# The Transition to No-Lead Brass

**Adjustments to feeds and speeds, coolant, tooling and scrap management all play a significant role in allowing a productive switch to unleaded brass.**

By Chris Felix

To improve machinability, brass is commonly alloyed with lead, allowing for better chip control and longer tool life. Recent environmental legislation, however, is further restricting the use of lead, particularly in the areas of food, drinking water and sanitation. With lead content removed or significantly reduced from materials such as brass, shops face new challenges for keeping productivity up and costs down.

Here's a look at some considerations for the transition to unleaded brass from a few different perspectives, including views from a shop, a metalworking fluids supplier and a cutting tool manufacturer.

## David Parker, CEO, Metric Machining Inc., Ontario, California


While we've done a few no-lead jobs, it's not something we've pushed strongly yet from a sales and marketing standpoint. But we're prepared for it, and our engineering department is experienced with it. The state of California and California EPA are driving the change to no-lead, particularly in food and water applications. While we used to do a fair amount of plumbing work, it's a much smaller percentage for us now. Much of that work is produced in Asia, but if shops there are not prepared, we could see those jobs come back.

We do about a million and a half dollars in agricultural work. I foresee California, at some point, enforcing the lead ban on a lot of that work as well because of the irrigation systems that bring the water to the produce, which then retains that water.

We're fortunate that we're a large company and have extra capacity. We've scaled several locations down to one, so with the extra equipment, we have been able to commit sufficient assets to strictly no-lead brass. We have a dedicated brass chip spinning system as well as a manual, single spinner that we do our aluminum and stainless and everything else in. But we have a secondary spinner and separate scrap bins that we've painted a different color to identify them specifically for no-lead brass. We make sure to never put our no-lead brass into our main spinner and contaminate our 360 alloy brass.

As far as machinability, we've worked with an advisor from our board as well as our materials suppliers who have helped our engineers gain valuable knowledge about what is required to effectively process no-lead brass. It's given them a jump start so we know we can handle it.

As a job shop, we need to understand that our cycle times are going to change as we move to no-lead, as will tooling wear. We need to account for that when quoting. It's not just that it's more expensive brass; costs also increase in relation to cycle times and cutting tools. The most important thing is to be educated up front on understanding the cutting speeds and properly quoting the jobs accordingly.

The back preparation is far less complicated. It's easy enough to clean out a machine and run no-lead on it. For us, with the extra equipment, it's easy for us to keep our chips separate. Other shops may need to take extra steps to keep scrap separate. So due diligence as far as the material handling at the back end is important for getting a shop's brass scrap value back. You could have an entire bin of 360 brass chips, and if someone throws even a handful of no-lead or low-lead brass in there, the entire container is then deemed as contaminated.

Photo Credit: Concast Metal Products Co.

**Joseph Gentile, Product Manager,**
**Hangsterfer's Laboratories Inc., Mantua, New Jersey**

Lead-free brass definitely wears tools out at a much higher rate than leaded brass, as the lead improves the cutting performance. But tool life can be improved with better coolant. In many cases, lead-free brass will create almost the same wear rate on the tools as lead-free steel. What would be considered an effective brass oil or coolant doesn't typically work well in the switch to lead-free.

We've shown that putting in a vegetable oil in such applications can substantially increase tool life. Yes, the price of the oil will increase, perhaps even double, but the cost of carbide or some of the other tools that are being used up more quickly without it can be far more significant. It might take a little time to realize the savings, but after a job runs for a couple of weeks, a shop might already have spent as much on tooling as it would have, had it purchased the better oil.

Most shops tend to buy the oil that works best with the lower end materials that they're cutting, then make other adjustments, whether in tooling or feeds and speeds, to compensate for differences in other materials that they run. Perhaps they even push to get more of the free machining work because they know it can be done at a lower cost. But even if only a smaller percentage of their work is lead-free, improving their cutting oil can still improve most of their operations across the board. It's obvious where that comes into play with the lead-free, but if they reevaluate their speeds and feeds on the other work, they can maximize the performance value for that work as well. When they're doing 300- or 400-piece runs or longer, depending on the complexity of the part, the savings can easily justify the time studies required. It's all relative to the material that is being used and the extent of the tool wear.

As shops run more and more lead-free materials, whether brass or steel, they need to start looking more closely at non-traditional oils. They don't necessarily have to jump all the way up to vegetables if they're running slower feeds and speeds or using older equipment. Partial vegetable/partial mineral-based oils may be sufficient. But an appropriate lubricant is necessary to get the most from high-end equipment and tooling.

