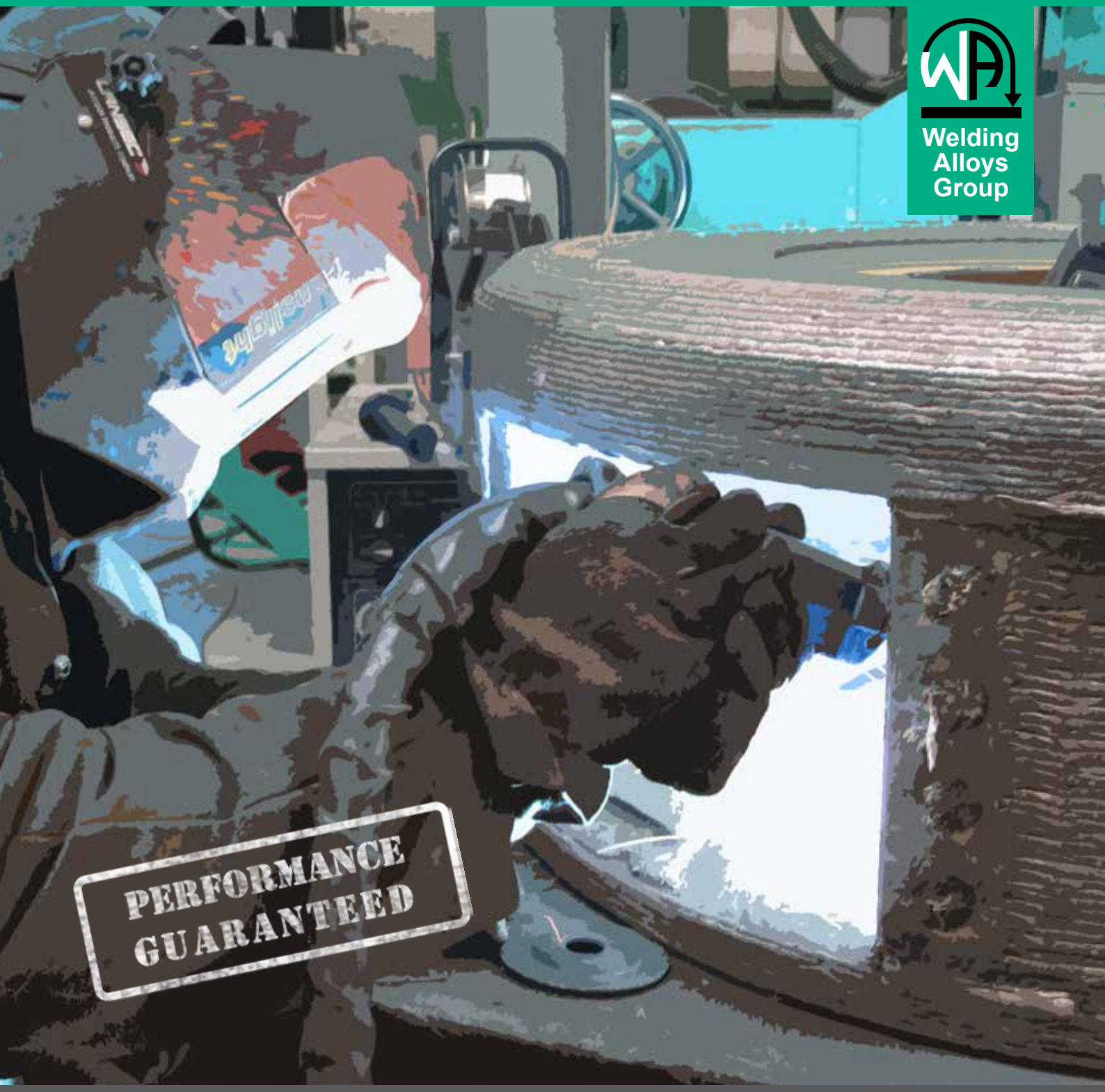


Welding Alloys Group

ACTING GLOBAL
WELDING LOCAL

WA Cored Wires

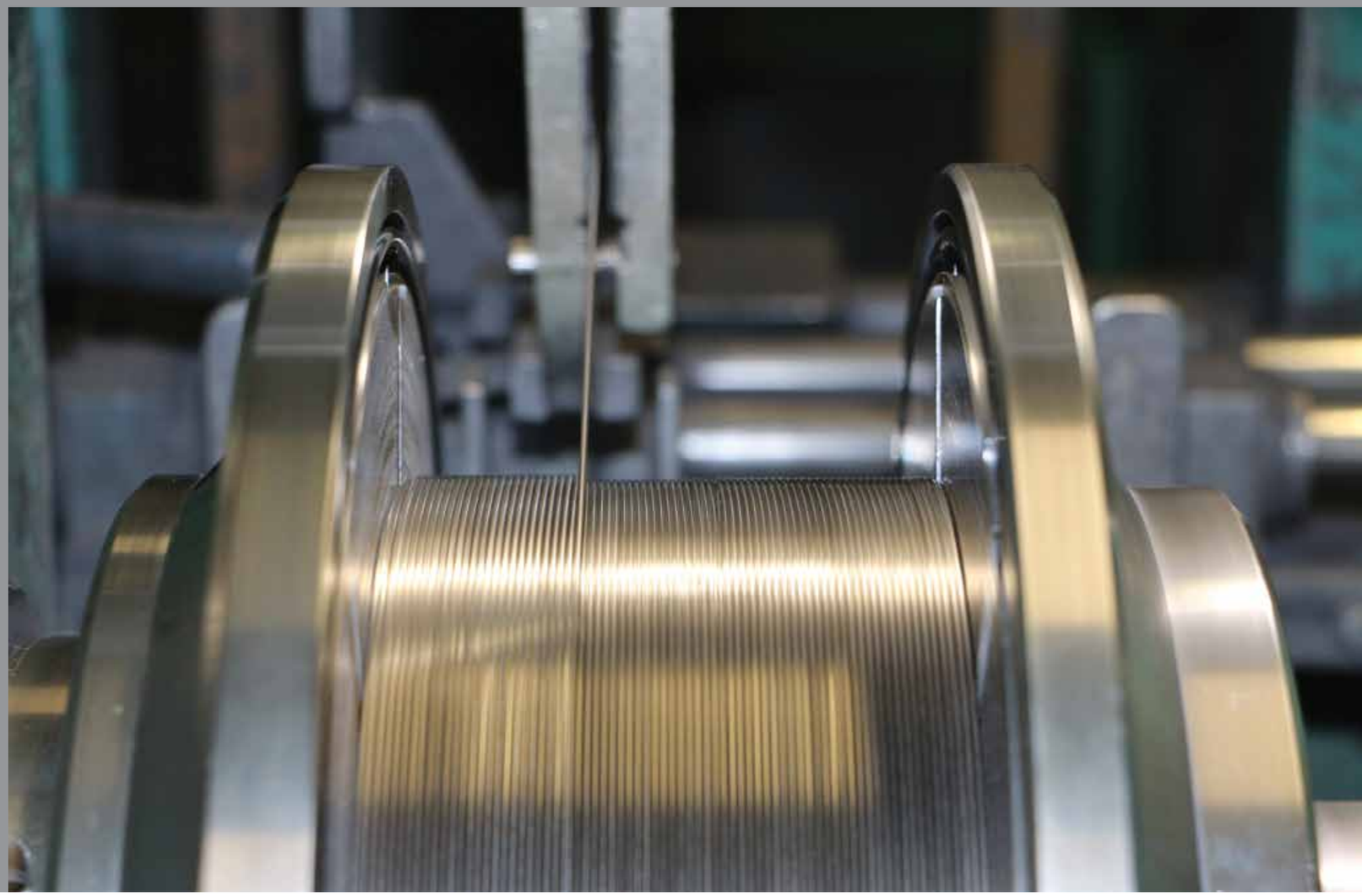
Hardfacing

Cladding - Weld overlay - Surfacing

Welding Alloys Group

This catalogue presents a selection of standard products for hardfacing, cladding and thermal arc spraying applications. Welding Alloys cored wires for joining applications feature in a separate catalogue. We will gladly examine any special request. Please do not hesitate to consult us.

