alloys, customers occassionally ask how to adjust their solder pot to get the desired tin-lead percentages. Fortunately, solder pots can still be adjusted to get the desired tin-lead percentages.

There are three ways to change the composition of the solder pot:

1. **Empty the current solder pot and start with a fresh alloy that has the desired tin-lead constituents.** However, this is not advised for the following reasons:
   - Costs associated with downtime, labor, and materials
   - Safety concerns with emptying a solder pot (the fewer times the pot is cleaned, the less risk of injury)
   - It is unnecessary
2. The **Additive Method** uses pure tin or lead to increase the amount of tin or lead needed for solder in the pot.

   Before starting, here is what you need to know:

   - Weight of the solder currently in the pot
   - Percentage of tin and lead currently in the system
   - Percentage of tin and lead that is wanted in the system

   Example 2a: **Additive Method (when Sn% increases)**

Given:	100lbs of an alloy
Starting alloy:	60Sn/40Pb (60lbs Sn, 40lbs Pb)
Ending alloy:	63Sn/37Pb (63lbs Sn, 37lbs Pb)

$$\frac{60\text{lbs Sn} + X\text{lbs Sn}}{100\text{ lbs alloy} + X\text{lbs Sn}} = \frac{0.63\text{lbs Sn}}{\text{lb alloy}}$$

$$60 + X = 63 + 0.63X$$

$$0.37X = 3$$

X = 8.108lbs of Sn
that needs to be added to the pot

   Example 2b: **Additive Method (when Sn% decreases)**

Given:	100lbs of an alloy
Starting alloy:	60Sn/40Pb (60lbs Sn, 40lbs Pb)
Ending alloy:	63Sn/37Pb (63lbs Sn, 37lbs Pb)

$$\frac{37\text{lbs Pb} + X\text{lbs Pb}}{100\text{lbs alloy} + X\text{lbs Pb}} = \frac{0.40\text{lbs Pb}}{\text{lb alloy}}$$

$$37 + X = 40 + 0.40X$$

$$0.6X = 3$$

X = 5lbs of Pb
that needs to be added to the pot

3. The **Subtractive Method** requires that you remove some alloy from the pot and replace it with either 100%Sn or 100%Pb. When some of the alloy is removed, you also remove some of the material that you want, therefore the calculation is different from the previous method.

   Here is what you need to know:

   - Weight of the solder currently in the pot
   - Percentage of tin and lead currently in the system
   - Percentage of tin and lead that is wanted in the system

   Example 3a: **Subtractive Method (when Sn% increases)**

Given:	100lbs of an alloy
Starting alloy:	60Sn/40Pb (60lbs Sn, 40lbs Pb)
Ending alloy:	63Sn/37Pb (63lbs Sn, 37lbs Pb)

The first step is to figure out how much Pb needs to be removed by figuring out how much Pb you want in the pot and subtracting that from the amount of Pb that is currently in the pot:

Current amount of Pb:
→ 40Pb x 100 lbs = 40lbs

Desired amount of Pb:
→ 37Pb x 100lbs = 40lbs

∴ 40lbs - 37lbs = 3lbs Pb
that needs to be removed

The second step is to figure out how much of the alloy is contained in of 3lbs of Pb:

$$3\text{lbs Pb} \times \frac{1\text{lb alloy}}{0.4\text{lb Pb}} = 7.5\text{lbs alloy}$$

This shows that in 7.5lbs of alloy there are 3lbs of lead. Next, you need to remove 7.5lbs of alloy and replace it with 7.5lbs of pure tin to get the desired 63Sn/37Pb alloy.

From One Engineer To Another®

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Example 3b: **Subtractive Method** (when Sn% decreases)

Given:	100lbs of an alloy
Starting alloy:	63Sn/37Pb (63lbs Sn, 37lbs Pb)
Ending alloy:	60Sn/40Pb (60lbs Sn, 40lbs Pb)

The first step is to figure out how much Pb needs to be removed by figuring out how much Pb you want in the pot and subtracting that from the amount of Pb that is currently in the pot:

Current amount of Sn:
→ 63Sn x 100 lbs = 63lbs

Desired amount of Sn:
→ 60Sn x 100lbs = 60lbs

∴ 63lbs - 60lbs = 3lbs Sn that needs to be removed

The second step is to figure out how much of the alloy is contained in of 3 lbs of Sn:

$$3\text{lbs Sn} \times \frac{1\text{lb alloy}}{0.63\text{lb Pb}} = 4.76\text{lbs alloy}$$

This shows that in 4.76 lbs of alloy there are 3 lbs of tin. Next, you need to remove 4.76 lbs of alloy and replace it with 4.76lbs of pure lead to get the desired 63Sn/37Pb alloy.

Unfortunately, the Additive and Subtractive Methods can be inconvenient if you have to calculate percentages other than the ones shown here. This is why a calculator was created in Microsoft Excel that does all the work for you. All you need to do is input the current percentage of tin, the desired percentage of tin, and the weight of the alloy in the pot, and it will calculate how much tin or lead you need to add to or remove from the system to achieve the final alloy.

Please feel free to contact us at askus@indium.com and we will email the calculator to you. Or you can use this link: https://www.indium.com/technical-documents/process-optimizations-calculators-and-guides/solder-pot-calculator/

Contact our engineers: **askus@indium.com**
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