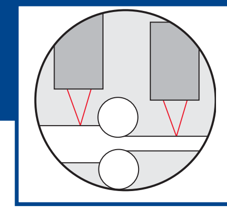
MFAGC



Using Mass Flow for Automatic Gauge Control to achieve better gauge control during the rolling process in Cold Rolling mills, requires the speed and thickness of the strip to be measured at the entry and exit of each mill stand. The mass of the steel strip flowing into the rolling stand equals the mass of the strip exiting the stand.

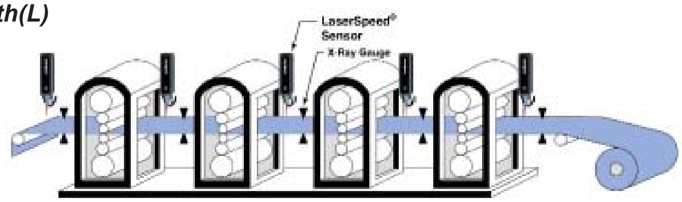
For Mass Flow Automatic Gauge control, a LaserSpeed gauge is used in conjunction with a thickness gauge to perform Mass Flow Automatic Gauge control. The MFAGC is calculated by:

Mass Entry = Mass Exit

Mass = Thickness (T) X Width(W) X Density(D) X Length(L)

Length = Speed(S) X Time(T).

Width, Density, and Time are constant.



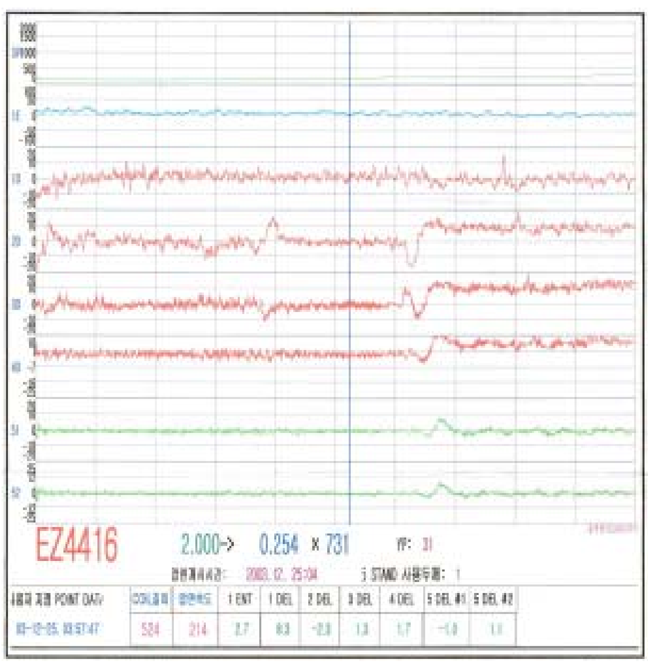
Therefore, substituting in the Mass formula;

$T_{Entry} \times S_{Entry} = T_{Exit} \times S_{Exit}$ Or $T_{Entry} \times (S_{Entry}/S_{Exit}) = T_{Exit}$

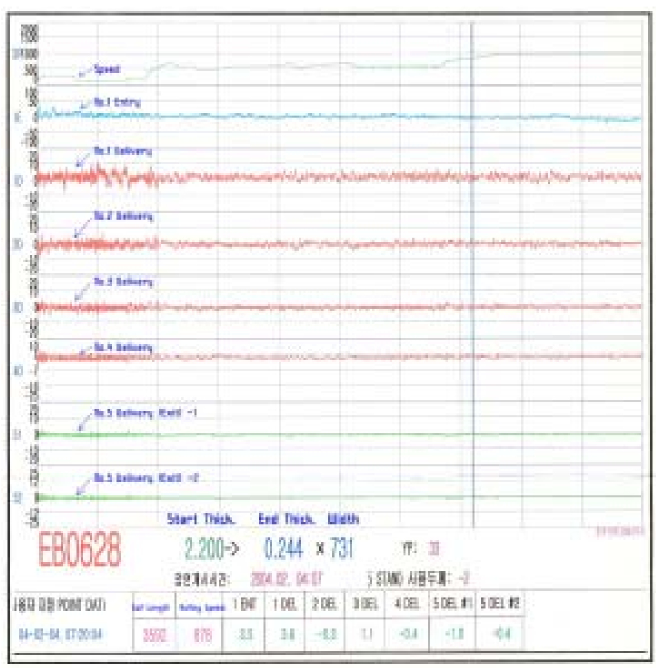
In summary, you can control the thickness out of a mill stand if you know the entry side thickness and speed and the exit speed.

LaserSpeed can be used to greatly improve the gauge control of a rolling mill. Graph A shows the gauge of the strip at the entry of stand one and exit of each mill stand in a four stand Tandem cold rolling mill without using LaserSpeed gauge to measure the speed. The speed reference is obtained from drive rolls of the mill. Driven and non-driven rolls always have slippage between the strip and the roll. The strip always lags the driven roll and the strip always leads a non-driven roller due to slippage.

Graph B shows the same mill's performance when LaserSpeed gauges are used for the speed measurement in the Mass Flow control system. The gauge control has been significantly improved by using LaserSpeed gauges as seen on following graph. In addition, the more than 97% of the coil length is within gauge specification when using LaserSpeed gauges compared to only about 85 to 87% of the coil being within specification when LaserSpeed is not used for MFAGC.



Graph A



Graph B

LaserSpeed gauges measure the speed of the strip directly and is not effected by slippage as opposed to using a driven roller that measures the speed of the roller. There is always slippage between the roller and the strip. The amount of slippage depends on many factors, such as pressure, amount of cooling solution, hardness of the steel, and the steel alloy.

The graph below shows the slippage between a driven roller and the strip in a cold rolling mill. The top graph shows the target speed for the control system. The bottom graph shows the speed measure by the driven roll (Blue line) matches the target speed of the control system but lags the actual strip speed by 150 milliseconds. The speed measured from the LaserSpeed gauge (Red line) measures the true strip speed.

The biggest difference is seen during acceleration of the strip. Here the driven roll speed leads the actual strip speed by 150 milliseconds. Where as, the speed from the LaserSpeed gauge follows the true strip speed exactly. This is why LaserSpeed gauge can make a significant improvement in the performance of cold rolling mills.