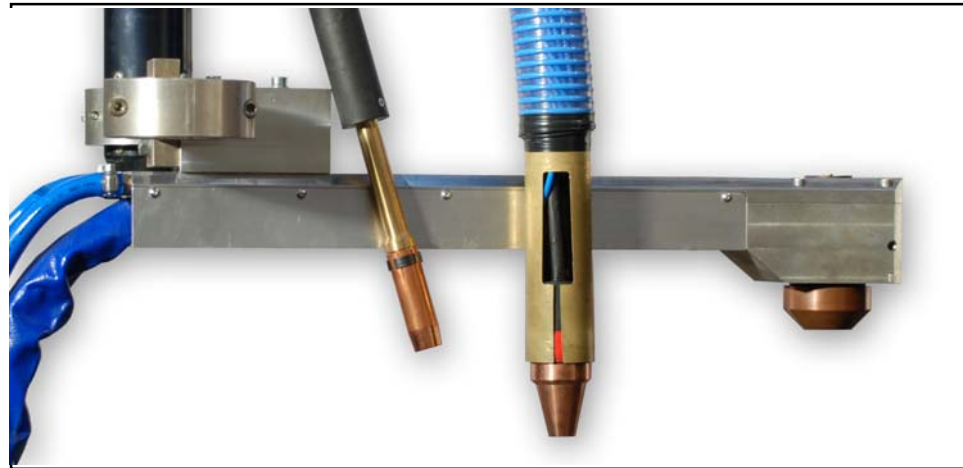


CONCLUSION

The results of the chemical analysis confirm the indisputable way in which the reduced dilution of the PTA powder process permits you to obtain a deposit with typical values of Inconel 625 even when welding a single layer only.



Ultrasound and liquid penetrant non destructive tests proved that there were no cracks, porosity and lack of fusion neither in the deposit nor in the welded coating and the base metal.

WELDING PARAMETERS FOR WELDING BALL VALVES

Base material	Fe 420
Valve size	16"
Welding consumable	KOY 625 P (53-150)
Preheat	50 - 80 °C:
Interpass	<200°C.
PWHT	None
As welded coating average thickness	3,5 mm
Penetration	10%
Oscillation width	mm 15
Deposit rate	3,60 Kg/h
Efficiency	95%
Dead time	10%
Faults	None

NB:
Parallel tests carried out with cobalt based grade 21 welding consumables resulted in similar dilution rates.

KOY 625



Chemical analysis of the KOY 625 P powder alloy used to carry out both coating of valves and control tests.

Elemento	%
Carbon	0,02
Nickel	Base
Chrome	21,30
Iron	1,00
Silicium	0,50
Manganese	0,40
Sulphur	0,004
Phosphorous	0,012
Molybdenum	8,70
Titanium	0,20
Cobalt	nn
Niobium	3,54
Alluminium	0,10

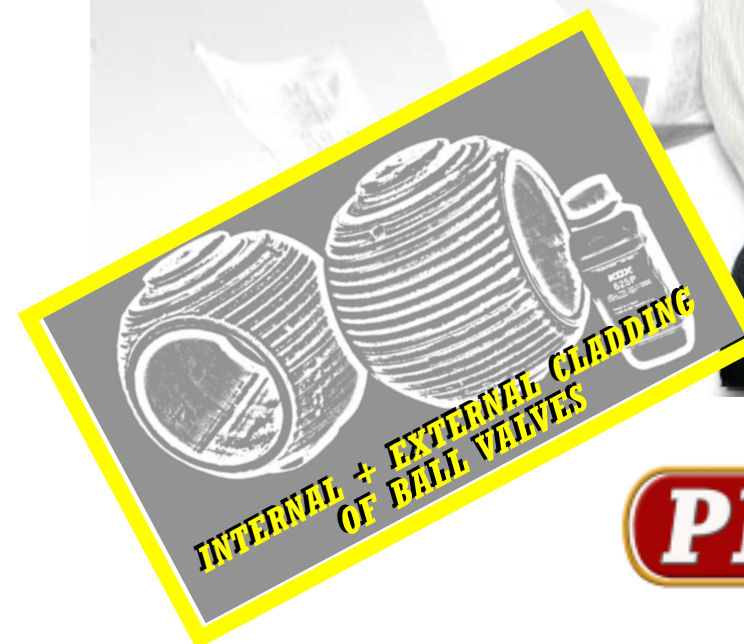
COMMERSALD IMPIANTI

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Tel.+39 059 822374 Fax 333099

LESS THAN 5% IRON IN THE FIRST LAYER

MAXIMUM RESPECT OF THE METALLURGICAL PROPERTIES



PLASMIG

COMMERSALD IMPIANTI

WHY ?

