



## Technical Service Report

**Customer**                      Ensitech Pty Ltd

**Contact**                       Clive White

**Reported by**                 Simon Lewer

**Control number**             GIE-E-017

**Date**                            17<sup>th</sup> October 2013

**Work Requested**            Gauge Industrial and Environmental Pty Ltd was commissioned by Ensitech Pty Ltd. to conduct a study into the passivation of 2205 and 2507 duplex stainless steel after the use of Ensitech's TIG Brush™ employing TB-25 Weld Cleaning Fluid for Stainless Steel. ASTM A967/A967M-13 "Chemical Passivation Treatments for Stainless Steel Parts" Practice 14.4 Practice D – Copper Sulfate Test was used in this study as the most appropriate guide for determining the performance of the TIG Brush™ with TB-25 to passivate 2205 and 2507 stainless steel successfully. The ASTM A380/A380M-13 "Cleaning, Descaling and Passivation of Stainless Steel Part, Equipment, and Systems." Section 7.2.5.3 test procedures calls for the same tests as ASTM A967/A967M-13, therefore compliance with the A380/A380M-13 standard was also required.

Specifically, the request for work was:

1. Clean 2205 and 2507 duplex stainless steel samples with the Ensitech TIG Brush™ on "Clean" setting using Ensitech's TB-25 as per manufacturer's instructions.
2. Conduct the passivation studies as per ASTM A967/A967M-13 "Chemical Passivation Treatments for Stainless Steel Parts".
4. Report on the success or otherwise of the TIG Brush™ using TB-25 to passivate 2205 and 2507 stainless steel.

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**Method**

1. A TIG Brush™ was used throughout this study as per manufacturer's instruction providing 13 volts alternating current\*.
2. The method of cleaning was as per Ensitech's instruction which included saturating the tip with the TB-25 and contacting the tip of the brush on the area to be cleaned.
3. Uncleaned samples of both 2205 and 2507 were used as a negative control in this study. These were tested as per the cleaned samples.
4. To eliminate contamination, the brush for each chemical was triple rinsed in deionised water between each sample.
5. The batches of TB-25 fluid was manufactured in June 2013 as a production batch and compliant with specifications.
5. Samples of 2205 and 2507 stainless steel were supplied by Ensitech. The welded samples were MIG welded.
6. Both welded and unwelded samples were treated and subsequently tested.
7. All treatments were performed in triplicate.
8. Both 2205, 2507 stainless steel were tested for passivation as per ASTM A967/A967M-13 Practice 14.4 Practice D – Copper Sulfate Test.
9. A ferrous sulphate spike was added to a blank piece each of 2205 and 2507 stainless steel acting as positive controls.

\* The electrical offer can be achieved using any of the following TIG Brush™ models and settings:

TB-250 setting "3B"

TBX-150 / TBE-150 setting "Clean" output

TBX-300 / TBE-250 setting "High Power / Clean Mode"

TBE-700 setting "Low Power / Clean Mode"

**Table 1: Sample Type and Numbers of Samples**

Material	Type	Treatment	Copper Sulfate Test
2205	Unwelded	None	3
		TB-25	3
	Welded	None	3
		TB-25	3
		Total	12
			<b>Copper Sulfate Test</b>
2507	Unwelded	None	3
		TB-25	3
	Welded	None	3
		TB-25	3
		Total	12

**Results:****Table 2: Results of Passivation Testing (triplicates)**

Material	Type	Treatment	Copper Sulfate Test
2205	Unwelded	None	-,-,-
		TIG Brush (TB-25)	-,-,-
	Welded	None	+++ ,+++ ,+++
		TIG Brush (TB-25)	-,-,-
			<b>Copper Sulfate Test</b>
2507	Unwelded	None	-,-,-
		TIG Brush (TB-25)	-,-,-
	Welded	None	+++ ,++ ,+++
		TIG Brush (TB-25)	-,-,-

Key: - = no reaction/no sign of corrosion or staining  
 + = a reaction /positive observation of corrosion or staining  
 Number of + indicates degree of copper deposit indicating

iron presence (where +++ is high and + is low)

Note: The ferrous sulphate spike on both 2205 and 2507 tested positive in the copper sulfate test indicating efficacy of the test solution.

