Refining & Petrochemical

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Automated Weld Overlay Presentation

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Andrew Petticrew, 2017

Andrew Petticrew
TFSNI Business Development Manager

andrew.petticrew@sulzer.com
00 44 79084 26330

Weld overlay -
The smart way to extend tower lifetime and keep your shutdowns under control

Focus of presentation

This presentation will highlight following topics:

- Corrosion issues faced in refineries
- Corrosion protection using weld overlay
  - Technology
  - Process
  - Quality
- Case study where automated weld overlay has been applied

Modern corrosion challenges

Material degradation in assets

NACE, the professional body for the corrosion control industry, estimates that the **total annual cost** of the effects of corrosion in the oil and gas production industry is **1.372 billion USD**.

Its common to see increased corrosion levels and shell material loss in the below assets:

- Vacuum columns
- Sulphur recovery units
- CO2 absorbers
- Reactors
- LNG columns
- Decoking drums

Modern corrosion challenges

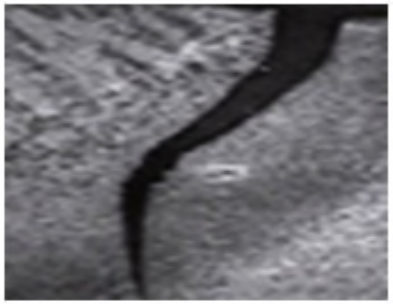
Operational Pressures on Refineries & Petrochemical Plants

Factors contributing to accelerated corrosion rates:

- Demanding operating schedules
- Feedstock changes
- Pressure for higher production rates
- Shortened TAR mechanical windows
- Increased durations between TAR's
- Overloading of equipment

Modern corrosion challenges

Common causes of corrosion and material loss



- Hydrogen induced cracking (HIC)
- Sulphide stress cracking (SSC)
- Stress corrosion cracking (SCC)
- Acidic corrosion
- Base material damage
- Material erosion
- Pitting

Modern corrosion challenges

Compromising asset integrity

- Unplanned shutdowns
- Higher volume of maintenance activities and related costs
- Possible safety incidents
- Long term reliability compromised
- Disruption to production – loss of revenue

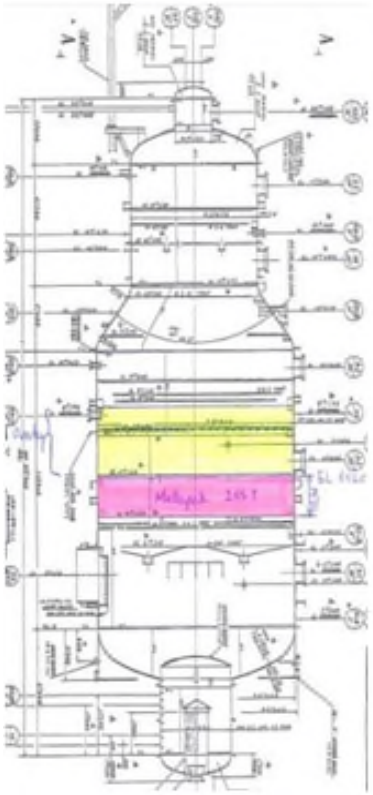
Modern corrosion challenges

Upgrades and protective measures

If corrosion allowances are at a critical levels:

- Corrective actions must now be considered
- Repair procedures/processes to reinstate material thickness to the nominal thickness
- Evaluation of the possibility of future corrosion
- Upgrade in materials to protect against further corrosion
- Mechanical windows available for this work scope

During your shutdown we can mobilize our specialist teams for specific repairs and corrosion protection projects; alternatively we can integrate the requirement within our wider scope of services including internals maintenance or revamping



- Seamless interface with internals work. full shutdown scope.
- Removal of internals.
- Modification of attachments
- Fully automated weld overlay process with multiple machines.
- Multiple types of weld Alloy materials can be applied.
- Alloy 625, SS317L, SS309L, and more….
- Supply of mass transfer equipment.
- Installation of internals

Modern corrosion challenges

Corrosion resistant alloys

The following are some of the common CRA's which can be applied onsite using weld overlay processes and satisfying the requirements outlined in standards such as ASME and NACE.