Our technical ‘spark’ solves your industrial challenges



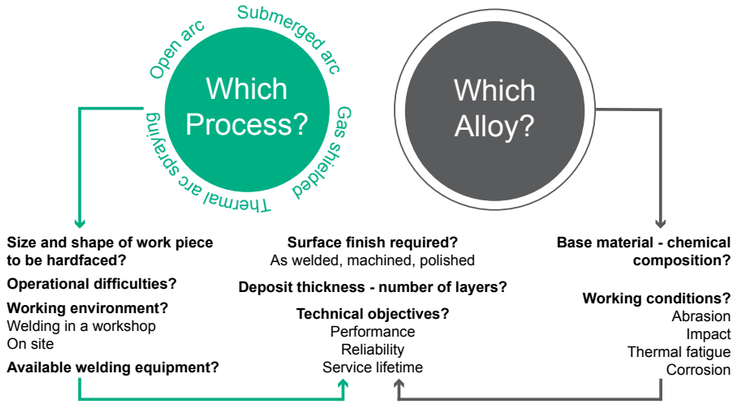
Since its foundation in 1966, the Welding Alloys Group, an independent group, has specialised in the manufacture of cored welding wires for joining, cladding and hardfacing applications – 100% produced in our modern factories – 100% our own technology.

Performance and quality criteria are becoming ever more stringent and require ever more complex materials. Shortages of raw materials are leading increasingly to the development of composite components, with surfacing provided by the hardfacing method, using sophisticated alloys. Welding Alloys Group are proud to bring ground-breaking hardfacing technology to our customers.

Welding Alloys performance guarantee means we will always recommend the product and service best suited to our customers’ applications.

Contents

Definitions and using this catalogue



Understanding wear phenomena and material attributes

Wear mechanism	Description
Metal / metal friction	Metal surfaces in relative motion forced into contact with or without lubricant. Degradation by the formation of micro-welds between the contacting surfaces.
Mineral abrasion	Wear by relative movement of mineral particles of suitable hardness, shape and texture to remove material from the metal surface.
Abrasion under pressure	Wear by relative movement under pressure of mineral particles of suitable hardness, shape and texture to remove material from the metal surface, leaving superficial deformation.
Hot abrasion	As above but in a high-temperature environment, leading generally to softening of the metal or its constituents.
Erosion	Repeated high-speed impacts between mineral particles and a material surface. Local destruction by tearing out of metallic grains.
Cavitation	Tearing out of grains from the metal surface by the formation and implosion of bubbles in a liquid in rapid motion.
Impact	Impact between two materials, one of which provokes deformation or rupture of the surface of the other. This phenomenon is controlled by the toughness or ductility of the two materials.
Mechanical fatigue	Cyclic deformation not exceeding the elastic limit of the material. Degradation over time by localised stress concentrations.
Thermal fatigue	Cyclic exposure to high temperatures leading to permanent deformation by alternate expansion and contraction. Alteration of the structure and properties of the material.
Hot oxidation	Creation of a poorly adhering oxide layer that reforms constantly. Degradation by loss of material thickness.
Corrosion	Degradation of the material by chemical reaction with its environment. Complex phenomenon involving numerous parameters.

Attributes	Description
Rebuilding or cladding	Repair by resurfacing to the original or specified dimensions. Application of a corrosion-resistant protective cladding.
Buffer layer or assembly	Layer of weld metal providing a good metallurgical transition between the base metal and the coating. For welded joints between similar or dissimilar materials.
Cutting ability	Ability of the material to resist impact, heat, friction and abrasion simultaneously for edge retention of cutting tools.
Work-hardening	Ability of a material to increase its surface hardness under the effect of impact or high pressure. In general, this increases wear resistance.
Machinability	Suitability for machining by removal of metal shavings, e.g. turning, milling or drilling.

Chemical composition

Each alloy is composed of elements expressed as percentages by weight. The values of those elements essential to the physical, chemical and mechanical properties of the deposit are highlighted in the composition tables.

Example:

Product Name	Composition [%]			
	C	Mn	Si	Cr
HARDFACE AP	0.40	**16.0**	0.50	**14.0**

Cored wires

Hardfacing by arc welding is a surfacing operation to extend the service life of industrial components, preemptively on new components, or as part of a maintenance programme. The result of significant savings in machine downtime and production costs has meant that this process has been adopted across many industries.

For each industrial application and wear phenomena, there is a Welding Alloys cored welding wire to provide wear resistance. Due to the unrivalled flexibility and ease of application, cored wires are used in many situations – in workshops, on site, for new parts or for repair.

An alloy may be deposited by various welding methods:

- Open arc welding (O)
- Gas shielded welding MIG/MAG (G)
- Submerged arc welding (S)
- Thermal spraying (as shown by the symbol)

Welding Alloys Quality Control teams are an integral part of the production process at all our production sites, to ensure our continued commitment to delivering high quality, standard-setting welding consumables.

The go-to provider of advanced welding consumables

Hardfacing - Work-hardening manganese alloys

Shielding Gas and Flux Recommendations

- **HARDFACE** (a cored wire with a seam) the recommended shielding gas is
  M21: Argon + 15-25% CO_2

- **ROBODUR / ROBOTOOL** (a seamless cored wire) the recommended shielding gases are
  M12: Argon + 0.5-5% CO_2
  M13: Argon + 0.5-3% O_2
  M21: Argon + 15-25% CO_2

- A **neutral flux** is required for submerged arc welding

Product Name	Composition [%] - Fe balance					Hardness - 3 layers	
	C	Mn	Si	Cr	Ni	as welded	work hardened
HARDFACE 19 9 6	0.10	**6.00**	0.50	**19.0**	**9.00**	180 HB	47 HRC
HARDFACE AP	0.40	**16.0**	0.50	**14.0**		240 HB	48 HRC
HARDFACE NM14	1.00	**14.0**	0.50			200 HB	46 HRC

Product Name	Process O: open arc G: gas-shielded S: sub-arc	Standard diameters [mm]	EN 14700 standard	Metal / Metal friction	Mineral abrasion	Abrasion under pressure	Hot abrasion	Erosion	Cavitation	Impact	Mechanical fatigue	Thermal fatigue	Hot oxidation	Corrosion	Rebuilding or cladding	Buffer layer or assembly	Cutting ability	Work-hardening	Machinability	Description and applications
HARDFACE 19 9 6	O	1.2 to 2.8	T Fe10	◆◆					◆	◆				◆		◆◆		◆◆	◆	• **Highly resistant to cracking** - austenitic structure that work-hardens strongly • Wide field of application: buffer layer before hardfacing, assembly of wear plates and armouring, and of manganese steels and dissimilar joints
	G	1.2 to 2.4																		
	S	2.4 to 3.2																		
HARDFACE AP	O	1.2 to 2.8	T Fe9	◆					◆	◆◆						◆◆		◆◆	◆	• **High rate of work-hardening** • Non-magnetic deposit strongly resistant to impact and high pressure • Rebuilding, buffer layers and assembly of manganese steels • Buffer layer before hardfacing with chromium cast iron • Applications: repair work on railway frogs and crossings, hammers, bars, cones and jaws for crushers
	G	1.2 to 2.4																		
	S	2.4 to 3.2																		
HARDFACE NM14	O	1.2 to 2.6	T Fe9	◆◆					◆	◆◆	◆				◆◆	◆		◆◆	◆	• **Colour and structure of the deposit similar to Hadfield type manganese steel** • Applications: for retouching of casting imperfections
	G	1.2 to 2.4																		