The need to improve the corrosion resistance properties of coatings on ball valves has progressively orientated the choice of engineering companies that work in the petrochemical field towards the superalloy type Inconel 625. More attentive technicians are also reconsidering welding processes and procedures to adapt them to new requirements. Frequently the chemical analysis tests on the coatings are carried out as per **API specifications**, at 1,6mm of the as welded part, sometimes at 3,0 mm. In both cases the deposit carried out with the traditional MIG (SMAW) and submerged arc (SAW) processes do not allow you to contain the iron content below 5% in the first layer, which is typical of the alloy 625 due to the high penetration of the base material. On the other hand, the coated welding on an only layer, besides drastically reducing the costs, also respects the metallurgical structure of the deposit far better due to the low heat input and therefore it is less subjected to micro-cracks and porosity. Commercald Impianti offers a highly trustworthy package.

- THREE HIGHLY TRUSTWORTHY PROCESSES

SOFT MIG

**PLASMA
POWDER**

TANDEM



- HIGH QUALITY WELDING CONSUMABLES WITH A LOW IRON CONTENT

- DEDICATED CARTESIAN HANDLING

We hereby describe the experiences had regarding ball valve coating with the Plasma powder process (PAW) reserving us the right to complete asap, a cycle of in depth tests with the Soft mig and tandem processes.

PROPERTIES OF THE NICKEL BASED SUPERALLOY TYPE INCONEL 625

This currently popular alloy has many properties that make it suitable for coating artefacts in the petrochemical industry, namely:

- High resistance to oxidation
- Maximum resistance to pitting and crevice corrosion especially in sea water areas;
- Optimum properties of resistance to mechanical stress.

In this amagnetic superalloy, the resistance to chemical agents and corrosion is guaranteed by the balanced content of Cr + Ni.

The chemical elements Ni + Mo, in this proportion, are suitable for resisting to non oxidising environments. The molybdenum content is perfect for defeating pitting phenomenae.

Niobium stabilises the alloy, preventing the formation of intercrystalline combinations that come about during welding processes.

PROBLEMS INVOLVED WELDING ALLOY 625 AND TRADITIONAL SAW -SMAW PROCESSES

It is compulsory that the delicate equilibrium of the chemical elements be in no way modified during the welding process if you want to maintain the optimum properties of this superalloy.

It is mainly the iron content coming from the base material, melted during the welding process, that has to be monitored carefully as it is the element which most easily doesn't stay within standards due to the inevitably elevated and inconstant dilution coming from the physical properties of the (SAW - GTAW) traditional welding processes.

The Inspection Authorities correctly require that hardfacing the Inconel 625 superalloy with the SAW and SMAW processes be carried out in 2 or 3 overlapping layers so that the Iron content comes within the foreseen acceptable limits. This obviously involves extra costs with respect to coating carried out in a single layer.

PTA POWDER COATING

The typicality of the Commercald PTA welding plants consists in penetration control of the base material through control of the temperature in the plasma arc. The temperature of the plasma arc varies between 10 000°C and 15 000°C in relation to the quantity of Argon gas injected through the plasma nozzle and ionised by the electric arc inside the nozzle.

Therefore, on the contrary to traditional processes, penetration is no longer tied to heat input deriving from amperage, voltage and arc distance, but it may be set independantly which allows you to work on the penetration of the base material with extreme precision and continuity.

The refinement of this technology and from the experience gained from hundreds of plants sold throughout the world, allows us to claim and guarantee absolute trustworthiness and continuity of the process.

WELDING TESTS

To confirm the am, we carried out a cycle of tests coating ball valves in our lab, and certified the chemical analysis values of the main elements obtained in a single layer and in a double layer, with the following results:

PARAMETERS USED FOR WELDING TESTS			
	Single layer		Double layer
Base material		Fe 420	
Size		100 x 100 x 200 mm	
Preparation		milling	
Preheat		none	
PWHT		none	
Layer sequency		side by side layers	
As welded average thickness	3,8 mm		6,4 mm
Machined coating thickness	3,0-1,6		5,0-3,0
Penetration		~ 10%	
Oscillation width		15 mm	

ELEMENT %	Iron	Chrome	Niobium	Molybdenum	Manganese	Nickel
TYPICAL ANALYSIS INCONEL 625	Min=0 Max=5,00	Min=20,00 Max=23,00	Min=3,15 Max=4,15	Min=8,00 Max=10,00	Min=0 Max=0,50	Base
ANALYSIS OF POWDER USED	1,00	21,30	3,54	8,70	0,40	Base
ONE LAYER at 1,6 mm	4,37	20,54	3,45	8,36	0,44	Base
ONE LAYER at 3 mm	3,66	20,58	3,49	8,42	0,45	Base
TWO LAYERS at 3 mm	3,02	20,79	3,58	8,49	0,44	Base
TWO LAYERS at 5 mm	2,09	21,02	3,57	8,63	0,49	Base

Tests were done by the MCP laboratory in Modena - Certified TUV - the rests were carried out with a fluorescent instrument type XRF port NITON XL1999