- **SS 316/317L**
- **22 Cr Duplex**
- **25 Cr Duplex**
- **N08825 – Alloy 825**
- **N06625 – Alloy 625**
- **N10276 – C-276**
- **Monel**

Nominal chemical composition of alloys (Wt. %)								
Alloy (UNS No.)	Cr	Ni	Mo	Fe	Mn	C	N	Other
13 Cr (S42000) to API Standard	13	-	-	Bal.	0.8	0.2	-	-
S13Cr (typical ranges)	11-13	1-6	1-2	Bal.	0.2-0.5	0.025	-	0-2.0 Cu, Ti trace
316L (S31603)	17	12	2.5	Bal.	1	0.02	-	-
22 Cr duplex(*)	22	5	3	Bal.	1	0.02	0.15	-
25 Cr duplex (*)	25	7	4	Bal.	1	0.02	0.28	-
28 (N08028)	27	31	3.5	Bal.	1	0.01	-	1.0 Cu
825 (N08825)	22	42	3	Bal.	0.5	0.03	-	0.9 Ti, 2 Cu
2550 (N06975)	25	50	6	Bal.	0.5	0.03	-	1.2 Ti
625 (N06625)	22	Bal.	9	2	0.2	0.05	-	3.5 Nb
C-276 (N10276)	15.5	Bal.	16	6	0.5	0.01	-	3.5 W
* There are a variety of 22 Cr and 25 Cr duplex stainless steels with different UNS numbers.								

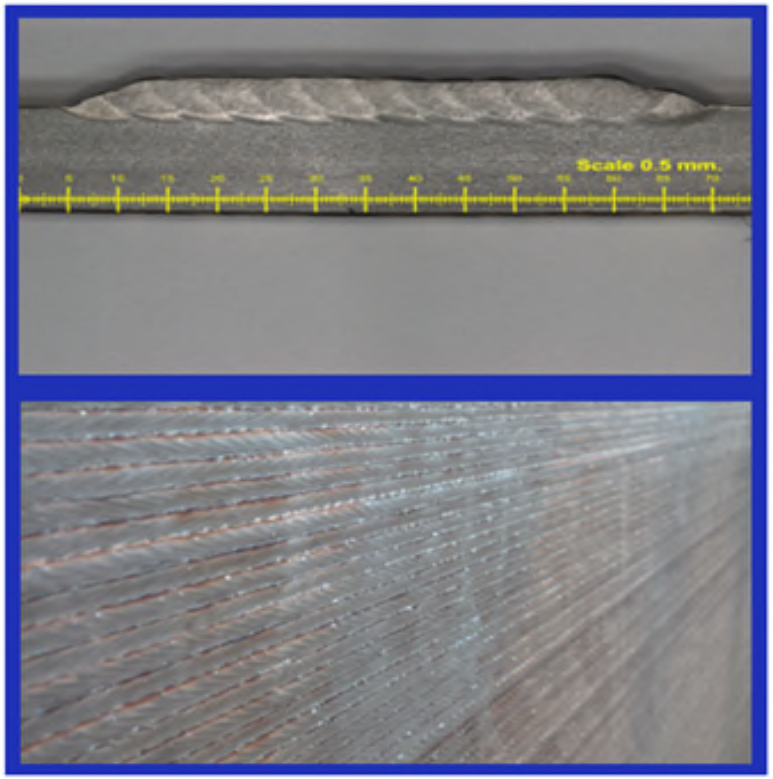
Application of weld overlay

Weld overlay processes and procedures

- CRA's can be applied to large areas of the vessel walls
- WPS/PQR's developed in accordance to the requirements of standards and codes such as ASME 9 and NACE TM0177-2016
- Bespoke procedure can be developed
- Work can be executed during normal mechanical windows
- No limitation on the selection of alloys
- Multiple machines can be applied