Suited to thermal arc spraying ◆ Suitable ◆◆ Highly suitable

Hardfacing - Low and medium alloys

Product Name	Composition [%] - Fe balance						Hardness 3 layers as welded
	C	Mn	Si	Cr	Mo	V	
HARDFACE B	**0.10**	1.50	0.40	**1.00**			260 HB
HARDFACE T	**0.15**	1.50	0.80	**1.50**			360 HB
HARDFACE P	**0.20**	2.00	0.80	**3.00**			400 HB
HARDFACE L	**0.50**	1.50	**2.50**	**8.50**			650 HB
ROBODUR K 250	**0.10**	1.50	0.70	**1.50**	**0.20**		250 HB
ROBODUR K 350	**0.15**	1.50	0.70	**2.00**	**0.50**		350 HB
ROBODUR K 450	**0.40**	1.50	0.70	**2.50**	**0.50**		450 HB
ROBODUR K 600	**0.50**	1.20	0.70	**6.00**	**0.70**		600 HB
ROBODUR K 650	**0.50**	1.30	1.30	**5.60**	**1.30**	**0.30**	650 HB
ROBODUR K CERAMIC	**0.35**	0.70	2.50	**9.50**			55 - 60 HRC

HARDFACE – ROBODUR: for a description of shielding gas and flux recommendations – see page 6

Product Name	Process O: open arc G: gas-shielded S: sub-arc	Standard diameters [mm]	EN 14700 standard	Metal / Metal friction	Mineral abrasion	Abrasion under pressure	Hot abrasion	Erosion	Cavitation	Impact	Mechanical fatigue	Thermal fatigue	Hot oxidation	Corrosion	Rebuilding or cladding	Buffer layer or assembly	Cutting ability	Work-hardening	Machinability	Description and applications
HARDFACE B	O	1.2 to 2.8	T Fe1	◆							◆				◆◆	◆◆			◆◆	• Crack-resistant deposit • **Repair, rebuilding and buffering of castings** • Automated welding of large parts, semi-automated welding for outdoor use • Applications: shafts, rollers, wheels, etc. in the mining and civil engineering industries
	S	2.4 to 3.4																		
HARDFACE T	O	1.2 to 3.2	T Fe1	◆							◆				◆◆	◆◆			◆◆	
	S	2.4 to 3.2																		
HARDFACE P	O	1.2 to 2.8	T Fe1	◆							◆				◆◆	◆◆			◆◆	
	S	2.4 to 3.2																		
HARDFACE L	O	1.2 to 2.8	T Fe8	◆	◆					◆							◆			• **Self-tempering deposit for hardfacing** • Wide field of application in the mining and civil engineering industries: bucket teeth and blades, slides, conveyor screws, etc.
	S	2.4 to 3.2																		
ROBODUR K 250	G	1.0 to 1.6	T Fe1	◆							◆◆				◆◆	◆◆			◆◆	• **Seamless copper coated tubular wires for gas-shielded welding** • Excellent weldability • Rebuilding and buffering of forged or rolled mechanical components: transmission shafts, rolls or chocks for steel making, roller bearing seats, rollers for gantry cranes, gear teeth, forging tools and dies
ROBODUR K 350	G	1.0 to 1.6	T Fe1	◆							◆◆				◆◆	◆◆			◆◆	
ROBODUR K 450	G	1.0 to 1.6	T Fe2	◆							◆◆				◆◆	◆◆			◆◆	
ROBODUR K 600	G	1.0 to 1.6	T Fe2	◆	◆					◆	◆						◆			• **Seamless copper coated tubular wires for gas-shielded welding** • Retains a high hardness level to 400°C • Excellent weldability • Hardfacing applications for all industries: seats, cams, raceways, press and transport screws • ROBODUR K CERAMIC is particularly suited for hardfacing new or worn ceramic molds thanks to the higher hardness level achieved from the first layer
ROBODUR K 650	G	1.0 to 1.6	T Fe8	◆	◆					◆	◆									
ROBODUR K CERAMIC	G	1.0 to 1.6	T Fe8	◆	◆					◆	◆									

Suited to thermal arc spraying ◆ Suitable ◆◆ Highly suitable

Hardfacing - Heat treated steels for tooling

Product Name	Composition [%] - Fe balance							Hardness 3 layers as welded
	C	Mn	Si	Cr	Mo	V	Others	
HARDFACE WLC	0.25	2.00	0.80	**6.50**	**1.50**		**W: 1.50**	44 HRC
HARDFACE W	0.50	2.00	0.80	**6.50**	**1.50**		**W: 1.50**	55 HRC
HARDFACE VMOLC	0.08	1.00	0.90	**10.0**	**2.40**		Ni: 1.80	36 HRC
HARDFACE WM	0.30	0.30	0.40	**2.40**		**0.60**	**W: 4.00** **Ni: 0.20**	45 HRC
HARDFACE WMOLC	0.30	0.80	0.60	**6.50**	**2.00**	**0.60**	**W: 2.00**	52 HRC
ROBOTOOL 46	0.20	1.00	0.60	**5.00**	**4.00**		Ti: 0.30	42 - 45 HRC
ROBOTOOL 47	0.20	1.00	0.60	**6.00**	**4.00**		Ti: 0.30	40 - 42 HRC
ROBOTOOL 58	0.37	1.40	0.60	**7.00**	**2.50**		Ti: 0.30	54 - 58 HRC
HARDFACE AR	1.10	0.40	0.25	**5.00**	**7.60**	**1.10**	**W: 2.20**	60 HRC
HARDFACE DCO	0.15	0.40	0.70	**14.0**	**2.50**		**Ni: 0.50** **Co: 12.5**	47 HRC

HARDFACE – ROBOTOOL: for a description of shielding gas and flux recommendations – see page 6

Product Name	Process O: open arc G: gas-shielded S: sub-arc	Standard diameters [mm]	EN 14700 standard	Metal / Metal friction	Mineral abrasion	Abrasion under pressure	Hot abrasion	Erosion	Cavitation	Impact	Mechanical fatigue	Thermal fatigue	Hot oxidation	Corrosion	Rebuilding or cladding	Buffer layer or assembly	Cutting ability	Work-hardening	Machinability	Description and applications
HARDFACE WLC	O	1.2 to 2.8	T Fe3	◆						◆◆	◆	◆	◆		◆◆	◆◆	◆		◆◆	• **Low cracking sensitivity** • Specially developed for rebuilding and buffering on very large components and alloyed steels • Applications: mill rolls, bells and hopper seats in blast furnaces, moulds for light alloys, forging tooling, etc.
	G	1.2 to 2.4																		
	S	2.4 to 3.2																		
HARDFACE W	O	1.2 to 2.8	T Fe3	◆			◆			◆	◆	◆	◆				◆◆		◆	• **Hard deposit (55 HRC) that keeps its properties over long periods of exposure up to 500°C**
	G	1.2 to 2.4																		
	S	2.4 to 3.2																		
HARDFACE VMOLC	G	1.2 to 2.8	T ZFe3	◆						◆	◆◆	◆◆	◆		◆◆		◆◆		◆◆	• Resists thermal fatigue and high pressure • **Deposit can be polished** • Applications: moulds for moulded glass or for pressure casting of light alloys and impact forging tools
HARDFACE WM	G	1.2 to 2.4	T Fe3	◆						◆◆	◆◆	◆◆	◆		◆◆		◆◆		◆◆	• **Medium hardness deposit (46 HRC)** offering exceptional oxidation resistance and hot toughness up to 600°C • As-welded hardness may be increased by tempering
HARDFACE WMOLC	G	1.2 to 2.8	T Fe3	◆						◆	◆◆	◆◆	◆		◆◆		◆◆		◆	• **Hard deposit (52 HRC)** offering exceptional oxidation resistance and hot toughness up to 600°C • A suitable heat treatment enables hardnesses up to 57 HRC to be reached • Applications: press tooling
ROBOTOOL 46	G	1.2 to 1.6	T Fe3	◆						◆	◆	◆	◆		◆◆		◆◆		◆	• Seamless copper coated tubular wires for gas-shielded welding • Tough deposits with increasing hardness for touching up and repair of hot and cold working tooling • Can be heat treated by oil quenching and tempering (40, 46 and 58 HRC) • Applications: plastic injection screws and moulds for polymers
ROBOTOOL 47	G	1.2 to 1.6	T Fe3	◆						◆	◆	◆	◆				◆◆		◆	
ROBOTOOL 58	G	1.2 to 1.6	T Fe3	◆						◆	◆	◆	◆				◆◆		◆	
HARDFACE AR	G	1.2 to 2.4	T ZFe4	◆◆		◆	◆			◆◆		◆◆	◆				◆◆		◆	• Seamless copper coated tubular wire giving a tough high speed steel deposit • **Exceptional wear resistance in cold cutting operations** • Keeps its properties to 600°C (hardness may be increased to ~65 HRC by tempering) • Hardfacing of parts subject to metal-to-metal wear under moderate impact: machining tools, cold shearing blades, milling cutters, knives and wire guides
HARDFACE DCO	O	1.6 to 2.4	T ZFe3	◆◆			◆	◆	◆	◆		◆◆	◆◆	◆			◆◆	◆	◆	• **Superalloy offering similar performance to cobalt based alloys** • High cracking resistance little affected by dilution, highly resistant to thermal shock, may be polished and keeps its properties to 550°C • Applications: traction rollers in continuous casting installations, valves for diesel engines, steam valves, deburring stamps and dies, moulds for ceramic tiles, screws for filled plastic
	G	1.2 to 2.4																		
	S	2.4 to 3.2																		

