The Los Angeles Silhouette Club

Babbitt!!

Tin based Babbitt, Lead based Babbitt - Copper, good or bad?

By: Felix Robbins/Felix

On many of the cast sites, we'll encounter discussions about Babbitt metal and casting boolits. Mr. Babbitt was an inventor of various non-ferrous mixtures containing lead, tin, antimony, arsenic, and copper, principally for bearing applications. These alloys have been termed Babbitt metal in the literature for many years. Babbitt metal has been used extensively within the marine, railway, and large electrical generator industries in particular. And, now are being used for boolit material augmentation as well!

Boolit casters are, by second nature, scroungers of lead appearing metals. Babbitt can be encountered in scrap yards, and in obscure places not yet classified as a scrap pile. I was recently at a scrap yard and asked if they had any Babbitt, and received the "deer in the headlights" look from the young attendant. He had no idea what I was talking about. Babbitt is currently in use as it was seen recently for sale on the McMaster-Carr catalog website.

Babbitt appears to the naked eye as lead. Many times Babbitt is encountered in a glob form because some enterprising soul has melted scraps down for a scrap sale. Babbitt occasionally can be found as straight from the foundry in new bar form. These bars are typically branded in a way, which helps us to decipher the composition. Without identifying marks, the metal should be considered as junk lead of unknown composition.

Babbitt has been used to cast boolits successfully. In fact, I once melted down a batch of mystery metal to make water quenched Lyman 429360s for use in a Model 29 Smith and Wesson in .44 Magnum. When attempting to size these in an old Ideal #45 sizer lubricator, I almost broke the linkage and had to call upon a friend's SAECO to finish the job. Even when using the SAECO machine the sizing process was hard and prompted the question from the owner, "What in hell are these made from? I bet that is Babbitt." However, Babbitt metal should not be used in pure form for making boolits for this reason and others indicated further below.

All Babbitt's are not created equal. The table below lists only some of the more common Babbitt compositions. Industrially speaking, the tin based Babbitt's are used for high speed, low weight bearing applications. The lead based Babbitt's are formulated for low speed, heavy rotating weight systems. Their compositions also vary considerably because of the casting requirements for the various applications vary wildly. In addition, the charts below do not list lead based Babbitt's with copper, and tin based Babbitt's with arsenic. These compositions are just as plentiful as those shown below, but perhaps not as common. Many formulations are custom made.

Tin Based Alloys - Chemical Composition (%) Chart

INDUSTRY NAME	ASTM B23	Sn (Tin)	Sb (Antimony)	Cu (Copper)	Pb (Lead)
Marine 11 D	-	90.0 - 92.0	4.5 - 5.5	3.5 - 4.5	0.35 (Max)
No. 1	Grade 1	90.0 - 92.0	4.0 - 5.0	4.0 - 5.0	0.35 (Max)
Marine 11R	-	89.0 - 89.5	7.5 - 8.5	2.5 - 3.0	0.35 (Max)
Nickel Genuine	Grade 2	88.0 - 90.0	7.0 - 8.0	3.0 - 4.0	0.35 (Max)
Marine 11	-	88.0 - 90.0	5.5 - 6.0	5.0 - 5.5	0.35 (Max)
4X Royal Nickel Genuine	-	87.5 - 89.5	7.25 - 7.75	3.25 - 3.75	0.35 (Max)
Diesel Special	-	87.5 - 88.0	6.5 - 7.0	5.0 - 6.0	0.35 (Max)
No. 11	Grade 11	86.0 - 89.0	6.0 - 7.5	5.0 - 6.5	0.35 (Max)
SAE 11	-	85.0 - 87.0	7.0 - 8.0	6.0 - 7.0	0.35 (Max)
Imperial Genuine	-	85.0 - 87.0	6.5 - 7.5	6.5 - 7.5	0.35 (Max)
Turbine	-	84.0 - 86.0	6.5 - 7.5	7.5 - 8.5	0.35 (Max)
Royal Armature	-	83.5 - 84.0	8.0 - 8.5	7.5 - 8.5	0.35 (Max)
Super Tough	Grade 3	83.0 - 85.0	7.5 - 8.5	7.5 - 8.5	0.35 (Max)
Maximum Allowable Impurities: Fe=0.08, As=0.10, Bi=0.08, Zn=0.005, Al=0.005, Cd=0.05					