### Test Sample Images

**Figure 1: 2205 sample Untreated – Copper Sulfate Test**



**Note the copper deposits throughout the weld surface indicating the presence of free iron.**

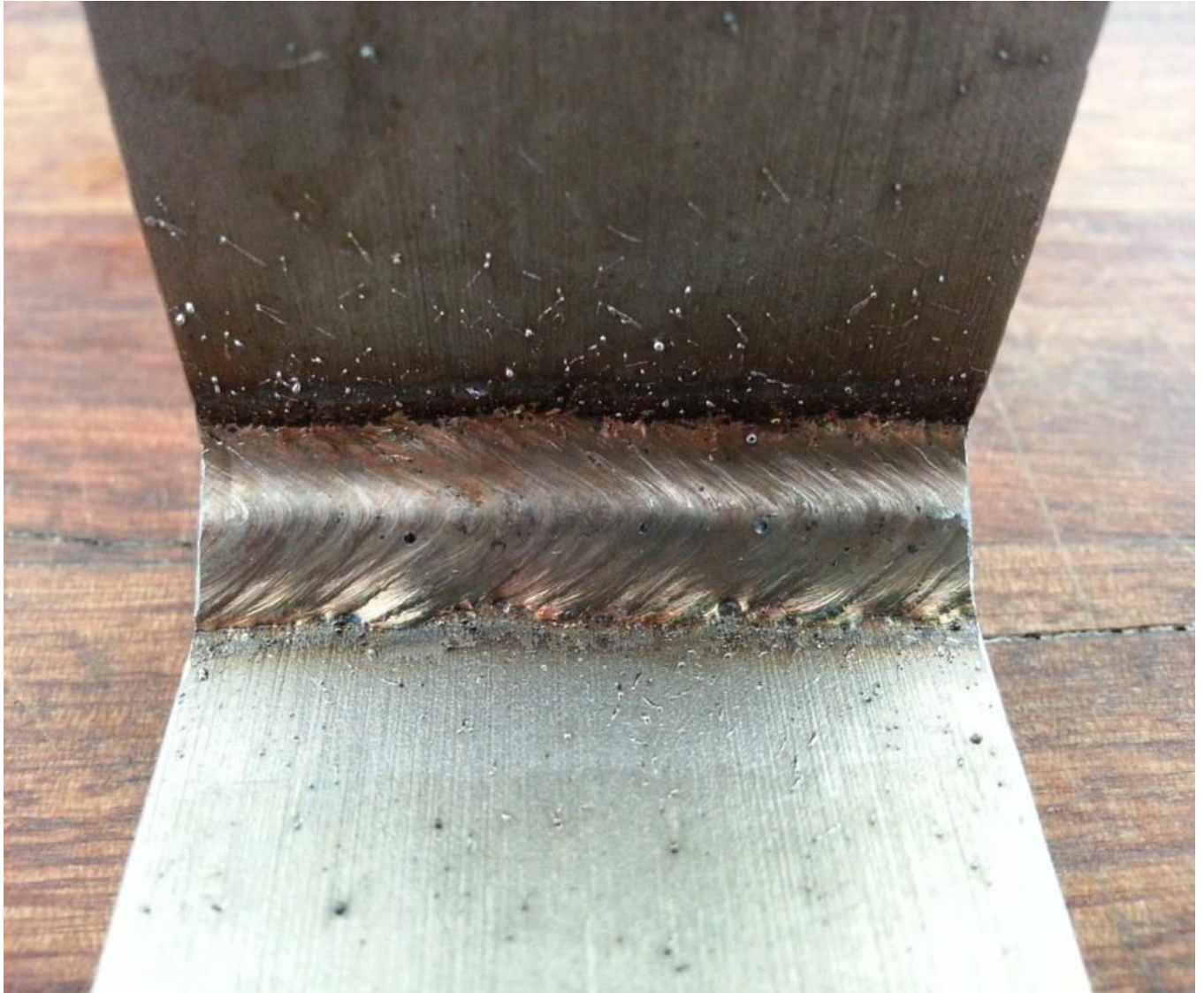


**Figure 2: 2205 sample TIG Brush/TB-25 Cleaned - Copper Sulfate Test.**



**Note that the surface shows no copper deposits indicating no free iron present**

**Figure 3: 2507 sample Untreated – Copper Sulfate Test.**



**Note the copper deposits throughout the weld surface indicating the presence of free iron.**



**Figure 4: 2507 sample TIG Brush/TB-25 Cleaned - Copper Sulfate Test.**



**Note that the surface shows no copper deposits indicating no free iron present**

### Description of Results

- All unwelded samples showed NO evidence of free iron. This was true for unwelded samples uncleaned or cleaned with the TIG Brush™. This was an expected result since the passive chromium oxide layer had not been disrupted by welding.
- Welding of both the 2205 and 2507 samples compromised their ability to resist corrosion. This was shown by significant levels of free iron on the weld surface which showed in the Copper Sulfate Test.
- All welded 2205 and 2507 samples cleaned with the TIG Brush and TB-25 showed negative results in the Copper Sulfate Test indicating no free iron on the weld surface.

### Interpretation and Conclusions

Welding of stainless steel is an operation that reduces the material's ability to resist corrosion. This is due to the disruption of the passivating dense chromium oxide layer and creation of a surface oxide layer which contains iron and is not resistant to oxygen penetration which allows the continuing corrosion of the weld. The removal of iron in the surface layer allows the dense chromium layer to re-establish which passivates the weld and returns the material to an equivalent corrosion resistance to that of unwelded stainless steel.

**This study determined that the use of the TIG Brush™ as per Ensitech's use recommendations with TB-25 fluid provides effective passivation of 2205 and 2507 duplex stainless steel welds compliant via the relevant passivation verification sections of standard methods ASTM A967/A967-13M "Chemical Passivation Treatments for Stainless Steel Parts, as well as complying with ASTM A380/A380M-13 "Cleaning, Descaling and Passivation of Stainless Steel Part, Equipment, and Systems.**

#### References:

ASTM A967/A967-13M "Chemical Passivation Treatments for Stainless Steel Parts; ASTM International

ASTM A380/A380M-13 The ASTM A380/A380M-13 "Cleaning, Descaling and Passivation of Stainless Steel Part, Equipment, and Systems." ASTM International

Technical Guidelines on TIG Brush™ use for cleaning stainless steel. Ensitech Pty Ltd.

END OF DOCUMENT

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