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ESSC CLADDING OF ALLOY 825

Felguera Caldereria Pesada S.A., Spain

Felguera Caldereria Pesada (FCP) in Gijon is part of the Duro Felguera Group and specializes in the manufacture of (turnkey) equipment for chemical and petrochemical plants, power generation, mineral processing and handling, fuel storage plants and other installations for the oil & gas sector. It is internationally well-known as an important fabricator of pressure vessels and reactors.

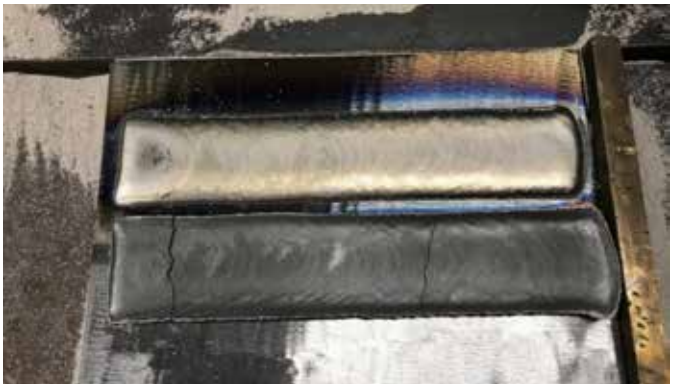
During 2016, the company faced difficulties in the purchasing of roll-bonded plate with Alloy 825 CRA cladding from its regular steel suppliers - needed for the construction of a number of heavy plate thickness reactors. It considered to produce the required amount of clad plate in-house, using its own electro slag strip cladding facilities, but needed a faster solution than the conventional strip/flux combination they were using at the time. UTP Maintenance received a request to develop a significantly more productive solution for the two layer cladding of Alloy 825 onto reactor vessel steel.

Tailor-made solution developed in time

UTP Maintenance had to cope with an unusually short period of time to develop, test and implement an innovative and productive ESSC solution that would help FCP to fabricate the reactors within the agreed delivery schedule. The full development consisted of the following steps:

- Development of a high-speed ESSC flux for the deposition of Alloy 825 in two thin layers
- Selection of Alloy 825 strip with the most adequate chemical composition
- Finding the optimal cladding parameters to guarantee FCP's chemical and productivity requirements
- Implementation of the new strip / flux combination on-site using FCP's equipment
- On-time delivery of the products

UTP Maintenance completed the project to the full satisfaction of FCP, enabling them to complete the reactors in time.



SOUDOTAPE 825H / RECORD 825H HS* - stable cladding process, flat beads and good slag detachability.

Technical masterpiece with superb performance. Increasing the cladding economy of the ESSC process through the consumables only – without any significant adaptation of existing cladding equipment – has often been tried for the very popular Alloy 825, but only with moderate results. The more remarkable it makes the successful development by UTP Maintenance of the new flux RECORD EST 825H HS.
The flux shows excellent process stability at cladding speeds in the range of 35 cm/min. at current settings as high as 2100 A (strip size 90 x 0.5 mm), combined with a high resistance to hot cracking. Its slag detachability is very good and the overlay beads are flat with smooth overlaps requiring minimal machining. The total thickness of the two-layer deposit is in the area of 7 mm. The flux is suited for the strip sizes 60 x 0.5 and 90 x 0.5 mm.
High speed cladding parameters go hand in hand with a higher dilution with the underlying base material. Reaching Alloy 825 composition in two layers with standard strip quality was therefore not feasible. It proved necessary to tighten the chemical analyses and perform a selection of heats. This led to the specification of a new strip in the UTP Maintenance range, SOUDOTAPE 825H.
The table below compares the economy of the conventional industry solution for ESSC with the new high speed strip / flux combination (90 x 0.5 mm size strip), showing a truly dramatic increase in cladding productivity.

Layer no.	Current (A)	Voltage (V)	Cladding speed (cm/min.)	Layer thickness	Deposition rate/100% duty cycle (kg/h)	Covered surface (m^2/h)
Conventional strip / flux combination for two-layer ESSC cladding of Alloy 825 (typical values)						
1	1500 - 1550	24	15	4.8	30	0.58
2	1500 - 1550	24	15	4.3		
New strip / flux combination: SOUDOTAPE 825H / RECORD 825H HS						
1	2050 - 2100	26	37	3.4	55	1.33
2	2050 - 2100	26	37	3.4		

The next table shows the building up of the chemical composition to reach Alloy 825 composition in the 2nd layer for the new strip / flux combination. The values for Si and Ti were agreed with the customer to be out of the scope of Alloy 825. Samples were also subjected to non-destructive testing and side bend tests.

Weight %	C	Si	Mn	Cr	Ni	Mo	Ti	Fe	Cu	Al	P	S	Other total
Alloy 825**	≤ 0.05	≤ 0.5	≤ 1.00	19.5-23.5	38.0-46.0	2.5-3.5	0.6-1.2	≥ 22.0	1.5-3.0	≤ 0.2	≤ 0.03	≤ 0.03	≤ 0.50
SOUDOTAPE 825H	0.015	0.3	0.7	21.8	Bal.	3.2	0.8	30.0	2.0				
1st layer	0.050	0.6	0.7	17.3	32.8	2.5	0.2	43.0	1.6				
2nd layer	0.030	0.7	0.6	20.9	39.5	3.1	0.3	31.9	1.9				

* Two layers deposit on carbon steel 0.18 % C. Preheat temperature: 80 °C, interpass temperature: 150 °C. Chemical analyses according ASTM A751 at 3 mm below top surface (2nd layer). PWHT: 840 min / 630 °C. NDT: dye penetrant examination, ultrasonic examination, side bend test.
** UNS N08825 /W.Nr. 2.4858

FELGUERA CALDERERIA PESADA S.A., SPAIN - ESSC CLADDING OF ALLOY 825

Project summary with customer benefits

FILLER MATERIALS, BASE MATERIALS AND WELD REQUIREMENTS

Filler material

ESSC Strip
SOUDOTAPE 825H
ASME II C SFA.5.14 EQ NiFeCr-1
ESSC Flux
RECORD 825H HS
EN 14174 (E) SA FB 2

Base materials

Reactor vessel steel

Weld types

Weld overlay Alloy 825

Additional cladding requirements

Alloy 825 composition guaranteed in two layers
Faster than conventional industry solution
High weld quality

CUSTOMER BENEFITS

» 130 % higher productivity in m^2/h than conventional industry solution
» Strip consumption 18 kg/m^2 lower than conventional industry solution
» Flat beads with smooth overlap requiring minimal machining of clad surface