- **Heat treatable self-hardening deposits** - range of products designed for the construction and repair of hot working tooling: forging, stamping and deburring dies
- Tooling for hot shearing, punches, inserts
- Product selection depending on the deposit hardness required, the welding technique and the base material
- Use HARDFACE WLC for rebuilding or buffering

Suited to thermal arc spraying ◆ Suitable ◆◆ Highly suitable

Product Name	Composition [%] - Fe balance							Hardness	
	C	Mn	Si	Cr	Mo	Nb	Others	3 layers as welded	Hard phases [micro-hardness HV]
HARDFACE BN	0.50	2.00	1.30				Ni: 2.00 B: 4.50	65 HRC	2100 - 3300
HARDFACE BNC	2.50	2.00	0.60	11.5		5.00	B: 2.20	67 HRC	1350 - 3300
HARDFACE NCWB	1.10	0.80	0.80	22.0	3.50	3.50	W: 6.00	66 HRC	950 - 1450
HARDFACE HC	5.00	1.50	1.50	27.0				61 HRC	950 - 1450
HARDFACE CN	5.00	0.50	1.00	22.0		7.00		63 HRC	950 - 2000
HARDFACE CV	5.50	0.50	1.00	22.0	3.00	6.00	W: 1.00 V: 0.40	64 HRC	950 - 2900
HARDFACE CNV	5.50	0.50	1.50	22.0	5.50	6.00	W: 2.00 V: 1.00	65 HRC	950 - 2900
HARDFACE DIAMOND	> 5	0.20	1.20	> 10		+	V	63 HRC	950 - 2900

HARDFACE – ROBODUR: for a description of shielding gas and flux recommendations – see page 6

Product Name	Process O: open arc G: gas-shielded S: sub-arc	Standard diameters [mm]	EN 14700 standard	Metal / Metal friction	Mineral abrasion	Abrasion under pressure	Hot abrasion	Erosion	Cavitation	Impact	Mechanical fatigue	Thermal fatigue	Hot oxidation	Corrosion	Rebuilding or cladding	Buffer layer or assembly	Cutting ability	Work-hardening	Machinability	Description and applications
Low impact																				
HARDFACE BN	O	1.2 to 2.8	T ZFe13		◆◆			◆◆												• Ultra-hard single layer deposit designed to resist pure abrasion - for welding on unalloyed steels with C < 0.5% • Good weldability in the horizontal vertical position (PC) for the diameter 1.2 mm • Applications: equipment used in agriculture, quarrying, mining and civil engineering. Examples: screw conveyors, hoppers, strimmer cutters, etc.
HARDFACE BNC	O	1.2 to 3.2	T ZFe		◆◆		◆◆	◆◆												• Ultra-hard deposit offering extremely high resistance to abrasion under high stresses and moderate impacts • Contains boron carbides of extreme hardness • Applications: screw conveyors, riddles for hot materials, fans, crushers, etc.
HARDFACE NCWB	G O	1.6 to 2.4	T ZFe8		◆◆		◆◆	◆◆												• Ultra-hard deposit offering highest resistance to abrasion • Applications: screw conveyors, fans, equipment used in agriculture and mining
Moderate impact																				
HARDFACE HC	🔫 O	1.2 to 3.2	T Fe15		◆◆	◆◆		◆												• Highly abrasion resistant chromium carbide deposit • Combination of primary and eutectic chromium carbides in a tough matrix • Applications: design of high performance composite parts such as wear plates, mineral conveying equipment, dredger pumps, mixers and riddle plates
HARDFACE CN	O	1.6 to 3.2	T Fe15		◆◆	◆◆	◆	◆												• High concentration of niobium and chromium carbides • Very good wear resistance to fine abrasive particles of high hardness • Applications: vertical crushers, armouring of conveyors for coal, clinker and glass
HARDFACE CV	O	1.6 to 3.2	T Fe16		◆◆	◆◆	◆◆	◆												• Highly-alloyed chromium carbide based deposit with a high concentration of complex carbides • Resistant to combined abrasion and impact at high temperatures • Applications: thick deposits for sinter processing in steel-making - e.g. drop zones, sinter stars, sinter bars, thermal treatment of metal ores
HARDFACE CNV	O	1.6 to 3.2	T Fe16		◆◆	◆◆	◆◆	◆◆												• Highly-alloyed chromium cast iron with a high concentration of complex carbides • Resists combined abrasion and impact at high temperatures - the properties are reached in only three layers • Applications: riddling, blast furnace hoppers, extractor fans
HARDFACE DIAMOND	O	1.6 to 3.2	T Fe16		◆◆	◆◆	◆◆	◆◆												• Highly-alloyed chromium cast iron with a high concentration of complex carbides • Outstanding abrasion resistance • Applications: grinding mills, vertical mills, screws, blades, ventilators

🔫 Suited to thermal arc spraying ◆ Suitable ◆◆ Highly suitable

Hardfacing - Anti-abrasion

Product Name	Composition [%] - Fe balance						Hardness	
	C	Mn	Si	Cr	V	Others	3 layers as welded	Hard phases [micro-hardness HV]
HARDFACE STEELCARBW	Composite deposit containing tungsten carbide particles in a steel matrix					WC : 50 to 60 according to Ø	60 HRC*	950 - 2000
HARDFACE STAINCARBW	Composite deposit containing tungsten carbide particles in a stainless steel matrix					WC : 50 to 60 according to Ø	52 - 62 HRC*	2000 - 2500
HARDFACE NICARBW	Composite deposit containing tungsten carbide particles in a nickel-boron-silicon matrix					WC : 50 to 60 according to Ø	52 - 62 HRC*	2000 - 2500
HARDFACE TIC	**1.80**	1.20	0.80	**6.50**	0.20	Mo : 0.80 Ti: 5.00	57 HRC	950 - 3200
HARDFACE TICM	**1.60**	1.20	0.90	**7.00**	0.20	Mo : 1.10 Ti: 5.00	59 HRC	950 - 3200
HARDFACE 168NB	**1.3**	1.00	1.00	**6.00**		Nb : 8.5 Ti: 0.2	58 HRC	950 - 3200