Many shops are still desperately trying to figure out a way to run lead-free brass the same way they run the leaded. If they're running slower machines, the differences aren't as apparent. But when they eventually come around to making the significant change that is necessary, in equipment, tooling and coolant, they see that the better technology makes up for what they are losing in lubricity without the lead.

Although the cost of these oils is higher, with the right maintenance, the cost can be contained. With a good chip spinning system and a filtration system in place, the higher level oils can last so much longer than the others.

## Scrap Segregation is Key in Brass Materials

By Miles Free, Director Industry Research and Technology, PMPA

Free machining brass materials rely on the presence and absence of certain chemical ingredients to facilitate machining. The same ingredients that make unleaded free machining brasses free machining also happen to be detrimental to the production of leaded free machining brasses. Therefore, maintaining material identity and tight controls on segregating the different grades of scrap in your shop are important for ensuring that the scrap materials that a shop generates will be bought back for the highest dollar.

**Unleaded brass to leaded brass: Silicon contamination could disqualify the material.** Silicon is a key ingredient in C69300 brass rod for machining and in C87850 alloy for brass castings. It ranges typically from 2.7 to 3.4 weight percent in these alloys. In leaded brass C36000, a maximum of 0.007 weight percent of silicon will be accepted by the mills. The silicon in the C69300 brass is almost 500 times the acceptable limit of the C36000 grade. Even a single chip of the C69300 brass in a sample taken for analysis could disqualify the material for remelting.

**Leaded brass to unleaded brass: Lead content could disqualify the material.** In leaded brass (grades C36000, C37700, C34500, C35000, C35300), the lead content ranges from a low of 0.8 to a high of 3.0 weight percent. The scrap acceptance specification for unleaded brass scrap at the mill allows a maximum of 0.09 weight percent. In the lowest lead content grade, C35000, the lead content ranges from 8.8 to 22 times the maximum allowable lead content. In C36000 the lead content ranges from 2.5 to 3.0 5, or 28 to 33 times the maximum allowable. If leaded chips are mixed in with unleaded chips, the material will not be acceptable for remelting.

**Iron and brass don't mix.** Imagine that your tool is freely plowing through a soft, leaded brass material, and suddenly it encounters a steel chip firmly embedded in the material. Not a pleasant thought, is it? As segregating unleaded and leaded chips from each other is needed, it is critical to ensure that no iron or steel chips make their way into any brass scrap stream. Two tenths of a percent (0.20 percent by weight) maximum

### Ken Hamming, Sales Engineer, Horn USA Inc., Franklin, Tennessee

One of the biggest challenges I see with shops that run predominately leaded brass is the mindset shift to unleaded brass. Unleaded brass reacts differently to tooling compared with the leaded version, so the process will need to be adjusted accordingly.

Shops that cut a mix of materials may find the transition from leaded to unleaded brass easier than those who do not have the diversity in materials they cut. Unleaded brass is much more abrasive than leaded, so adjustments will need to be made in tooling and cutting parameters. Surface footage and feeds can be optimized to minimize the impact of unleaded brass to cycle time because surface footage is generally lower on unleaded, yet higher feeds can help to minimize the impact to cycle time. Shops using high speed steel tooling should look at carbide, and for those already using carbide, this is a good opportunity to evaluate their current substrate, coating and geometry. As materials evolve, so does the tooling that is offered. Manufacturers should challenge their cutting tool suppliers to help them with the transition.

Communication is also the key to successfully transitioning to unleaded brass. It is important for all aspects of the manufacturing process to understand the differences in leaded and unleaded brass machining. Sales, purchasing, engineering, manufacturing, and even quality need to understand the differences in order to make a successful and profitable transition. PM is the limit for free iron in unleaded brass scrap accepted by the mills. On leaded brass, the acceptable limit is 0.50 percent. A handful of steel chips in a truckload of brass scrap could result in a shipment being rejected. A magnetic separation test is run on every incoming batch, so separate streams for ferrous (steel and stainless steel) and brass materials should be maintained in the shop.

**Aluminum is unwelcome.** Free aluminum and aluminum alloys are also held to the 0.20 percent maximum limit for both leaded and unleaded brass scrap returns.

**Scrap segregation saves money.** On many jobs, the revenue for the job is booked after the scrap from the job has been sold back to the mill. A high volume of material is "not used" to produce the parts. Assuring the recovery of the full value of the unused brass scrap materials will require segregation of materials to avoid cross contamination and rejection, while ensuring materials are free of excess moisture and oil. Failure to tend to these simple steps of material control can cost a company money needlessly. Keep scrap streams separate. It's money in the bank.

*For more information from Hangsterfer's Laboratories Inc., call 856-468-0216 or visit hangsterfers.com.*

*For more information from Horn USA Inc., call 615-771-4100 or visit hornusa.com.*

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