Cold Point Determination in Heat Treated Steel Coils

New Zealand Steel
Glenbrook, New Zealand

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Company Profile

BlueScope Steel is the leading steel company in Australia and New Zealand, with integrated steel works at Port Kembla, NSW, Australia and Glenbrook, New Zealand, producing flat steel products such as steel slab, hot-rolled coil and cold-rolled coil through to the value added products of metallic and painted steel coil.

NZ Steel represents BlueScope Steel's interests in New Zealand. NZ Steel uses processes that are unique on the world stage for the production of steel. Our steel production process is aligned to use iron rich sand as the primary raw feed and the design of annealing furnaces used for the heat treatment of steel coils is one of a kind.

PROBLEM SUMMARY

Heat treatment (annealing) of cold rolled annealed (CRA) steel coils is critical to ensure the correct mechanical properties of the final product. At NZ Steel, coils of steel are batch annealed 9 coils at a time in a 3x3 grid in a uniflow annealing furnace (UAS). There are 5 annealing time/temperature profiles (cycles) in use at NZ Steel, each with the aim of producing a different range of mechanical properties.

For a coil to be correctly annealed, both the annealing time and temperature need to be correct. It takes time for the entire coil to reach the atmosphere temperature inside the furnace. The rates of axial and radial heat transfers are what will determine the cold point of the coil and how long it will take to reach annealing temperature. Depending on the cycle type that a batch of coils is to be annealed, there is an equation relating heating time to a set point cold temperature.

Cycle 2

$$H = -54.059 + 72.115 \times \sqrt{W} + 1.431 \times Od^2 - 10.14 \times W^2 + 1.75$$

An additional 2 hours for process correction and 4 hours for soak time are added to H

Cycle 3

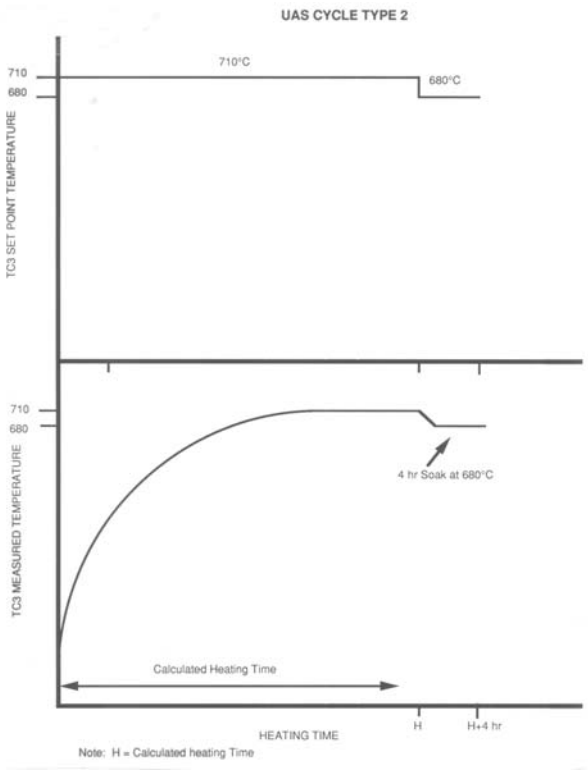
$$H = 0.2858 \times M + 6.164 \times W - 0.1042 \times M \times W + 3$$

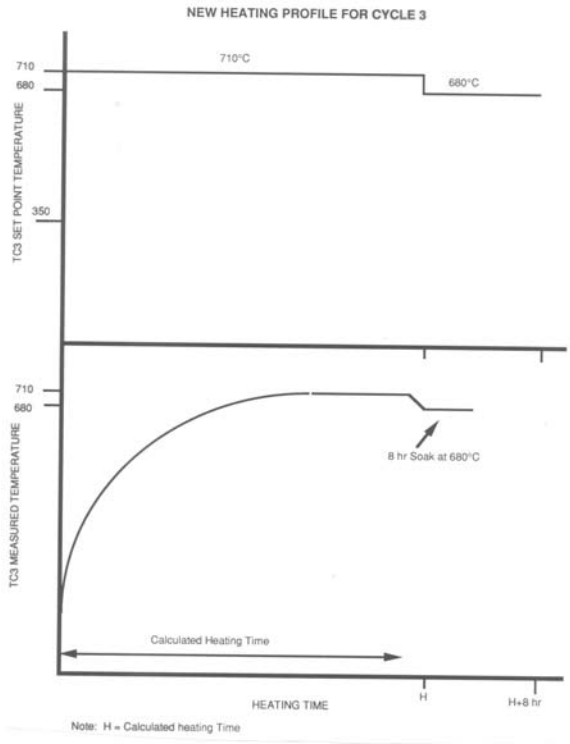
An additional 2 hours for process correction and 8 hours for soak time are added to H

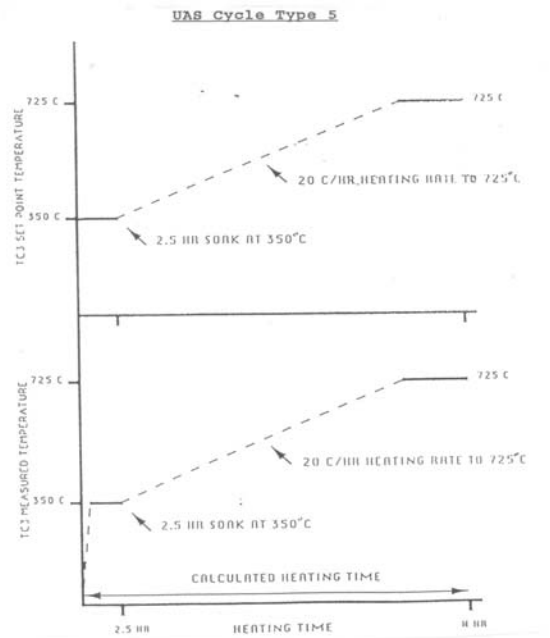
Cycle 5

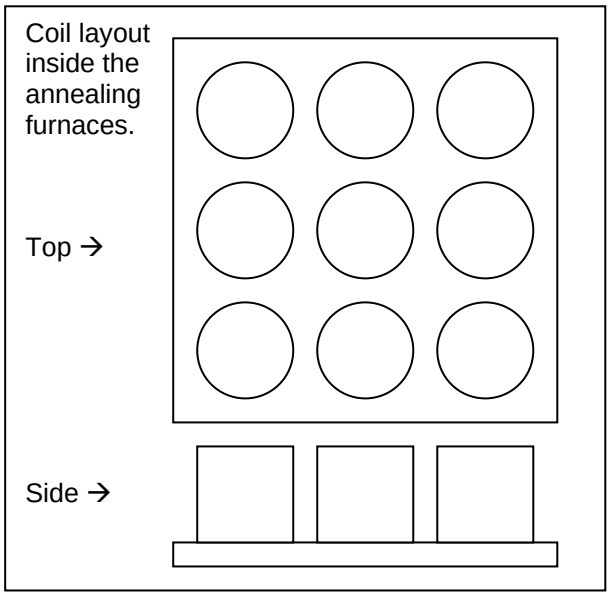
$$H = 0.877 \times M + 3.23 \times W + 14.279$$

H=heating time in hours
W=coil width in metres
M=coil weight in tonnes
Od=outside diameter in metres









Knowledge of the theoretical cold point and how long it will take to reach the set point temperature for the soak period will allow optimisation of the annealing heating formulas and provide an improvement of furnace through put and product quality.