* Hardness Matrix

HARDFACE – ROBODUR: for a description of shielding gas and flux recommendations – see page 6

Product Name	Process O: open arc G: gas-shielded S: sub-arc	Standard diameters [mm]	EN 14700 standard	Metal / Metal friction	Mineral abrasion	Abrasion under pressure	Hot abrasion	Erosion	Cavitation	Impact	Mechanical fatigue	Thermal fatigue	Hot oxidation	Corrosion	Rebuilding or cladding	Buffer layer or assembly	Cutting ability	Work-hardening	Machinability	Description and applications
Moderate impact (continued)																				
HARDFACE STEELCARBW	O	1.6 to 2.8	T Fe20		◆◆			◆												• Composite wire filled with carbide particles • **Fine tungsten carbide grains embedded in a martensitic matrix** • Extreme resistance to abrasives, especially fine-grained - e.g. dust extractor fans in the mining, cement and steel industries, scrapper blades, components for agriculture, etc.
HARDFACE STAINCARBW	G	1.6 to 2.8	T Fe20		◆◆		◆◆	◆◆						◆						• Composite wire filled with carbide particles • **Tungsten carbide grains embedded in a soft corrosion resistant matrix** • The surface roughens slightly under the effects of wear, which protects the deposit from attack by coarser particles • Applications: mixers, beaters, helices, screw-flights, hardfacing in corrosive environments, brick and tile industry
HARDFACE NICARBW	G	1.6 to 2.8	T Ni20		◆◆		◆◆	◆◆						◆◆						• Composite wire filled with carbide particles • **Tungsten carbide grains embedded in a corrosion resistant nickel-based matrix** • The surface roughens slightly under the effects of wear, which protects the deposit from attack by coarser particles • Applications: drilling, food processing, chemical, fertilizer and rubber industries
High impact																				
HARDFACE TIC	O/G	1.2 to 2.8	T Fe8		◆◆	◆◆		◆		◆◆	◆									• Tubular wire containing extremely hard, finely dispersed titanium carbides • **Ideal solution for combined resistance to abrasion, high pressure and impact** • Exceptional weldability and ease of application • Applications: crushing of hard materials, shredders, asphalt kneaders, vertical shaft impact crusher rotors, roller presses
HARDFACE TICM	O/G	1.2 to 2.8	T Fe8		◆◆	◆◆		◆		◆◆	◆									• Metal cored wire with high recovery • Exceptional weldability • Contains extremely hard, finely dispersed titanium carbides • Ideal solution for combined resistance to abrasion, high pressure and impact • Applications: crushing of hard materials, shredders, asphalt kneaders, vertical shaft impact crusher rotors, roller presses
HARDFACE 168NB	O	1.6 to 2.8	T Fe8		◆◆	◆◆		◆		◆◆	◆									• Tubular wire for self shielded metal arc welding, designed for hardfacing of items subjected to impact, gouging and abrasion under high stresses • **Gives a highly abrasion-resistant, crack-free deposit which may be machined despite its high hardness** • Suitable for multi-layer deposits • Applications: crushing hammers and roller press, leading edges, teeth of excavator buckets and bulldozer blades, crusher cones

Suited to thermal arc spraying ◆ Suitable ◆◆ Highly suitable

Hardfacing - Ferritic and martensitic stainless steels

Shielding Gas and Flux Recommendations

- **CHROMECORE** the recommended shielding gases are
  M12: Argon + 0.5-5% CO_2
  M13: Argon + 0.5-3% CO_2
  M21: Argon + 15-25% CO_2
  I1: 100% Argon

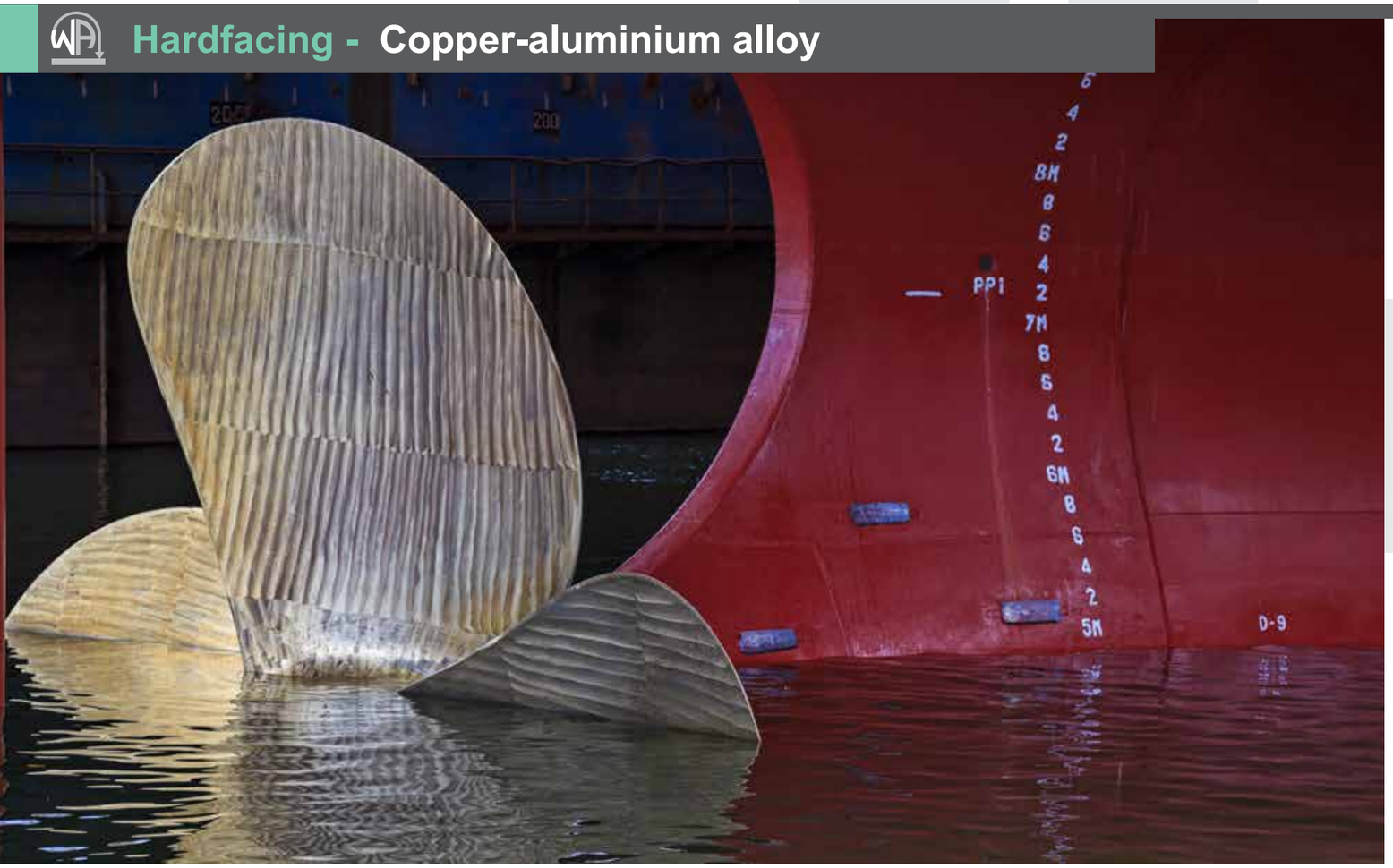
- A **neutral flux** is required for submerged arc welding

