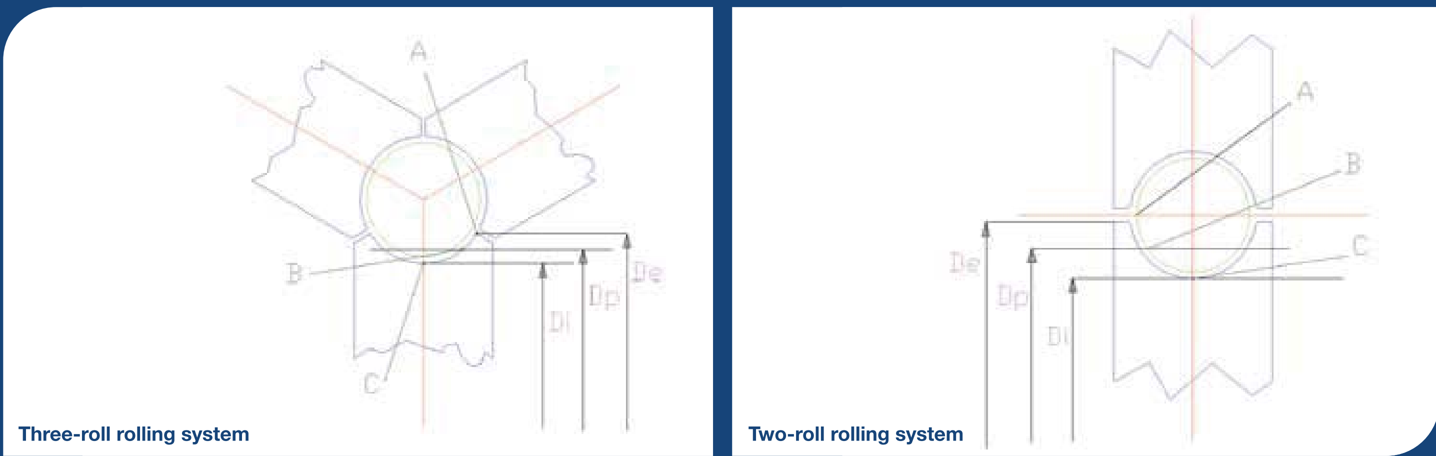
COMPARISON

: Some comparison between two-rolls and three-rolls rolling system

The sketches show the cross section of the rod and the rolling rolls, under rolling process, in case of three-roll and two-roll rolling technology. Subject of the present article is the study of the kinematics and relative motion between rod and rolls during the operations.
In the sketches here below we have identified for both systems the following diameters:

De = external diameter of the roll
Di = internal diameter of the roll
Dp = theoretical or primitive diameter of the roll



Three-roll rolling system

Two-roll rolling system

Cross section of rod and rolls during rolling process

As Vr is the speed of the travelling rod (function of the diameter and the production rate) only in correspondence to the theoretical diameter (Dp) there is no relative speed between the travelling rod and the rectilinear component of the speed of the rotating roll. Therefore only along that generatrix passing through point B the following equation is valid:

$\omega Dp/2 = Vr$

where ω is the angular speed of the rotating roll.
Outside this generatrix, there is relative speed between the rotating roll and the travelling speed. In particular, along the generatrix passing through point A, the speed of the roll is higher than the speed of the rod (max. positive ΔV); along the generatrix passing through point C the speed of the roll is lower than the speed of the rod (max. negative ΔV)
It is needless to say that this speed causes friction and therefore wearing.
Assuming that for both systems there is a symmetry along the arc AC between the positive and negative ΔV, we can say that, under same operative conditions, the max ΔV is given by the following equations:

>> For the two roll system
Max. $\Delta V = Vr - \omega De/2 = Vr - (Dp + D_{rod} Sin\ 45°)$
>> For the three roll system
Max. $\Delta V = Vr - \omega De/2 = Vr - (Dp + D_{rod} Sin\ 30°)$

This is because in the three-roll system the theoretical active arc of each roll is 120°. In the two-roll system the same arc is 180°.

It is quite evident that in the two-roll system the item D_{rod} Sin 45 ≈ $0{,}7D_{rod}$ is rather bigger than D_{rod}Sin 30 ≈ $0{,}5D_{rod}$ resulting in the two-roll system. Therefore we can conclude that the wearing phenomena, dependent from the relative speed, are more evident in the two-roll system.

Talking about the shape of the rod, it is quite important to underline that in the two-roll system is quite difficult to control the spreading of the metal between the two working rolls and the consequent power wasting, while using the three-roll system, we can say that a well trained crew can produce a rod with constant and precise dimensions and an optimized power consumption. *by Carmelo Maria Brocato*