Maintenance products

COMMERSALD

KOY COMMERSALD
MATERIALI E IMPIANTI PER SALDATURA

COMMERSALD WELDING CONSUMABLES FOR MAINTENANCE

What makes our products different from those of our competitors

Electrodes, wires, rods and alloys available in a wide range, to meet the criteria of universality and versatility. Materials which have been carefully followed throughout the entire production process and which have undergone strict quality control testing. Specially formulated products to contain the emissions of fumes and for welding in conditions of maximum safety.

Performance features

Deposits which are tough and resistant to stress as a result of the purity of the elements used in fabrication. High strength-elongation ratio obtained through a careful formulation, with a consequent reduction to the risk of breaking: this characteristic is particularly useful in maintenance as, is often the case, maintenance interventions are often carried out on metals of an unknown origin.

What makes them so affordable

The importance of maintenance works and the high cost of labour highlights the need to use products of the highest reliability also for the negligible effect of the filler material to the overall cost of maintenance itself. The increased product cost, compared to similar materials, commonly used in production, is compensated by the performance, while the highly favourable ratio between cost and performance remains.

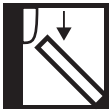
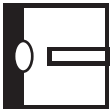
Included in the price

Forty years of experience in the specialised consumable materials sector for welding. Number one in the Italian market for this sector. Technical experience and reliability recognised by the most important companies in the welding industry. Among the first in Italy to be UNI EN ISO 9001 certified in the welding consumables sector. Pre and post sales services and the highest levels of operational assistance.

What information is contained in this manual

The brief description of the usable materials and welding procedures subdivided by application type. The mechanical values, the welding positions in reference to the electrode and the cored wires, the characteristics and the field of use. The temperature, drying times and storage of the electrodes, the type of current, the polarity and intensity in relation to the various diameters are all found on the label applied to the packaging. Further technical information related to the products may be requested from our sales personnel or our internal and external technical service.

SYMBOLS			
Rm	Mechanical strength	T.L.	Fluxing range temperature
Rs	Elastic limit	T.F.	Temperature of furnace brazing
KV	Charpy V. resistance	>	Greater than:
A%	Elongation percentage	<	Less than:
▼	Hardness	÷	Between
HB	Brinell hardness	~	Approximately
HV	Vickers hardness	J	Joule (0.102 Kg m)
HRC	Rockwell C hardness	N	Newton (0.102 Kgf)
I.F.	Melting range	(5d)	Test piece length equal to five diameters
P.F.	Melting point		

WELDING POSITIONS					
					
1	2	3	4	5	6

The welding positions relative to the covered electrodes and core wires are referenced in the text with the number corresponding to the figure above.

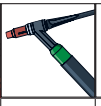
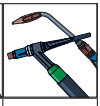
NOTE
Commersald reserves the right to carry out, at any time, any modifications, whole or in part, to the technical data and product characteristics listed in this catalogue.

Welding

- Mild steel and low alloy steel
- High resistance steel
- Stainless steel
- Cast iron
- Aluminium and its alloys
- Copper and its alloys
- Nickel and its alloys

COMMERSALD

Welding

Index Welding						
Mild steel and low alloy steel	**10**					
	5A			**292 S**		
	1009					
			2201			
	1002 A		**202 S**	**300 S**		
High resistance steel	**75**					
	74 HL	**507 S**	**425**			
				429 S		
		515 S	**429**			
	85					
	1351					
Stainless steel	**54 S**	**510 S**	**453**			
	55 H					
	66 S	**512 S**	**466**			
	64 H					
	76 S	**509 S**	**477**	**477 S**		
	86 S	**518 S**	**219 S**			
Cast iron					**1514 S**	
	2000			**348 FS**		
	13 A					
	20 A					
Aluminium and its alloys		**522 S**	**328 A**			
			370 S			**524 S** **526 S**
	24				**523 TS**	
Copper and its alloys	**34 S**	**532 S**	**334 S**			
	36 A					
Nickel and its alloys	**29 A**	**529 S**	**338 S**			

Mild steel and low alloy steel

The difficulties encountered in the welding of non-alloy steels or low alloy steels are in relation to the carbon content in the base material which, the higher the level the more problems will occur, and to the impurities such as sulphur and phosphorous which must be inferior to 0.04%.
The **percentage of carbon** determines the classification of the steels in:

Extra-mild	up to 0.15% carbon
Mild	from 0.15 to 0.25% carbon
Semi-hard	from 0.25 to 0.50% carbon
Hard	from 0.50 to 0.75% carbon
Extra-hard	over 0.75% carbon

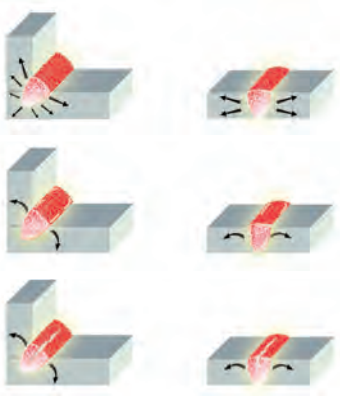
Mild steels are more commonly used in construction welding and are sold with the acronyms S235 - S275 - S355 and are welded with electrodes **KOY 10 - KOY 5A**. The quality of "unkilled" steel may be difficult to weld as there are no impurity checks for this type of steel. The electrode **KOY 1009** is used with welding thermal cycles and "cold working" (see the paragraph "operational suggestions").

Alloy elements such as chrome, molybdenum, nickel, etc, with regards the operating difficulty, should not be a concern. Evidently, if the steel is alloyed with chrome or other elements and is chosen for specific needs, the consumable material should be chosen with respect for these needs; **KOY 1002 A** is used.

Semi-hard steel, such as grade C40, can present problems of fragility in the weld in both the molten area as well as adjacent areas, if adequate consumable materials are not used. Also, cast steel which often contains a high percentage of impurities, are welded adopting the same precautions used for semi-hard steel.

In the catalogue, these steels are also called medium alloys or highly alloys as they are well-known terms; they contain a carbon content exceeding 0.25% and are to be considered difficult to weld due to the hardening effect caused by heat input on the base material in the zone immediately **adjacent to the welding bead**. This zone which becomes hard and fragile is then stressed by the withdrawal of the bead deposited, and which during cooling decreases in volume.

This is the stress:



This is its effect if the consumable material has a resistance exceeding that of the **heat-affected zone (HAZ)**.

And this is what often happens when the consumable material **is not suitable** as a **normal mild steel electrode is not (KOY 10 S - KOY 1009 - KOY 5A, etc.)**.

Therefore a consumable material must be used which makes the migration of carbon originating from the molten zone of the base material ineffective. Otherwise there is a risk of breakage at the centre of the bead. It is also necessary to take all possible precautions to make the HAZ less fragile.

With regards to the consumable material for the welding of C40 and similar steels, cast steels and semi-hard steels, it is possible to use the electrodes **KOY 75, KOY 74 HL, KOY 85, KOY 1351**. Each of these is equipped with its own strength-elongation ratio; one product varies from another due to the prevalence of one characteristic or another. It is also possible to use, with some risk attributable to the MIG process, wires of the series **KOY 425 and KOY 429**, equally suitable paying attention in all situations to scrupulously respect the following rules:

ADOPT A WELDING THERMAL CYCLE AND "COLD WORKING"

Therefore use: thin electrodes, carry out fast steady constant passes and a low intensity current to limit dilution with the base material, use the "pilgrim step" technique, distribute the heat evenly to the piece, and on small pieces have frequent interruptions. Every time the dimensions and the shape of the material to be joined allow: **APPLY PRE-HEATING**.
The approximate temperature of pre-heating, taking into consideration the percentage of carbon in the steel and the thickness of the material are as follows:

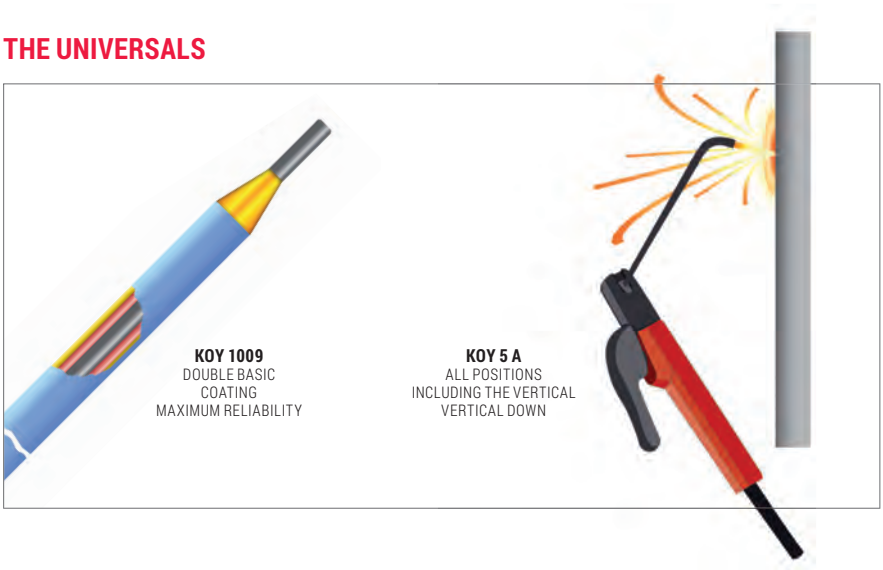
STEEL	THICKNESS OF THE MATERIAL		
%carbon	6 mm	12 mm	20 mm
up to 0.30	-	-	-
0.30	20°	70°	150°
0.35	20°	100°	200°
0.40	100°	200°	250°

STEEL	THICKNESS OF THE MATERIAL		
%carbon	6 mm	12 mm	20 mm
0.45	150°	250°	300°
0.50	200°	300° ÷ 350°	300°
0.60	300°	300° ÷ 350°	300° ÷ 350°
0.70	300°	300° ÷ 400°	300° ÷ 400°
0.80	300°	300° ÷ 400°	300° ÷ 400°

If pre-heating is performed, do not use the "pilgrim step" technique and ensure that there are as few interruptions as possible. It is still necessary to use diameters which are not too large and steady passes. In both cases, work in such a way that the cooling of the weld is as slow as possible. Whenever the conditions permit, weld as much as possible to **free shrinkage**, that is with pieces not restricted at the two ends.

Hard and **extra-hard** steels are to be considered **not weldable**.

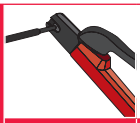
THE UNIVERSALS



KOY 1009
DOUBLE BASIC
COATING
MAXIMUM RELIABILITY

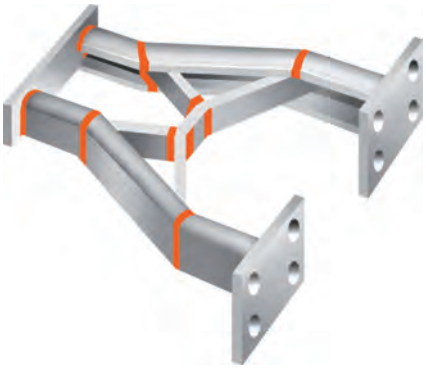
KOY 5 A
ALL POSITIONS
INCLUDING THE VERTICAL
VERTICAL DOWN

Mild steel and low alloy steel

RECOMMENDED PRODUCTS				
	KOY	**KOY**	**KOY**	**KOY**
CARBON STEEL				
Thin flat sheet metal	10	500 A	205 S	-
Thin sheet metal in place or tubing	5 A	-	-	-
Large thickness	1009	500 A	2201	292 S
Pipes	5 A-1009	-	-	292 S
Pointing	5 A	500 A	205 S	-
Assembly and installation	5 A	-	205 S	292 S
Filling	1009	-	205 S	292 S
HIGH LIMIT ELASTIC STEELS (TI, ETC.)	**1002 A**	**-**	**202 S**	**300 S**
MANGANESE STEELS	**74 HL**	**507 S**	**425**	

Electrode for contact welding on mild steel with good elasticity and mechanical strength

10



Perfect curability and ease as there is no need to control the length of the arc. The beads are aesthetic and well-connected with excellent resistance to cracking and tight coupling of the joint.

The KOY 10 electrode is used with short arcs to obtain a good penetration. The electrode welds in all positions except in the vertical down. The heat input is limited for the possibility of contact welding at high speed of advancement; this results in a substantial reduction of the deformation of the welded structure. The slag is easy to remove, out of the weld gap it lifts on its own as the piece cools.

Main applications: welding of sheet metal and profiles of medium thickness when resistance and security of the welded joints is a priority: containers and tanks, doors, shelves, construction and repairs to trailers, foundations, frames and machine accessories, precision mechanical equipment.

