

REBOX[®] oxyfuel solutions in reheating. Direct Flame Impingement (DFI) in a galvanising line.

Summary.

- DFI oxyfuel for highest possible heat transfer, 800–1000 kW/m²
- 30% capacity increase
- DFI oxyfuel unit effectively cleans strip, no strip pre-cleaning section is needed
- No extension of furnace or line

Customer: ThyssenKrupp Steel, Frintrop, Germany

ThyssenKrupp Steel (TKS), Frintrop, Germany was searching for an easy-to-implement and effective solution in order to increase the galvanising capacity of an existing production line at the Frintrop works. The galvanising line at TKS Frintrop (FBA 3) processes both hot and cold rolled strip with a width of 650–1550 mm and thicknesses of 0.3–3.25 mm for automotive, white goods and construction applications. The total furnace length is 130 m, where 67 m is air-fuel-fired. The highest strip speed is 180 m/min and the maximum output was limited to 82 tonnes/hour.

Customer objectives

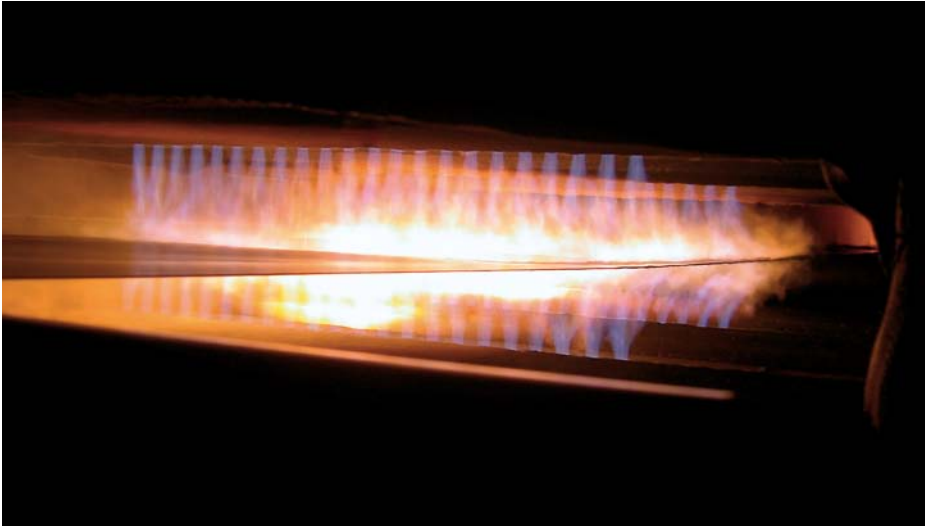
TKS had identified that by increased strip heating, the line could reach 105 tonnes/h. It was also determined that the appropriate heating solution should free the strip surface from unwanted contaminants, such as emulsions, oils, grease and particles, which originate from the upstream strip production process. Another requirement was that the boosting unit should allow for strict control of the required surface properties needed for successful galvanising of the strip. With these specifications in mind, TKS met with Linde at the end of 2004 to discuss the possibilities of applying oxyfuel to its galvanising lines.

REBOX[®] DFI oxyfuel

Direct Flame Impingement (DFI) oxyfuel is based on Linde's vast experience in oxyfuel combustion and its application in steel heating processes. This expertise was adapted to continuous and large-scale use in reheating and annealing furnaces. With our DFI technology, where controlled oxyfuel flames are fired directly onto the moving metal, the heat transfer is drastically improved. Tests have verified the higher level with local heat flux for the DFI oxyfuel technology, reaching levels of 800–1000 kW/m².

Features

- DFI oxyfuel unit, 5 MW, 120 oxyfuel flames from 4 burner row sets
- 80–90% thermal efficiency
- Compact unit size; 2.8 m long, 2.8 m wide and 1.2 m high
- 3 m of recuperative zone removed for installation of DFI
- Option for 2 more burner arrays, (+2.5 MW possible within the same outer dimensions)
- Complete safety and flow control system
- Automatic width adjustment
- Flowtrains for natural gas and oxygen
- Installation, commissioning and fine tuning
- Guaranteed performance



120 oxyfuel flames arranged in 4-burner row sets efficiently heats the strip.



Three metres of the recuperative zone was used to fit the compact DFI oxyfuel unit.

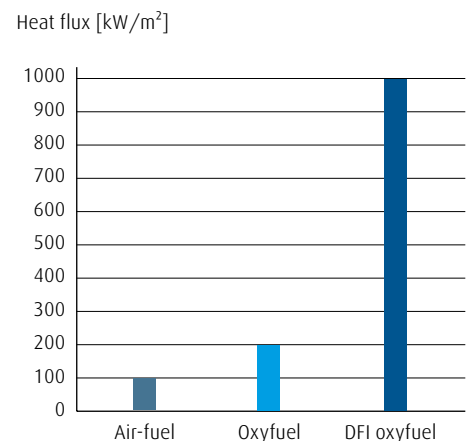
Benefits

- 30% more galvanising capacity
- The oxyfuel flames effectively burn off and clean the strip from residues, oil, etc.
- DFI oxyfuel effectively strip, cleans eliminating the need for the strip pre-cleaning section (25 m)
- Specific fuel consumption reduced by 6%
- No extension of line or furnace necessary
- Improved annealing properties over the entire strip width
- DFI oxyfuel allows for modification of metal surface properties
- Short installation time for limited production down-time

REBOX® DFI oxyfuel solutions

In more than 90 installations in reheating and annealing furnaces, Linde's REBOX® oxyfuel solutions provide more capacity and flexibility at lower total costs. Direct Flame Impingement with oxyfuel is one of the leading solutions in the REBOX® portfolio. The broad REBOX® technology and application experience drives the development work and results in fast and safe project handling. We provide turnkey installations with guaranteed performance.

Higher levels of heat flux with DFI oxyfuel



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