Product Name	Composition [%] - Fe balance										Hardness 3 layers as welded
	C	Mn	Si	Cr	Ni	Mo	W	V	Co	N	
CHROMECORE 430	0.05	1.00	0.80	17.5							220 HB
CHROMECORE 410	0.08	1.20	0.80	12.5							42 HRC
CHROMECORE 414	0.05	1.20	1.00	13.5	4.00	0.50					38 HRC
CHROMECORE 414N	0.08	1.00	0.60	13.5	4.30	0.50				0.10	42 HRC
CHROMECORE 414DN	0.04	1.50	0.70	13.0	5.00	0.50	0.80	0.50	0.20	0.07	40 HRC
CHROMECORE 414MM	0.15	1.20	0.50	12.3	2.20	1.20		0.20			43 - 47 HRC
CHROMECORE 414COILER	0.30	1.00	0.70	13.0	1.20	0.60	0.30				50 - 54 HRC
CHROMECORE 420	0.30	0.80	0.60	13.0							50 HRC

Product Name	Process O: open arc G: gas-shielded S: sub-arc	Standard diameters [mm]	EN 14700 standard	Metal / Metal friction	Mineral abrasion	Abrasion under pressure	Hot abrasion	Erosion	Cavitation	Impact	Mechanical fatigue	Thermal fatigue	Hot oxidation	Corrosion	Rebuilding or cladding	Buffer layer or assembly	Cutting ability	Work-hardening	Machinability	Description and applications
CHROMECORE 430	O	1.2 to 2.8	T Fe7	◆◆					◆		◆◆	◆◆	◆	◆	◆◆	◆◆			◆◆	• 17% chromium ferritic stainless steel deposit • Optimum combination of corrosion, frictional wear and temperature resistance • Resists sea water and dilute organic acids • Can be polished • Applications: anti-corrosion coatings or buffer layer before martensitic stainless steel coatings - e.g. continuous casting rolls, valve seats, shafts, pump bodies and rotors
	G	1.2 to 2.4																		
	S	2.4 to 3.2																		
CHROMECORE 410	O	1.2 to 2.8	T Fe7	◆◆				◆	◆	◆	◆◆	◆◆	◆	◆	◆◆				◆	• 13% chromium martensitic stainless steel deposit • Resists wear by friction, erosion, corrosion and thermal fatigue • Can be polished • Applications: continuous casting rolls, tooling for moulded glass, valves for steam and petroleum
	G	1.2 to 2.4																		
	S	2.4 to 3.2																		
CHROMECORE 414	O	1.6 to 2.8	T Fe7	◆◆				◆	◆	◆	◆◆	◆◆	◆	◆	◆◆				◆◆	• Soft martensitic stainless steel deposit • Resists thermal fatigue, corrosion and frictional wear • Homogeneous deposit structure with controlled ferrite content • Applications: hardfacing of continuous casting rolls, pulleys and rolls for port and waterway installations, hydraulic rams
	G	1.2 to 2.4																		
	S	2.4 to 3.2																		
CHROMECORE 414N	O	1.6 to 2.8	T ZFe7	◆◆				◆	◆	◆	◆◆	◆◆	◆	◆					◆◆	• Nitrogen-containing martensitic stainless steel weld deposit • Resists corrosion, wear, galling and thermal fatigue • Applications: continuous casting rolls, hot-rolling mills, steam turbines, valve seats • Hardfacing for use at elevated temperatures and corrosive environments
	S	2.4 to 3.2																		
CHROMECORE 414DN	O	1.6 to 2.8	T ZFe7	◆◆				◆	◆	◆	◆◆	◆◆	◆	◆◆					◆◆	• Resists thermal shock, rubbing abrasion and corrosion • Applications: Continuous casting rolls, hot rolling mills, steam turbine components, valve seats, valve gates, valve wedges, safety valves
	S	2.4 to 3.2																		
CHROMECORE 414MM	G	1.2 to 2.4	T Fe7	◆◆				◆	◆	◆	◆◆	◆◆	◆	◆					◆	• Hard ferritic-martensitic stainless steel deposit alloyed with Ni and Mo • Resists corrosion, wear, galling and thermal fatigue • Extensively used as a cladding alloy for rebuilding steel mill rolls subjected to repetitive thermal stresses, corrosion and metal-to-metal wear • Applications: cladding of continuous casting rolls and certain rolls used in hot rolling applications
	S	2.4 to 3.2																		
CHROMECORE 414COILER	S	2.4 to 3.2	T Fe7	◆◆				◆	◆	◆	◆◆	◆◆	◆	◆					◆	• High-carbon ferritic-martensitic stainless steel deposit alloyed with nickel, molybdenum and tungsten • Resists thermal fatigue and galling • Applications: hardfacing of hot strip mill rolls, pinch rolls, wrapper rolls, leveller rolls
CHROMECORE 420	O	1.6 to 2.8	T Fe8	◆◆				◆			◆◆	◆◆	◆	◆	◆				◆	• Hard martensitic stainless steel deposit • Resists frictional wear • Applications: mechanical components suffering atmospheric corrosion, rolling mill guides, static brakes for railway marshalling yards
	G	1.2 to 2.4																		
	S	2.4 to 3.2																		

Suited to thermal arc spraying ◆ Suitable ◆◆ Highly suitable

Hardfacing - Copper-aluminium alloy



Shielding Gas and Flux Recommendation

- **CORBRONZE** the recommended shielding gases are
  I1: 100% Argon
  I3: 0.5-95% He

Product Name	Composition [%] - Cu balance				Hardness 3 layers as welded
	Al	Mn	Fe	Ni	
CORBRONZE 302	**11.5**	1.00	2.00	**4.80**	320 HB

Product Name	Process O: open arc G: gas-shielded S: sub-arc	Standard diameters [mm]	EN 14700 standard	Metal / Metal friction	Mineral abrasion	Abrasion under pressure	Hot abrasion	Erosion	Cavitation	Impact	Mechanical fatigue	Thermal fatigue	Hot oxidation	Corrosion	Rebuilding or cladding	Buffer layer or assembly	Cutting ability	Work-hardening	Machinability	Description and applications
CORBRONZE 302	G	1.2 and 1.6	T Cu1	◆◆					◆◆					◆◆	◆◆				◆	• Combines high hardness with resistance to marine corrosion • Applications: sealing seats, guides • Series of alloys with a low coefficient of friction, good heat resistance • Resists corrosion by oxidising acids and sea water • Toughness may be increased by a suitable thermal treatment

Suited to thermal arc spraying ◆ Suitable ◆◆ Highly suitable

Hardfacing - Nickel base

Joining wires

Complementary nickel base wires for joining are presented in the joining catalogue

Product Name	EN ISO Standard	AWS Standard
GAMMA 182	T Ni6182 (NiCr15Fe6Mn) B M21 3	ENiCrFe3T0-4
GAMMA 182-O	T Ni6182 (NiCr15Fe6Mn) B NO 3	ENiCrFe3T0-3
GAMMA V 4648	T Ni6083 (NiCr20Mn6Fe4Nb) P M21 1	ENiCr3T1-4
GAMMA 625	T Ni6625 (NiCr22Mo9Nb) B M21 3	ENiCrMo3T0-4
GAMMA V 625	T Ni6625 (NiCr22Mo9Nb) P M21 1	ENiCrMo3T1-4
GAMMA 276	T Ni6276 (NiCr15Fe6Mn) B M21 3	ENiCrMo4T0-4
GAMMA V 276	T Ni6276 (NiCr15Fe6Mn) P M21 1	ENiCrMo4T1-4
GAMMA 400	T ZNi4060 (NiCu30Mn3Ti) B M21 3	ENiCu7T0-4

Shielding Gas and Flux Recommendations

- **STELLOY (nickel base)** the recommended shielding gases are
  I1: 100% Argon
  M12: Argon + 0.5-5% CO_2

