The Manufacture of Semi Finished Brass Rod for Forging & Machining Applications

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Description

This process and plant described is intended to produce semi-finished brass rods and sections at an net output rate of up to around 150 tonnes per month, using either virgin metals or scrap brass feedstock.

The plant is designed for production of bars up to 4m long; 15mm - 45mm diameter and hexagon sections 15mm - 40mm across flats.

It is assumed that feedstock comprises 100% brass scrap, including in-house scrap arisings in the form of machining swarf and bar ends and reject machined components or forgings. Bought-in scrap of a similar nature to a known composition can also be used. Minor additions of virgin zinc and lead are added as required.

Process Route

1) **Feedstock preparation**, storage and feeding to melting furnace.

2) **Induction melting** of feedstock using a 1000Kg capacity 400 Kg/hr maximum coreless steel shell melting furnace.

3) **Metal transfer** via a refractory lined heated (normally by gas fired burners) launder.

4) **Continuous casting** of two strands of rod by a Rautomead RT850 Horizontal Continuous Casting Machine.

5) **Cut to length** (typically 3m - 4m) using a hand held powered bandsaw.

6) **Rod pointing** to reduce diameter of bar at one end to allow feed into shaving bench.

7) **Hydraulic shaving**, shaving straight lengths up to 4m long, removing up to a maximum depth of 1mm using a hydraulic shave bench with 3 shave dies..

8) **De-Tagging saw** to remove pointed end and cut to length.

9) **Bar straightening** using a 2 roll bar straightener.

10) **Storage and racking**.

11) **Quality control & testing**.

A typical factory layout demonstrating the equipment layout to achieve above process route is shown in drawing RD5147-4 attached at appendix C.

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Equipment

1. Feedstock Preparation, Storage and Feeding to Melting Furnace

Scrap from manufacturing processes such as reject components, swarf and bar ends where the composition is known is ideally suited to this process. This requires to be reasonably clean, dry and free from oil. Excessive amounts of cutting lubricant result in high levels of gaseous emissions. The subsequent weight loss also contributes to a net reduction in yield.

Fig. 1 Swarf Drying Equipment

Solid reject components from in house manufacturing process are usually relatively clean and dry and do not require special cleaning or drying. Storage is normally in bins or hoppers, which can be lifted directly onto the melting furnace platform.

Swarf and bar ends require to be dried by centrifuging. Storage can again be in bins or hoppers but a feature of swarf is that it can be transported, by conveyor, to the furnace and fed directly, using a vibratory table. In this case any sold scrap can be added manually to the vibratory table as the swarf/bar ends are charged. This approach is particularly recommended where the cost of labour is high.

Bought in scrap should be treated with caution. Quality scrap to the correct composition may be available from known sources, whereas trade scrap from unknown sources often contains ferrous and other impurities, making it unsuitable.

A swarf drying and handling system can be tailored to suit a particular installation but a basic system would typically consist of: -

a) A screw conveyor fed by tipper bins which raise the swarf/bar end mixture to a bar end separator. The bar ends and any random components are separated from the swarf and fed directly to a separate output storage hopper. This is loaded directly onto the melting furnace platform by crane or forklift truck.

b) The swarf is fed to a centrifuge, which separates the soluble oil, producing dry swarf of approximately 1-2% W/W soluble oil content. The oil is stored in a collection tank.

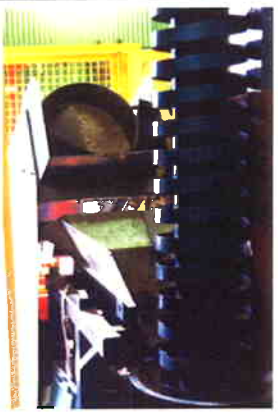

Fig 2 Swarf Tipper and Spiral Lift

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c) The hopper of dried swarf is moved by fork lift to a swarf elevating and feeding system, where it is tipped into the feed of a spiral elevator. As the swarf bar ends exit the spiral elevator, the material passes through a rotary self-cleaning magnetic separator to extract any contaminating ferrous materials.

Fig 3 Spiral Lift Exit feeding Rotary Magnetic Separator

Fig 4 Vibrating Table feeding Swarf into Furnace

d) The swarf is then fed in a controlled fashion into the furnace using an 80 m^3/hr vibratory hopper feeder (rate controlled by the operator). At this stage the bar ends and any solid scrap are added manually.

If a conveyor/vibrating feed table is not used, then there are two other basic approaches to the storage and feeding of the scrap to the furnace.

I. The scrap may be stored remotely from the furnace. The charges are weighed into specially designed feed hoppers, which are transported to the furnace by overhead crane to be fed directly into the furnace.

Fig 5 Feed Hooper for use with Overhead Crane

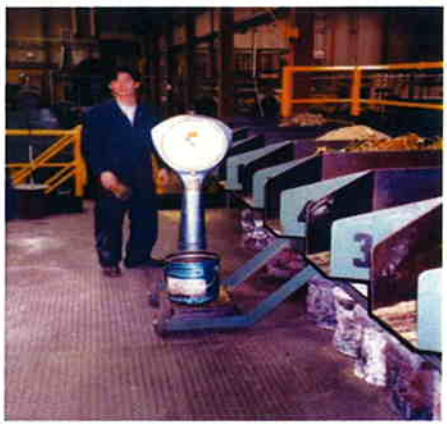

Fig 6 Storage Hoppers and weighing Station of Furnace Platform

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II. Buffer stores of swarf/bar ends and solid scrap hoppers may be located on the furnace platform along with buckets and weighing scales. Operators charge the materials into buckets by shovel for feeding into the furnace. This is labour intensive, but avoids the need for an overhead crane. The hoppers are loaded onto the platform by forklift truck.

Regardless of the feeding method employed, a stock of virgin zinc and lead along with weighing scales must be located on the melting furnace platform. Some manual assistance, using a "puddling" pole, may be required to ensure the charge is pushed through the surface of the melt.

2. Induction Melting

350 kW, 1000Kg capacity, medium frequency coreless steel shell melting furnace with hydraulically operated trunion tilted fume hood and hydraulic integral lid.

The furnace includes hydraulic power pack, load cell weighing system with digital readout, computerised melt manager and a recirculating closed circuit water cooling system.

Fig 7 Induction Premelting and RT850 Installation