Lead Based Alloys - Chemical Composition (%) Chart

INDUSTRY NAME	ASTM B23	Sn (Tin)	Sb (Antimony)	Pb (Lead)	As (Arsenic)
No. 13	Grade 13	5.5 - 6.5	9.5 - 10.5	Balance	0.25 (Max)
Mill Anchor	-	4.0 - 6.0	11.5 - 12.5	Balance	0.25 (Max)
Durite	Grade 15	0.8 - 1.2	14.5 - 17.5	Balance	0.8 - 1.4
Star	-	5.0 - 5.5	13.5 - 14.5	Balance	0.30 - 0.60
Silverstone	-	1.0 - 3.0	17.5 - 18.5	Balance	0.25 (Max)
Royal	Grade 8	4.5 - 5.5	14.0 - 16.0	Balance	0.30 - 0.60
Heavy Pressure	Grade 7	9.3 - 10.7	14.0 - 16.0	Balance	0.30 - 0.60
Special Sawguide	-	9.0 - 11.0	18.5 - 19.5	Balance	0.25 (Max)
Maximum Allowable Impurities: Cu=0.50, Fe=0.10, Bi=0.10, Zn=0.005, Al=0.005, Cd=0.05					

The majority of foundry marked bars are specially fluxed and cooled under strict temperature controls for a particular industrial application requirement. Re-melting foundry bars into smaller bars or boolits is a chancy undertaking at best for homogeneity sake. Besides, lead based Babbitt typically contains too much antimony for accurately shooting boolits; and, tin based Babbitt has too much tin to make boolits cost effective. Any Babbitt flavor can possibly have too much copper to cast any kind of boolit using home equipment, and/or too much arsenic to be safe while being in the melted state at home. Whenever the smell of garlic is noticed at ANY time, that hot pot contains far too much arsenic. This composition MUST be cut with another lead mix known not to contain arsenic until there is no further smell in the mix being currently made. We are talking about a 100 percent dilution minimum, and possibly a repeat dilution or two to force the smell down to zero. On the other hand, too much copper in the mix is not dangerous, but makes the physical act of casting almost impossible due to extremely rapid cooling of the liquid edges into a gummy solid. This feature can be checked in advance by pouring the mix back and forth between wide containers (cookie trays) before making boolits. If sheeting is noticed, then the mix should be diluted in 25 percent increments until the sheeting effect is no longer obvious.

Why mess with Babbitt?

The main reason we use Babbitt is that they contain useful goodies for augmenting a known shooting boolit mix which is not right for the job being contemplated. The tin in Babbitt is worth its weight in gold for making a boolit flow exactly into the mold pattern. Antimony and arsenic are excellent hardeners for our boolit material. The amount of tin, antimony and arsenic that we get from wheel weight alloy has gradually decreased over the years, making it imperative to find alternate sources when a particular boolit style demands attention. It is extremely difficult and/or dangerous to introduce elemental antimony, copper, and arsenic into our pots, but luckily we have various Babbitt alloys already made up with these elements for our immediate use. We just have to play Sherlock Holmes when a bar or two of something appealing appears.

Some casters are serious seekers of high-speed applications. In my experiences, the top speed that can be achieved with linotype metal and wheel weight alloy is about 2400 feet per second in the .223 Remington. Faster boolits must be extra tough so they will not glide over the rifling. This is where the copper content of Babbitt comes into play. I recently alloyed some of my .223 boolits with lead based Babbitt containing copper and shot the same boolits at 2600 feet per second with good accuracy and no leading. The copper content in the mix is the “toughener” of choice, whereas the antimony is the “hardener” of choice.

Pitfalls in casting using Babbitt.

