LINDOFLAMM®: Reducing the Risk of Hydrogen Cracking by Pre-heating

Business benefits

- Reduction of pre-heating time by over 50%
- Reduced customer pre-heating costs by over 50% including labour
- Overall labour costs reduced
- Reduce risk of hydrogen cracking
- Reduced risk of expensive weld cracking failing on site

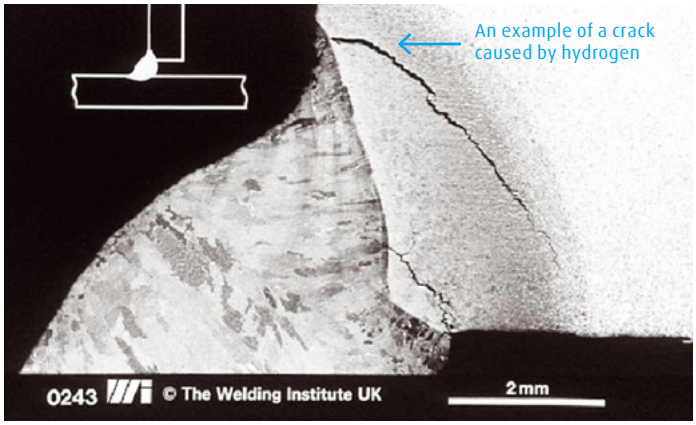
The risk of hydrogen cracking is an ongoing concern for steelwork contractors. BOC were approached by a customer to review how hydrogen cracking could be reduced which had become more frequent since production output was increasing. During the fabrication assessment BOC also identified areas for production improvement in their existing processes.

The customer is a leading steelwork contractor company who design, fabricate and construct both bespoke and production steel for bridges, car parks and buildings. The customer has a production capacity of approx 100k tonnes of steel per annum and wanted to move away from traditional pre-heating methods.

The issues

Quality
Hydrogen cracking occurs when hydrogen atoms diffuse through post welded steel. Operating pressure and residual stresses associated with the weld lead to cracks in the heat affected zone and the overall structure.

Productivity
Increase productivity and output by reducing the existing production bottleneck in the pre-heating process.



The BOC solution

A solution to both the quality and productivity issues was found by using BOC's patented LINDOFLAMM special burners with Acetylene.

The result was a significant improvement to the contractor's production output and a reduction in risks of hydrogen cracking.

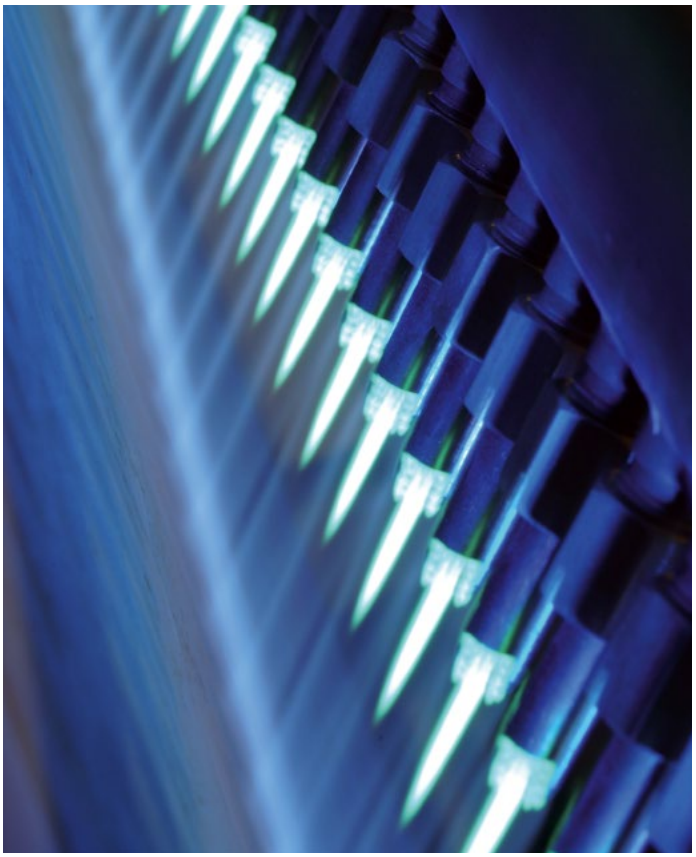
Quality

The risk of hydrogen cracking is minimised by pre-heating the parent material before welding.

Productivity

The high temperature (3,150°C for Acetylene compared to 2,800°C for Propane), high flame speed and concentrated primary flame of Acetylene enables the optimum pre-heating temperature of 140°C to be reached within 30 minutes compared to the customer's existing Propane fuel gas normally taking approximately 75 minutes.

During the pre-heating procedure it is extremely important to ensure moisture, a source of hydrogen, is minimised. By replacing the customer's existing Propane fuel gas with Acetylene the lower moisture content of Acetylene (3% for Acetylene compared to 32% for Propane) further minimised the risk of hydrogen cracking.



Customer Benefits

BOC conducted trials on a number of different thicknesses of material from 35mm to 85mm with positive results on all. The results for 35mm compared with the existing process were:

	Propane	Acetylene
Fuel gas flow rate (m^3/hr)	9.2	6.7
Compressed air flow rate (m^3/hr)	–	46.9
Fuel gas consumption per turn (m^3, 15 mins)	2.3	1.7
Comp air consumption (m^3, 15 mins)	–	11.7
Time to 140°C (mins)	75	30
Fuel gas consumption per heating (m^3)	11.5	3.4
Comp air consumption per heating (m^3)	–	23.5
Fuel gas cost per heating (£)	20.70	13.74
Comp air costs per heating (£)	–	0.7
Workplace costs per hour (£)	100	100
Workplace costs per heating (£)	125	50
Total cost per heating (£)	**145.70**	**64.44**

The results from the trial show that Acetylene took less time to achieve pre-heating temperature, consumed less gas and with these two factors combined reduced the cost of overall pre-heating by over 50%.

After reviewing the results of the trials the customer ceased using Propane and now uses Acetylene as their fuel gas of choice for pre-heating.

For further information on any of the items referred to in this case study, please speak to your account manager or use the contact details below.

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