ROLL FORMING - MANUFACTURE OF SECTIONS

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In this Thirty-ninth series of articles on Roll forming we will discuss about the manufacturing aspects of sections as such. Manufacture of shaped sections started sometime during the beginning of nineteenth century by drawing metal blanks through a series of stationary dies. Later these stationary dies were replaced by a series of idler rollers which progressively formed the metal. The idler rollers were replaced by driven rollers which led to the development of roll forming machines. Later, the initial sheets were replaced by coiled strips which has led to the continuous high production process called roll forming now.

Roll forming of sections requires considerable amount of skill, ingenuity, precautions and efforts which could be acquired over a period of time. Proper roll forming of sections depends mainly on several variables like a) quality of raw material strip used i.e thickness variation , hardness variation, width variation, camber in the strip. b) roll pressures c) roll gap setting d) rigidity of the roll shafts and the machine e) condition of the roll shaft bearings f) number of forming stages g) strip and roller lubrication condition h) proper roll design i) roll alignment j) roller material , hardness and condition of the rollers k) speed of rolling.

Raw Material:

Any ductile material could be roll formed successfully. Generally in India 0.3 mm to 4 mm material is being roll formed. Even up to 19mm thick steel material has been successfully roll formed in the advanced countries. Although stainless steel, aluminium, brass, copper, galvanized/pre painted strip could be roll formed, predominantly CRCA strips and HR strips are roll formed. In order to increase the roll life HR strips are to be pickled and oiled prior to roll forming. Regarding CRCA strips quarter hard (115- 135 VPN) material is the recommended hardness of the material. Too soft material will tend to give stretcher strain marks after roll forming. A small amount of cold rolling is required to reduce these marks. Too hard material will i.e. ½ hard to ¾ hard material tend to crack during roll forming. Predominantly used steel material is "D" grade strip (drawing quality). DD (deep drawing quality) or EDD (extra deep drawing quality) strips are used when very sharp 180 degree (with zero inside radius) bends are required to be formed or where further bending operations are done on the already roll formed sections. Normally unless specified, inside radius of sections would be assumed as 't '(thickness of material) For high tensile steel up to 4 t inside radius or more would be maintained.

Advantages of Roll forming

The principle advantage of roll forming as compared with other methods of forming is high production capacity. The normal production speeds achieved in India these days is 5 to 15 meters per minute. Higher speeds are achievable if the raw material quality is consistent, machines are sturdy, toolings are properly made and if there is proper coolant system is provided. Parts produced by roll forming are essentially uniform in cross section and can be held within very close tolerances. As a result of the ability of roll forming equipment to produce finished products with speed, accuracy and uniformity and with quality surface finishes real economies can result. It is claimed that where roll forming equipment can be used 25% or more of the time, it is probably the most economical method of manufacturing.

The increasing trend in the advanced countries is to combine the secondary operations like pre-punching, piercing, notching, lancing, stiching louvering, miteing, slitting, cutting, embossing, bending, curving, marking, coining, welding etc. during roll forming processes itself.

Combination of Materials

Another interesting and important aspect of roll forming is that two or more different materials may be fed into the machine at the same time and combined into a single product. The examples are-welding rod containing powdered core, automobile weather strips. They can be combined in such a way that desirable properties of each material like corrosion resistance, ductility, superior finish on one side and strength on the other side.

Curved Sections

As the strip material is being roll formed the sections coming out could be continuously curved upwards, downwards or sideways. Two wheeler rim and mudguards are some of the examples.

End Flare

As compared to press braking or pressing during roll forming complex stresses are generated in the section and it is the inherent property of roll forming that a certain amount of end flare would be there near the cutting areas. However, this could be minimized by the proper design and by providing more number of forming stages and stabilizing passes.

Spring Back

Low carbon steels due to work hardening effect at the bends gives a spring back of 1 to 2 degrees. Stainless steel which work hardens rapidly and high tensile steels gives a spring back which can go up to even 25 degrees. To counteract this, based on the bend radius, hardness of the material /material property a reverse spring back allowance has to be given during the design stage of the Toolings.

Figure A to Figure.N are some of the typical sections that could be produced using the roll forming method. The future trend in roll forming is going to be in the direction of closed sections which have high strength to weight ratios. Sedvik Industries, Bangalore has been in the field of manufacture of roll forming machines since 1986.

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