Application of weld overlay

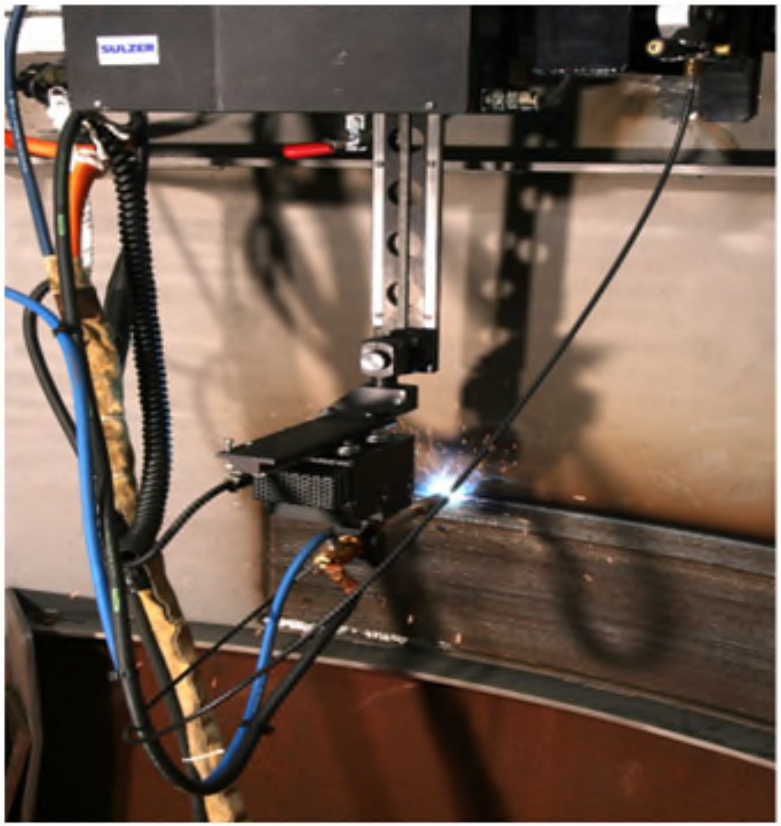
Weld overlay processes and procedures



- Consistently high weld quality
- Faster production rates
- Hostile environments - HT
- Minimal material dilution
- Overlay thickness > 3mm
- Low heat input @ HAZ
- Minimal base material distortion

Automated weld overlay CladFuse™ technology

Design features



- Designed for reliability in hostile environments
- Suitable for high temperatures
- Specifically for confined spaces
- Electronics located outside the confined space
- Complete PLC Controls
- WPS/PQR data programmed
- Minimal operator input
- Delivering consistent quality on multiple machines

Automated weld overlay CladFuse™ technology

PLC controls

- WPS/PQR data inputted into PLC system
- Multiple machines operating on the same parameters
- Faster process leading to shorter downtimes
- Delivering consistently higher quality with reliable productivity

Automated weld overlay CladFuse™ technology

Design features

Automated weld overlay CladFuse™ technology

Benefits

Safely

On Schedule

High Quality

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Protect

- Critical Failures
- Unplanned Shutdowns

Reduce

- Down time
- Maintenance Costs

Improve

- Asset Lifespan
- Revenue Streams

Case study

Customer: Refinery, Spain

Services: Vacuum column, ID=9.150m

Atmospheric column, ID=7.165m

Fractionator, ID=3.688m

Scope: Supply of new tower internals for debottlenecking

Dismantling of existing equipment (trays and packings)

Skim-gouging and surface preparation

Weld overlay of columns walls

Installation of new equipment (packings and associated internals)

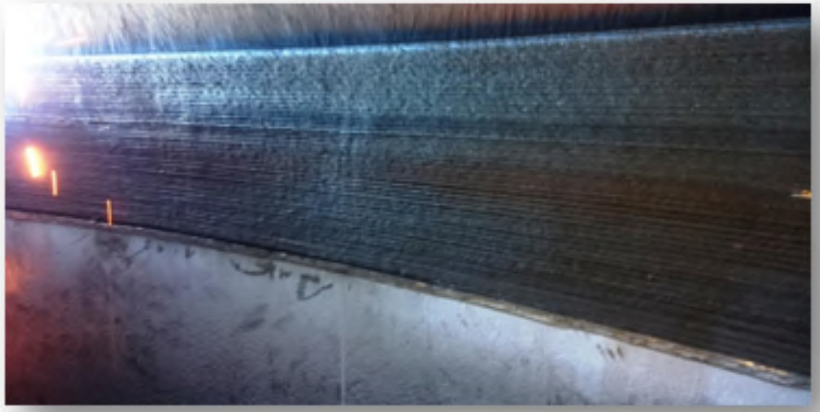
Case study

Time: Within regular refinery shut down, 25 days

Weld overlay took 2 weeks and was within time schedule also including additional scope generated during shut down

Cladded area: 110m2 in vacuum and atmospheric columns, local cladding of removed support rings

Sulzer supply: Weld overlay
Dismantling/installation
Hardware supply (column internals)



TFS
Technical Questions

Further discussions and clarification on technical requirements:

Thank You