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Starts.....

Free-machining brass:

A Closed Environmental Loop

Introduction

This is a particularly close look at the ease and thoroughness with which free-machining brass is recycled and reused. Recycling is essential to the economics of brass manufacturing and is very closely linked to the metal's positive relationship with environmental stewardship.

Background

Brass has been known of for at least two thousand years and, because of its very favourable properties, is still one of today's most useful alloys. There are over sixty types of brasses in everyday use today, all containing copper and zinc with the latter ranging from about 5% to 40% of the alloy's composition by weight. In addition to copper and zinc, brasses may contain small quantities of other metals including aluminium, tin, manganese, iron, nickel and lead to impart a range of mechanical and physical properties. Brasses are produced in all common product forms. As sheet and strip they are used in applications as diverse as architectural cladding and lamp sockets, computer keyboards and jewellery. Foundries cast brasses for such familiar products as bath and basin taps and architectural hardware, plus a large variety of marine and industrial equipment.



Propane tank valve adapters machined from free-machining brass

In terms of total metal consumed in the UK and elsewhere in the world, the most widely used brasses are those made in the form of extruded rods, bars and special shapes, which are machined into finished products. Paramount among these brasses is an alloy containing roughly 58% copper, 3% lead and about 39% zinc, which is commonly called free-machining brass. Engineers and machinists also know the metal by its official designation, BS EN CW614N (CZ121). Approximately 70,000 tonnes of brasses of all types are consumed in the UK each year, of which about half are the free-machining types. Annual world-wide consumption is several million tonnes.

Why ‘free-machining’?

Free-machining refers to CW614N’s high *machinability*. Machinability is a catch-all term that describes such important features as the ease with which a metal can be turned, milled, drilled or otherwise cut, the length of time cutting tools remain sharp and the quality of the metal’s machined surfaces. No other metal or alloy – and certainly none in its strength class – can be machined faster, longer or more consistently than free-machining brass. Tests have shown that CW614N can be machined up to five times faster than steel under conditions where both metals maintain the same cutting tool life.

Environmental questions

Free-machining brass achieves its high machinability primarily from the few percent of lead contained in the alloy. The lead is distributed in microscopic globules throughout the metal. In that form, the lead helps break up machining swarf, keeping it from curling up and interfering with high-speed operations. At the same time, lead provides a helpful lubricating action to the cutting tool. Many free-machining alloys, including steels, contain lead for this reason.

The presence of lead often raises questions regarding a product’s possible effects on the environment and health. One common question regarding lead-containing materials such as free-machining brass is the possibility that discarded objects and scrap containing the metal will end up in landfills. Is this likely? Fortunately - for everyone’s sake, including brass producers and fabricators, as well as users of brass products - the answer to this question is a very definite NO.



Small fragmented machining swarf literally flies away from the cutting tool during high-speed machining of free-machining brass

Brass is almost never intentionally discarded. Firstly, it's simply too valuable. Even in the form of scrap, it can command up to three quarters of the price of new metal, so every bit of scrap brass that can be acquired is quickly recycled to make new metal. Secondly, brass itself is almost entirely made from recycled metals. So, rather than contributing to environmental problems, the production and use of brass *removes* no-longer-used metals from circulation.

Consider car radiators, the kind made from copper and brass. Today, most new cars are equipped with aluminium radiators; however, contrary to popular belief, copper and brass still account for about two-thirds, by weight, of all radiator material currently in use. When old cars are scrapped, their copper/brass radiators can be removed and collected by scrap dealers to prepare the metal for reuse.

Once stripped of any plastic components, the recycled radiators contain only copper, zinc, tin and lead (the tin and lead are in the solder that holds the radiators together). Lead-free copper and brass radiators have recently been introduced but, until they find wide acceptance among car makers, conventional copper and brass radiators will continue to be a valuable source of raw materials for the manufacture of brass and other copper alloys.



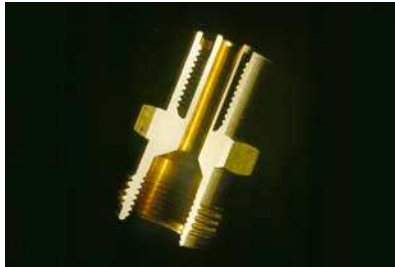
Cuprobraze® copper and brass truck radiator

Scrapped radiators are normally converted to ingots for use in foundries, which use the metal to make cast brasses and bronzes. Other types of scrap brass, such as stampings, brass wire and cartridge cases may eventually reappear as wrought brasses i.e. cold rolled

strip extruded bar or cold drawn wire. Free-machining brass represents a special situation, like other brasses, it is made almost entirely from scrap, but the scrap used in this case is usually in the form of discarded brass articles plus bare bright copper such as recycled electrical wire and plumbing tube from demolished buildings. Pure new zinc is usually added to make up to the required specification. The most important ingredient of free-machining brass, however, is used free-machining brass in the form of machine-shop swarf.

Turnings that keep returning

When a machine shop manufactures a part from free-machining brass (or any other metal, for that matter), it isn't unusual for the weight of swarf produced to outweigh the finished-machined product. The hose fitting shown below illustrates the point very well. In this case, more than 65% of the brass rod used to make the fitting was machined away.



*Cutaway view of a machined brass hose fitting.
Note how much metal has been removed*

The brass swarf produced by machine shops is never thrown away. Instead, it is collected, cleaned and sent back to a brass mill to make more brass rod. Swarf is so valuable that a machine shop will often buy its brass with the value of the returned swarf already calculated into the price of the new brass rod. It's a very efficient and economical closed cycle. The 'scrap' brass never really leaves the loop; it just keeps getting re-used again and again.

The recycling of brass scrap represents a very large business. Each year nearly 15,000 tonnes of swarf, such as those shown below is generated, picked up and delivered back to brass mills, where it is inspected, cleaned again and chemically analysed before being remelted to make new brass.



Free-machining brass swarf being collected at a typical machine shop

Is it worth the trouble to handle all that scrap? Absolutely, and everyone wins in the process. The machine shop owner wins because the brass he or she recycles reduces the shop's net cost of raw material. The recycling company wins because it profits from the transfer. The brass mill wins because it is assured of a steady supply of raw material of a known and fixed composition, one that generally needs very little adjusting in the furnace to reproduce the original product. Finally, the environment wins - along with the rest of us – because virtually none of the 70,000 tonnes of brass used in the UK each year finds its way to a landfill.

Think about that the next time that you pick up a machined brass product. So far as the environment is concerned, the part of the product you don't see – the recycled machining swarf – is just as important as the part in your hand.

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