- A **neutral flux** is required for submerged arc welding

Product Name	Composition [%] - Ni balance								Hardness - 3 layers	
	C	Mn	Si	Cr	Fe	Mo	W	Others	as welded	work hardened
STELLOY Ni 520	0.06	0.20	0.20	**13.0**	2.20	**6.00**	0.80	**Co: 11.5** Ti: 3.00 Al: 2.00	250 HB	400 HB
STELLOY CCO	0.05	1.00	0.60	**15.5**	3.00	**16.0**	**4.40**	**Co: 2.30**	220 HB	350 HB
STELLOY C	0.05	0.60	0.50	**16.0**	5.00	**16.0**	**4.50**		200 HB	350 HB

Product Name	Process O: open arc G: gas-shielded S: sub-arc	Standard diameters [mm]	EN 14700 standard	Metal / Metal friction	Mineral abrasion	Abrasion under pressure	Hot abrasion	Erosion	Cavitation	Impact	Mechanical fatigue	Thermal fatigue	Hot oxidation	Corrosion	Rebuilding or cladding	Buffer layer or assembly	Cutting ability	Work-hardening	Machinability	Description and applications
STELLOY Ni520	G	1.6 to 2.4	T Ni4				◆◆		◆	◆	◆◆	◆◆	◆◆	◆				◆◆	◆	• **Superalloy offering extreme resistance to high temperature stress and thermal shock** • Recommended with buffer layer of STELLOY C • Applications: high speed forging tools, tube extrusion mandrels
STELLOY CCO	O	2.4 and 2.8	T Ni2				◆◆		◆	◆	◆	◆	◆◆	◆				◆	◆	• **Superalloy offering extreme resistance to prolonged high temperature stress** • Good resistance to corrosion, wear and high temperature oxidation • Applications: tube extension dies, extrusion tooling and forging die
	G	1.6 to 2.8																		
STELLOY C	O	2.4 and 2.8	T Ni2				◆		◆	◆	◆	◆	◆	◆	◆	◆		◆	◆	• **Repair assembly, buffering, cladding and friction wear resistant coating** • Suited for use between -196°C and +1050°C • Resists stress corrosion cracking in the presence of hydrogen sulphide • Recommended for buffering before cladding with STELLOY Ni520 • Applications: pumps and valves for the chemical and petrochemical industries
	G	1.6 to 2.8																		
	S	2.4 to 3.4																		

Suited to thermal arc spraying ◆ Suitable ◆◆ Highly suitable

Hardfacing - Cobalt base

Shielding Gas Recommendation

- **STELLOY (Cobalt base)** the recommended shielding gas is I1: 100% Argon
- Specific TIG versions available in diameter 1.2 mm and 1.6 mm
- SAW versions available on request

Product Name	Composition [%] - Co balance							Hardness - 3 layers	
	C	Mn	Si	Cr	W	Fe	Others	as welded	work hardened
STELLOY 25	**0.15**	1.50	1.00	**20.0**	**14.0**	4.00	**Ni: 9.50**	210 HB	40 HRC
STELLOY 21	**0.25**	1.00	1.00	**28.0**		4.00	**Ni: 3.00 Mo: 5.50**	33 HRC	47 HRC
STELLOY 6 BC	**0.90**	1.00	1.00	**28.5**	**4.50**	4.00		38 HRC	
STELLOY 6	**1.05**	1.00	1.00	**28.5**	**4.50**	4.00		42 HRC	
STELLOY 6 HC	**1.20**	1.00	1.00	**28.5**	**4.50**	4.00		44 HRC	
STELLOY 12	**1.50**	1.00	1.00	**30.0**	**7.50**	4.00		45 HRC	
STELLOY 1	**2.30**	1.00	1.00	**28.5**	**12.0**	4.00		53 HRC	

Product Name	Process O: open arc G: gas-shielded S: sub-arc TIG: tungsten inert gas	Standard diameters [mm]	EN 14700 standard	Metal / Metal friction	Mineral abrasion	Abrasion under pressure	Hot abrasion	Erosion	Cavitation	Impact	Mechanical fatigue	Thermal fatigue	Hot oxidation	Corrosion	Rebuilding or cladding	Buffer layer or assembly	Cutting ability	Work-hardening	Machinability	Description and applications
STELLOY 25	G	1.2 to 2.4	T ZCo	◆					◆	◆◆	◆◆	◆◆	◆◆	◆◆	◆◆	◆		◆	◆◆	• Highly resistant to high temperature wear and metal-to-metal abrasion • **Ease of application due to its low cracking tendency** • Maintains a good level of hardness at high temperatures • Applications: straightening guides, vertical mill rolls and foot rolls in continuous casting
STELLOY 21	O	1.6 to 2.4	T Co1	◆◆					◆◆	◆◆	◆	◆◆	◆◆	◆◆	◆◆		◆◆	◆	◆◆	• **Ideal choice for resistance to multiple combinations of stress** • Resists corrosion and cavitation • Maintains a good level of hardness at high temperatures • Work-hardenable, can be polished, low coefficient of friction • Applications: industrial valve work, forging dies and hot shearing blades
	G TIG	1.2 to 2.4																		
STELLOY 6 BC	G	1.2 to 2.4	T Co2	◆			◆	◆		◆	◆◆	◆◆	◆◆	◆◆	◆◆				◆◆	• **Equivalent alloy to STELLOY 6 with lower carbon** • Easier machining and reduced cracking tendency • Recomended for buffering on large parts or for thick deposits
STELLOY 6	O	1.6 to 2.4	T Co2	◆			◆	◆		◆	◆◆	◆◆	◆◆	◆◆	◆◆		◆◆		◆	• **Combines all the outstanding properties of the cobalt base alloys, including abrasion and erosion resistance** • Deposit of intermediate hardness with good machinability • Wide field of applications: hot shearing tools, petrochemical and industrial valves, valves and valve seats of marine engines, pump sleeves and shafts
	G TIG	1.2 to 2.4																		
STELLOY 6 HC	G	1.2 to 2.4	T Co2	◆			◆◆	◆◆		◆	◆	◆◆	◆◆	◆◆	◆◆				◆	• Equivalent alloy to STELLOY 6 with higher carbon • **Allows the required hardness to be obtained on low alloy steels from the first layer** • Applications: small valves and valve gates, extrusion dies
STELLOY 12	G TIG	1.2 to 2.4	T Co2	◆			◆◆	◆◆		◆	◆	◆	◆◆	◆◆	◆◆		◆◆		◆	• **Good resistance to abrasion by minerals on account of its high hardness** • Particularly suited to the production of cutting tools • Applications: wood and paper industries, extrusion screws for filled plastic
STELLOY 1	G	1.2 to 2.4	T Co3	◆			◆◆	◆◆					◆◆	◆◆	◆◆		◆◆		◆	• **Highest hardness of the cobalt base alloy range, offering excellent resistance to abrasion and corrosion** • Self polishing, promotes scratch free sliding of abrasive materials • Applications: rubber kneaders

Suited to thermal arc spraying ◆ Suitable ◆◆ Highly suitable

Cladding

Product Name	Composition [%] - Fe balance						
	C	Mn	Si	Cr	Ni	Mo	Nb
TRI S 307	**0.100**	**6.50**	0.80	**19.0**	**8.20**		
TRI S 312	**0.100**	1.30	0.80	**29.0**	**9.50**	0.30	
TRI S 309L	**0.030**	1.75	0.80	**24.5**	**13.0**		
TRI S 308L	**0.030**	1.80	0.80	**20.5**	**10.0**		
TRI S 347	**0.080**	1.50	0.90	**20.5**	**10.0**		**0.50**
TRI S 309LMo	**0.030**	1.80	0.80	**24.0**	**13.0**	**2.80**	
TRI S 316L	**0.030**	1.40	0.80	**19.0**	**12.0**	**2.90**	

