Brasses – Rolled Products

(B Mason & Sons Ltd)

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B Mason & Sons Ltd. Founded in 1852 in Aston, Birmingham, and transferred to the present site in the early 1900's.
Initially only Brass was produced but in the period 1960 to 1980, with the introduction of continuous casting, Phosphor Bronze alloys and Nickel Silver alloys were introduced.
In 1987 the company was purchased by Wieland-Werke AG in Germany.
The production of Brass at Mason is no longer from continuously cast strip although this method of production is widely used throughout the world.
Currently Brass is bought in from one of our sister companies in Germany and is then rolled to finished sizes.

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Brasses are Copper based alloys in which the major alloying element is Zinc. There are a wide range of alloys covered by the term Brass, but the most popular have a Copper content in the range 58-95%.

The high Copper alloys are usually known as Gilding metals and can be extensively deformed at room temperature, making them most suitable for the manufacture of components by pressing,spinning and other cold forming processes. The material is usually supplied in the soft condition but cold worked material may be used when a higher tensile strength is required.

The alloys known as Brasses normally contain 70% or less of Copper. The Brasses have a very wide variety of uses and the exact alloy chosen depends upon the physical and mechanical properties required for its end use.

When Lead is added as an alloying element the alloys are known as Leaded Brasses and are characterised by their excellent machinability.

Specifications laid down in standards are for general engineering use and therefore the end user should co-operate with the supplier to define the exact properties required for a particular product. Some of these properties may not be defined in standards and and the supplier must be capable of producing material exactly as specified by the end user.

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1. Brass alloys are produced by melting Copper and Zinc in the appropriate proportions according to the alloy required. Whilst the ideal would be to melt copper and zinc, in reality a large portion of the charge is brass scrap. Casting is usually semi-continuous slab or continuously cast strip.

   Semi-continuously cast slabs are typically 1000mm wide x 5000mm long and 150 mm thick and are initially hot rolled to approx.. 10/20mm before annealing and further cold rolling takes place.

   Strip is normally cast at 15/20 mm thick and 400/800mm wide and is then cold rolled with intermediate annealing.

2. In the cold rolling process the thickness of the strip is reduced in successive passes with reductions of 70/80% being common during the intermediate rolling stages. This is followed by annealing (softening) to allow further rolling to take place. The final reduction given will depend upon the mechanical properties required in the finished strip and also on the alloy being rolled.

3. Brass is often supplied in the “soft” condition or in the “deep drawing quality” condition. The “soft” condition is achieved by final annealing , whereas “deep drawing quality” is dependent not only on the final annealing but also on the control of intermediate and final reductions.

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The casting department has four twin-strand horizontal casting machines manufactured by Metatherm.
<u>Melting Furnaces</u>
Four twin channel Ajax-Magnethermic electrical induction furnaces of 650 kW with a capacity of 4 tonnes each.
<u>Holding Furnaces</u>
Four single channel Metatherm furnaces of 160 kW each, with inclined inductors.
<u>Casting Machines</u>
Four twin-strand Metatherm extraction and withdrawal machines with coilers.

The cast coils are 3 to 4 tonnes in weight depending on the alloy being cast, and production rates per machine are between 1000 1300 kgs/hr.
Strip size 400 x 14 mm.

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Milling is the next step after casting and is necessary so that the oxidized surface from casting is removed.
The milling line consists of two multi-bladed cutters, one milling the top surface and one milling the bottom surface. The millings are sucked away from the machine and collected in a container to be returned to the casting department for re-melting.

Initial cold rolling is performed on a Four-high rolling mill to reduce the milled strip from approx.. 13.5mm to 2.0 mm, depending upon the alloy being rolled.

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When metal is rolled it hardens and after a certain amount of deformation it is necessary to “anneal” to enable the metal to undergo further rolling.

The annealing is normally performed in “Bell” furnaces or in “Strand” furnaces. The difference in the two types of annealing is that Bell annealing is a batch operation in which several coils are annealed together, whereas Strand annealing is continuous annealing of one coil at a time.

Typical loads for a batch furnace at Mason is 20 tonnes.
Strand annealing throughput can vary between 1.5 and 2.5 tonnes per hour depending upon strip thickness and alloy.

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Typical rolling mills used for the production of Brass or other non-ferrous alloys are of a “4-high” configuration, which means that there are two “work” rolls and two larger “back-up” rolls. This configuration enables large reductions to be achieved and, with associated thickness control equipment, close tolerances are possible.

The mill shown is capable of taking strip at 5.5mm thick and rolling to a minimum thickness of 0.3mm at speeds of up to 800 m/min depending upon alloy and thickness.