As I mentioned earlier, there are some pitfalls in using Babbitt alloy. The first is identifying the content of the alloy that you have. If it’s in bar form and marked, you’re in good shape. If it’s in home made ingots, you’re taking chances, but it still could be very worthwhile. If the ingots are dull and gray, you possibly have a lead based alloy, if they’re shiny looking they might be tin based. All newly formed

Babbitt are at least somewhat shiny, and therefore somewhat questionable as to what they are.

The real truth is that hardly any of us know what the stuff is that we melt. To "know" is possible, as there are metallurgical tests that can be performed on a particular batch of casting metal but normally, the cost is beyond the budgets of most of us casters who are frugal souls to start with and unless it's a huge amount of the same batch of metal, it's not worth the expense of having it analyzed.

The next problem is to see how it melts. This is preferably done in something other than a bottom pour pot, because when there is any amount of copper, you'll have a clogged pot around the nipple that will really enhance your vocabulary. Use the suggested sheeting test as described earlier before putting any "final" mix containing Babbitt into the casting pot.

Another of the main pitfalls of using Babbitt is the lack of repeatability of the final formula. If the boolits cast good and shoots good, I'm happy. Just be aware of this and process your metal in batches as big as you can, label the ingots and don't mix them.

Once you've identified a Babbitt alloy as useable and decided it's either lead or tin based, you're ready to make use of it.

Using Babbitt.

The two types of Babbitt, lead based or tin based, can usually be identified by weight after alloyed into something common like wheel weights or pure lead. Use a pistol boolit mould of 150-200 gr. Cast several that look good enough to shoot using each alloy, one with the common metal alone, and the other mixed with the Babbitt alloyed in. Weigh the boolits from each mix and calculate their averages. If the boolits from the Babbitt mix average lighter, then the Babbitt is tin based. Conversely, heavier boolits, or about the same weight, but never less, would indicate a lead based Babbitt.

If this test indicates a tin based Babbitt, then you can safely consider this Babbitt as a tin enhancer substance by adding the amount of Babbitt as would be required for adding 100 percent tin.

When you add it to a pot and stir, start looking for lumps rising to the surface. These are compounds carrying copper and possibly other impurities unknown, and might give you fits if you try to cast with the mix. There is a way to deal with that, too.

Lower your pot temperature to 650 using a thermometer (one of the Lyman manuals suggests 621 degrees), and for the next 10-12 minutes resist all temptations to stir, flux, or otherwise disturb the mix. After at least that amount of time passes, carefully skim the surface (the copper will still be suspended there as inter-metallic compounds). After this has been accomplished, adjust the temperature back up to your normal casting temperature and start casting. This

procedure is called “freezing out” the copper content, and can be used instead of dilution to lower the amount of copper in the pot.
Some Babbitt’s have the added benefit of arsenic which will aid in water quenching or heat-treating of your finished boolits if you’re so inclined.

If you have lead based Babbitt, this makes a good additive for wheel weight alloy or even pure lead alloy to make it harder and also to make it cast better. I’d add 10% or so of lead based alloy to pure lead or 5% to wheel weight alloy if you like hard boolits. I like my boolit for the most part soft so I’ll tend to make softer alloys than most people.

Always take the Babbitt and introduce it into the melt a bit at a time, by using an ingot of it dipped into the melt until I get the amount of metal off the bar that I want in the mix. Do not drop a whole ingot in, even if we know the analysis of the Babbitt. I’d let this mix set a bit and see what happens in the way of stuff rising to the top. Recommended is a ¼ to ½ pound of Babbitt to a 20 pound pot for starters. Then cast a couple of boolits and see if all is okay. Once you have the alloy you desire, cast the boolits, and drain the pot into ingots marking them as to alloy for the next time you want this special mix.

Is Babbitt worth messing with?

Many of us will say NO due to the problems we’ve discussed. I’d say a good 99% of us would elect to go through the process because we are frugal and wish to use any lead appearing alloy, at least for giggles and shouts.

I’d go through the process for the tin content, and I’d also go through it for the copper content. Little boolits shot fast need all of the reinforcement they can get.

Hopefully, this article will make you more familiar with Babbitt and the problems and benefits you encounter in using it.

If casting boolits were easy, everyone would be doing it. I’m just glad that there are a few hardy souls out there that need the challenge of “show me”.

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