Product Name	Process O: open arc G: gas-shielded S: sub-arc	Standard diameters [mm]	Standards EN ISO 17633-A EN 14700	Metal / Metal friction	Mineral abrasion	Abrasion under pressure	Hot abrasion	Erosion	Cavitation	Impact	Mechanical fatigue	Thermal fatigue	Hot oxidation	Corrosion	Rebuilding or cladding	Buffer layer or assembly	Cutting ability	Work-hardening	Machinability	Description and applications
TRI S 307	O	1.2 to 3.2	T 18 8 Mn U 3 T Fe10	◆◆					◆	◆◆	◆		◆	◆	◆◆	◆◆		◆◆	◆	• **High elongation, work-hardenable and resistant to high temperatures** • Rebuilding mechanical components: shafts and roller bearing seats • Buffer layer before hardfacing on 12-14% manganese steel
TRI S 312	O	1.6 to 2.4	T 29 9 U N 3 T Fe12	◆					◆	◆			◆	◆	◆◆	◆◆			◆	• **Rebuilding of heavily worked stressed mechanical components and of steels of high carbon equivalent** • High initial hardness – Work-hardenable deposit • Resists wear by friction and oxidation • Applications: repair of gear teeth, sprockets, chain links
TRI S 309L	O	1.2 to 2.4	T 23 12 L U N 3 T Fe12						◆				◆	◆	◆	◆◆			◆	• Cladding of mild and low alloy steels • Buffering before cladding with 308L or 347 • Transition layer on 308L-clad steel
TRI S 308L	O	1.0 to 2.4	T 19 9 L U N 3 T Fe12						◆				◆	◆	◆◆	◆			◆	• Cladding of 308L in the chemical and petrochemical industries
TRI S 347	O	1.6 to 2.4	T 19 9 Nb U N 3 T Fe12						◆				◆	◆	◆◆				◆	• Heat resistant cladding in 347 for the petrochemical industry
TRI S 309LMo	O	1.6 to 2.4	T 23 12 2 L U N 3 T Fe12						◆				◆◆	◆◆	◆◆	◆◆			◆	• Cladding of mild and low alloy steels • Buffering before cladding with 316L and similar alloys • Transition layer on 316L-clad steel
TRI S 316L	O	1.0 to 2.4	T 19 9 L U N 3 T Fe12						◆				◆	◆◆	◆				◆	• 316L cladding of vessels in the chemical, pharmaceutical and food processing industries

◆ Suitable ◆◆ Highly suitable

Notes

Packaging

Metal basket spool	
Standard net weight:	25 kg
External diameter:	410 mm
Internal diameter:	300 mm
Width:	100+/-3 mm
EN ISO 544 standard:	B 450

Drum	
Standard net weight:	330 kg
External diameter:	580 mm
Height:	800 mm

Metal basket spool	
Standard net weight:	15 kg
External diameter:	300 mm
Internal diameter:	51.5 mm
Width:	103 mm
EN ISO 544 standard:	BS 300

Plastic spool*	
Standard net weight:	15 kg
External diameter:	300 mm
Internal diameter:	51.5 mm
Width:	103 mm
EN ISO 544 standard:	S 300

Plastic reel*	
Standard net weight:	15 kg
External diameter:	390 mm
Internal diameter:	305 mm
Width:	90 mm

Small plastic spool*	
Standard net weight:	5 kg
External diameter:	200 mm
Internal diameter:	51.5 mm
Width:	55 mm
EN ISO 544 standard:	S 200

Small metal basket spool	
Standard net weight:	5 kg
External diameter:	200 mm
Internal diameter:	51.5 mm
Width:	55 mm

*Manufactured to order at client's request

Technical Information

- Suitable shielding gases (according to the standard EN IS0 14175) are recommended in decreasing order of preference
- Welding Alloys recommends suitable fluxes for use with its submerged- arc wires
- Technical data sheets and safety data sheets are available for all products in accordance with EC regulations Nos 1907/2006 (REACH) and 1272/2008 (CLP)

Welding products and techniques evolve constantly. All descriptions, illustrations and properties given in this catalogue are subject to change and should only be considered as general guidance.

Alphabetical Index

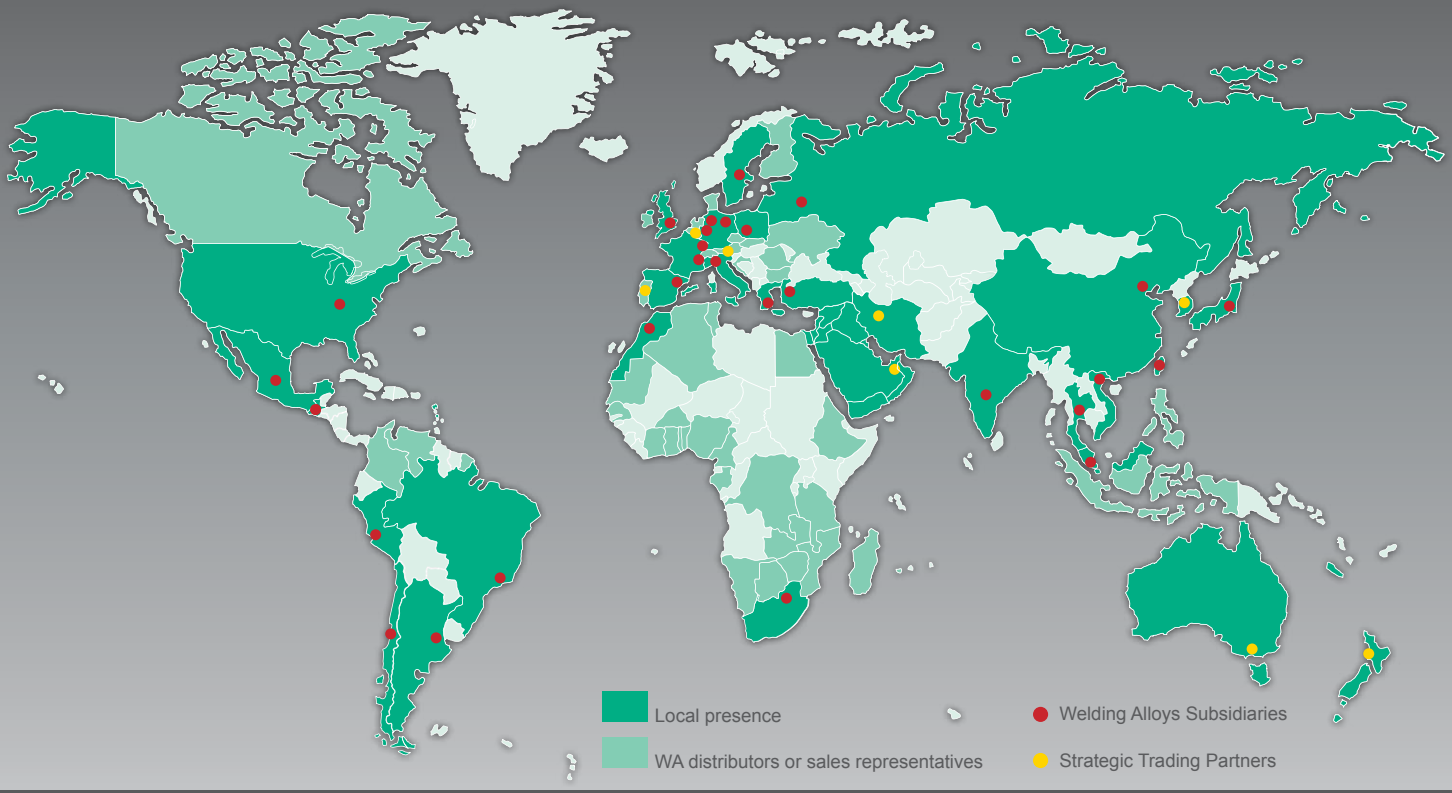
Our Technical 'Spark' Solves Your Industrial Challenges

WA Consumables
The go-to provider
of advanced welding
consumables

WA Machines
The go-to provider
of automated equipment
for wear protection

WA Integra™
The go-to provider
of engineered wear
protection solutions

A worldwide presence



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