

STEEL MANUFACTURING PROCESS IN MALAYSIA

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Steel has been part of some of the greatest achievements in history. Steel is the backbone of bridges, the skeleton of skyscrapers and the framework for automobiles.

And at the dawn of the 21st century, it's still revolutionising the way we live. It is the high-strength, lighter-than-plastic frames for eyeglasses; it's the stronger, more durable frame in housing; it's the high-tech alloy used in the Space Shuttle's solid fuel rocket motor cases; and it's the precise surgical instruments used in hospital operating rooms around the world.

Jurutera recently approached a prominent steel manufacturer in Malaysia to find out about the steel manufacturing process in the country.

Amsteel Mills Sdn Bhd, who mainly produces steel bars and wire rods, spoke to Jurutera about steel making and furnished us in detail the steel manufacturing process.

STEEL MAKING

Steel making is a process of melting the scrap, by means of using an electric arc inside the furnace for a certain period, where it slowly turns into molten steel. The molten steel, upon meeting several requirements, e.g. temperature, carbon content, etc., will be tapped or poured into the ladle (refractory-lined vessel to transport the liquid metal from the furnace to the casting area.) The ladle with the molten steel is sent to the Ladle Furnace where the refining process takes place. Alloys and fluxes are then added, where the amount to be added depends on the grade specifications required by customers. After fulfilling all the requirements, the ladle will be sent to the Continuous Casting Machine (CCM) for casting, whereby billets are produced. This semi-finished product is sent to the Rolling Mill to be rolled into finished products such as deformed bars, flat bars, wire rods, etc. The

process flow and detailed explanation are as follows:

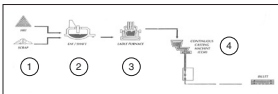
Raw material in steel making process – "Scrap"

Scrap in the steel industry is a collective form for ferrous waste products such as unserviceable machine parts, steel components from ships, demolished structures, e.g. bridges, automobiles and domestic appliances, all of which are no longer fit for use, plus material from within the plant.

Scrap delivered to the steel making indoor yard by trailers or trucks is sorted according to the scrap grades. The scrap is handled by overhead cranes, which are equipped with a grapple or magnet. During unloading, the scrap receiver will check the scrap condition. Scrap is mainly graded as: shredded, HMS imported, local premium or local mixed, pig iron or cast iron, excess or skull steel and home scrap. Besides scrap, Direct Reduced Iron (DRI) / Hot Briquetted Iron (HBI) is also used in steel making to produce better quality steel. Scrap from the indoor yard is loaded into the charging bucket by the scrap crane according to the scrap recipe prepared and transferred to the furnace bay via the scrap car. The bucket loaded with scrap is lifted to the standby position in front of the furnace for the scrap charging process. The furnace roof swings open and the signalman directs the crane to transfer the loaded scrap bucket to the correct position for charging. The furnace roof is then slewed on after scrap charging and the furnace is ready to begin melting the scrap.

Melting at Electric Arc Furnace

The melting starts with a short arc to allow the electrode to bore down into the scrap, followed by a long arc until the scrap is almost completely melted before using a normal arc. The same practice follows for subsequent scrap charging. To optimise the melting process, sidewall burners are put into operation depending



on the scrap condition. An Oxy-Carbon lance is introduced into the furnace once the door area is free from scrap. Flux is charged into the furnace during the melting process. Arcing continues until the required tapping temperature and desired chemical compositions are achieved. The molten steel is then tapped or poured into the ladle. The tapping operator must ensure that the ladle is in position before commencing the Eccentric Bottom Tapping (EBT) process. Ferro-Alloys such as SiMn, FeSi, Al ingot, CaO and Coke Recarborizer are charged into the ladle during tapping. Addition of alloys during tapping will be according to the steel grade produced and ladle bubbling is performed via the ladle bottom porous plug.

Refining at Ladle Furnace

After tapping from the furnace, the

ladle full with molten steel is transferred via the ladle car to the ladle furnace station for further refining process. The initial top temperature and steel sample are taken for analysis. Flux, alloys and wire injection are added accordingly depending on the steel grade to be produced. The operator has to monitor the Continuous Casting

Machine (CCM) casting status and adjust the operation accordingly. Final temperature check is performed after all the specifications have been met before sending the ladle to the CCM turret for casting via the ladle crane.

Casting Process

The molten steel from the ladle is allowed to flow out into the casting tundish via the slide gate, which is attached at the bottom of the ladle. The tundish steel level or weight is controlled by regulating the slide gate. The ladle steel stream is protected from contamination by the long nozzle fixed between the slide gate and the tundish. The tundish casting temperature must be monitored from time to time throughout the casting period for better castability. The molten steel from the tundish is cast into the mould and is further cooled down in the spray chamber to form billets of required cross section.

Rolling

Billets from the steel meltshop are reheated in the reheating furnace to a required temperature. The furnace temperature is closely monitored and controlled by the operator. Hot billets coming out from the reheating furnace are rolled down to the required size depending on the finished product, e.g. wire rods from low carbon steel grade billets; and deformed bars, round bars and flat bars from medium carbon steel grade billets. ■

