Brass Strip

(William West (Birmingham) Ltd)

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William West is a family business, that has been established on its present site since 1924, though its origins can be traced back to St Paul's Rolling Mills circa the late 19^{th} century. Employing 55 people, the company produces brass, copper and phosphor bronze strip. Strip is produced either by rolling down thicker strip which is made on site by a process of melting and semi-continuous casting, or by rolling down bought in strip. Finished strip sizes range from 4mm to0.20mm thick and from 3mm to 325mm wide. The company also produces copper and brass round wire and sections.

Approximately 700 customers are served, with orders ranging from a few kilos to 5 tonnes. The company prides itself on being able to offer good quality strip with short lead times. An efficient stock system of the most commonly required alloys and sizes supports this objective and improves manufacturing efficiency.

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Brass is an alloy of copper and zinc. There are a series of brasses with varying copper to zinc ratios. William West roll alloys with the following ratios of Copper (Cu) to Zinc(Zn):- 90/10, 85/15, 80/20, 70/30, 66/34 and 63/37. Because these alloys contain only two elements, it is possible to recycle brass with ease, by melting scrap and making suitable additions of copper or zinc. The company recycles around 1,700 tonnes of brass scrap each year.

The current Standard covering brass alloys is BS EN 1652 : 1998. From its title it can be seen that it is both a British (BS) and European (EN) standard. It replaced existing national standards throughout Europe and in the UK rendered BS2870 : 1980 obsolete. The major change was that physical properties previously were specified only by hardness range and these can now be specified by tensile strength and elongation (R numbers), by hardness (H numbers), or by hardness and grain size (GO numbers). This can be seen from the specification for 70/30 which is described as CuZn30 in the new standard. The range of properties should be regarded as approximate guides, rather than a limited number of physical property options.

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Brass scrap is melted in 2 electric induction furnaces. When the charge is molten a sample is cast to check for impurities and to determine any adjustment necessary to the copper/zinc ratio. When the molten charge is within specification it can be transferred to the holding furnace from which it is drawn through a water-cooled graphite die at 15mm thick by 334mm wide, at about 175mm per minute. This is coiled up and the strip is cut, when the cast coil reaches a weight of 1350KGs.

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This yields a coil of approximately 1200KG for further processing.

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This rolling mill consists of a pair of 12 inch (305mm) work rolls supported by a pair of 24 inch (610mm) backing rolls to restrain the bending of the work rolls under the 500 tonne rolling load. This configuration of rolls is termed 4 Hi. During cold rolling, the thickness (gauge) of the strip is reduced, the width remains the same, the strip grows correspondingly longer and it becomes harder. The amount of reduction carried out is expressed as percentage strip at this stage, has limited physical properties, due to the cast dendritic structure and only a limited amount of cold rolling is possible before the metal is annealed. Typically a reduction of between 26% and 40% is applied depending on the alloy being rolled. Annealing softens the structure and new cells (grains) are formed within the metal. This first anneal is carried out at a relatively high temperature (625 degrees Celsius) with a 7 hour soak, to allow some chemical homogenisation. A further 50% is undertaken following this anneal.

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When the strip has been reduced to about 4mm and is annealed again. Following this anneal, the metal is passed through a bath containing dilute sulphuric acid to remove surface oxides developed during annealing

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When our customers order brass they specify the weight, alloy, gauge, width and temper. Temper is usually expressed as a range of Vickers Hardness (HV) or a range of tensile strength in N/mm2. For example 1000Kg, 63/37 brass (CuZn37) 0.85mm thick 105mm wide with a hardness range of 110 to 135 HV is ordered. To achieve this hardness range we need to work harden the strip by cold rolling. Cold rolled brass when examined under the microscope reveals a mass of distorted grains, elongated in the direction of rolling. These distorted grains become harder the more they are deformed, thus offering an increasing resistance to further deformation. The mechanical properties can therefore be accurately controlled to comply with any relevant specification, by controlling the amount of cold deformation during rolling. To achieve the properties required in the example, an ROA of 15% is required. This can be achieved by rolling 1mm soft (1 – 0.85) /1 x 100. Thus we have established what is known in the trade as the 'ready size'. In other words the gauge at which the final anneal takes place. This order can now be satisfied by rolling 4mm base to 1mm on an 8" 4 Hi mill, annealing, pickling and rolling to 0.85mm. Three cuts of 105mm would now be taken through a shearing machine. Having started from a coil of approximately 1200 KT, 334mm wide the theoretical weight of the 3 coils produced will be (105 x 3)/ 334 x 1200 = 1132 KG. In practice there will be some loss due to the discard of ends throughout the process and the final weight will probably be of the order of 1080 KG and fall within the general delivery tolerance of +/- 10%.

The properties of the above example allow for a very wide range of application and is often described as half hard common brass. Simple blanking, forming and bending operations can be performed to produce a part with a greater rigidity than would have been achieved starting from the soft condition.

For deep drawn vessels, soft deep drawing quality (DDQ) is required. The alloy with the best properties is soft (less than 80 HV) 70/30 brass with an average grain size of less than 0.030mm. DDQ further requires that the ductility of the metal should be the same in all directions. If heavy reductions (say 75% ROA) are used in rolling before the final anneal, the new crystals formed will line up within the metal and allow preferential deformation in certain directions to take place in the annealed metal. This leads to a defect known as earring in the deep drawn component and results in four high spots which at best require trimming and may result in total failure. This can be avoided by minimising the ROA between anneals during the rolling of the strip to 50% ROA. Control of grain size is also important. The metal has to be heated to a temperature that allows recrystallization to occur but it is important that the metal does not stay at this temperature for longer than is necessary since the new grains formed continue to grow until the temperature is reduced. In practice large batches of brass (3 to 4 tonnes) are annealed and practical combinations of temperature and time to allow the load to achieve a uniform temperature within the specific furnaces at our disposal,achieve the desired results. A typical product of this brass is the cartridge cases used in the ammunition ranging from rifle bullets to large shells. It was the army that discovered the pitfall of stress corrosion cracking when rifle cartridges split in service causing death and serious injuries to the soldiers using them in India. The cause was identified as the combination of residual stresses in the brass and a mildly corrosive environment. A temperature of 200 degrees Celsius will stress relieve brass and avoid this problem.

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There was a time when plastic and aluminium alloys were fashionable for door handles and window catches and stays. It is pleasing to see that good quality new buildings are utilising brass to enhance the quality of interiors. Brass strip is used for window stays and the parts associated with them, on doors, the hinges, finger plates, fore plates of locks and some internal lock parts. In this application a pleasing polished surface finish is important. The strip is often polished and polycoated and the components formed with this protection in place. Brass is sometimes given a protective clear lacquer to protect it from tarnishing and obviate the need to polish it.

The higher copper brasses 90/10 and 85/15 are often referred to as gilding metal. They are the favoured alloys for gold plating since their colour is similar to that of gold and blends in well when some of the gold plate wears off. Most people will be familiar with medals, medallions and regalia utilising extensive quantities of gilding metal in its natural state, enamelled and plated.

Brass has a long association with coinage. The old expression" where there's muck there's brass, infers that brass has value. At the time, the brass coin was the old brass three penny piece being more valuable than a penny (copper) and less valuable than the silver coins. Today, brass has been promoted to £1 and £2 coins.

The above represents only a few examples of the wide range of uses of our brass strip that finishes up in motor car components, light fittings, picture frames, electrical and electronic equipment etc.