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The finished strip at 300/400mm wide is normally required to be slit to customer requirements, which can be from 5mm to 320mm wide.

Our Fröhling slitting line handles coils up to 4 tonnes in weight and 400 mm wide and has automatic loading and unloading facilities. Varying diameter re-coil drums ensure that customer specifications for inside coil diameters can be met. The maximum operating speed is 400 m/min.

We are at the moment commissioning our new state of the art slitting line which will enable us to achieve even better shearing tolerances.

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The packing of slit coils is a very important part of the service provided and until recently was semi-automatic. With the opening of our new production facility the packing line is now fully automatic. The packed coils are weighed and then placed on a pallet, which is then wrapped in polythene for protection. All of these operations are carried out automatically.

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The Brasses have good electrical and thermal conductivity which are superior to ferrous and Nickel based alloys.
Exposure of Brasses to the outdoor atmosphere results in the development of a superficial tarnish film which ultimately forms a thin protective green patina.
In the softened condition the alloys are ductile and strong and their strength increases with cold working, whilst still retaining good ductility.
This strength is retained up to about 200^{o}C.
When lead is present it has a lubricating effect that gives low friction and wear properties, which makes it suitable for the manufacture of gears and pinions in clocks.
Because of its unique combination of properties it is very suitable for cold forming.
The alloys are fairly easy to machine but the addition of small amounts of Lead further improves this property. “Free Machining Brass” sets the standard by which other alloys are judged.
Joining of brasses to copper alloys and steel is easily achieved by soldering and brazing.
Plating of all types is possible.
When struck brasses do not spark and are therefore approved for use in hazardous environments.
The colour changes with Zinc content from the gold hue of Gilding metals to the stronger yellow colour of 70/70 Brass.
Cost-effective: Close tolerances can be achieved, tooling costs may be lower, ease of machining reduces production costs, Brasses normally have a long service life and therefore the cost of service failures are reduced to a minimum.

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CuZN10

This alloy can be easily deformed and has a lower rate of work hardening during pressing which may make it more suitable than other alloys for some applications.
The gold colour is used to advantage in the production of costume jewellery and architectural work.
The alloy is easily brazed or enamelled.(for jewellery)

CuZn30

Often known as Cartridge Brass because of its extensive use for the production of ammunition. It has the optimum combination of strength and ductility and can produce deep drawn pressings in complicated shapes. Use is made of its good electrical and thermal properties in the production of electrical equipment. The alloy also has excellent spring properties and is used for springs and contacts in electrical applications.

CuZN37

This alloy is not quite as ductile as the other alloys, although other properties are similar. It can be easily cut and formed and is adequate for simple cold presswork not involving deep drawing.
Soldering and welding are easily performed.

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The graph illustrates the effect of cold working on the Tensile Strength and 0.2% Proof Stress. With increasing cold reduction the hardness increases and so do the tensile strength and proof stress. In the soft condition (70 VPN) the tensile strength is approx.. 380 N/mm^2 whilst in the extra hard condition (190 VPN) it is approx.. 620 N/mm^2.
Even at the higher tensile strengths there is still reasonable ductility, as shown in the next slide.

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The elongation, which is a measure of ductility, falls with increasing cold deformation and increase in tensile strength but it is still about 5% at 620 N/mm^2 (190 VPN).
In the intermediate hardness ranges normally used for spring and contact manufacture (120 - 160 VPN) an elongation of 18/35% can be expected according to the hardness specified. This allows bending and limited pressing to be performed even in this hardness range.

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CuZn10

Architectural - This alloy is used in the manufacture of window fittings,weatherstrip,and ornamental pressings and trim.
Decorative - Typical examples of the use of this alloy are cosmetic compacts and lipstick cases, costume jewellery, emblems, and as a base material for vitreous enamel.
Hardware - Marine hardware and zip fasteners.
Munitions - Primer caps.

CuZn30

Chemical - When arsenic is added to this alloy it can be used for heat exchangers,and fire extinguisher bodies.
Electrical - Lamp caps, lampholder components, switch plates, ceiling rose fittings.
Hardware - Door knobs, door handles, eyelets, hinges and locks, and finger plates.
Mechanical - Deep-drawn and spun components such as cartridge cases,musical instruments, and automobile radiator tanks. General pressings include torch cases, and reflectors.

CuZn37

Electrical - Lamp caps, lamp holders, and switch components.
Hardware - Chain, eyelets, fasteners, locks, hinges, kicking plates, and fingerplates
Mechanical - General presswork products such as instrument covers and containers, automobile radiator tanks, torch cases and reflectors.