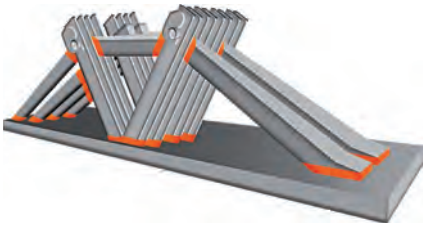
10

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.0 - 2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Rutile

TYPICAL MECHANICAL VALUES					
R_m	R_s	A%	KV	KV	KV
N/mm² 550	N/mm² 480	%24	J (20° C) >64	J (0° C) 50	J (-20° C) >28

Welding and tech-welding in all positions, including vertical down

5 A **292 S**



Joining of steels from 370 to 520 N/mm2, even if joints are difficult to access, irregular, poorly prepared, rusted or painted. Great ease of pointing due to the low voltage triggered by the arc. The high intensity of "peak" produces a deep and constant penetration. Optimum mechanical characteristics and good resilience down to - 10° C.

The KOY 5 A electrode offers perfect control of the bath, a highly concentrated arc and an absence of defects when subject to radiographic inspection, also in the vertical down. This makes it universally applicable and irreplaceable in welding work. The very thin slag facilitates the execution of pointing and welding with limited amperage. The strong penetration capacity and the rapid solidification of the bath allow welding on poorly prepared joints.

The cored wireKOY 292 S is of a tubular copper type and is characterised by a high hourly deposition rate. The aesthetic of the bead, the economy of post-welding work (absence of spray, very little over-metal) and the drastic reduction in the formation of pores and cracks, are characteristics which make it extremely affordable to use.

Main applications: welding of tubs, tanks, boilers, pipes, fittings and liquid-tight flanges (even under pressure), light and medium steel structures, sheet metal construction.

5A

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2 - 3 - 4 - 5 - 6	Rutil cellulosic

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 520	N/mm² 440	%24	J (-10° C) 47

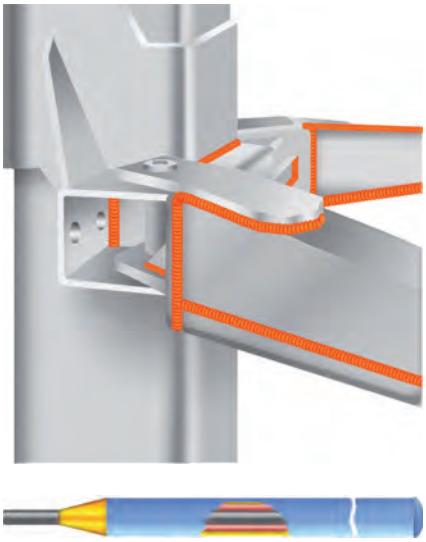
292 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	SHIELDING GAS
1.0 - 1.2 - 1.6	1 - 2 - 3 - 4 - 5 - 6	Argon-CO_2 mix • CO_2

TYPICAL MECHANICAL VALUES				
R_m	R_s	A%	KV	KV
N/mm² 540	N/mm² 440	%27	J (20° C) 100	J (-20° C) 60

Double coated electrodes for highly stressed joints on steel

1009



Construction welding subjected to high stresses or low temperatures (down to -40°C), welding of low alloy or rich in carbon steel (C = 0.4%) or high levels of impurities, welds subject to thermal shocks, to ageing and all general stresses which can cause cracks in warm or cold. Welding of steels difficult to weld due to the presence of sulphur and phosphorous (up to 0.1%). For all positions except vertical down, with alternating or continuous current.

The KOY 1009 electrode is characterised by a smooth, regular bead, perfectly penetrated without lateral incisions.
The slag is easily eliminated and the joint does not present defects when subject to radiographic inspection. The sophistication in the technical construction of this electrode makes it possible to combine perfect curability with extreme ease of use (instantaneous arc ignition, good stability of the arc and transfer of the filler metal in small drops), increased mechanical values which affect maintenance and are typical of the class of electrodes type-approved for the strictest controls.

Main applications: rolling stock materials, vehicle chassis and machine tool frames, trailer steering, the arms of earth-moving machines, load-bearing structures of mills and crushers, farm equipment, bridge cranes, high pressure pipes, chain wheels, hydraulic cylinders and lifting equipment.
The double coated KOY 1009 can be used advantageously also in the joining of thick cast iron, when combined with the KOY 13 A electrode.

Double coated electrodes for highly stressed joints on steel

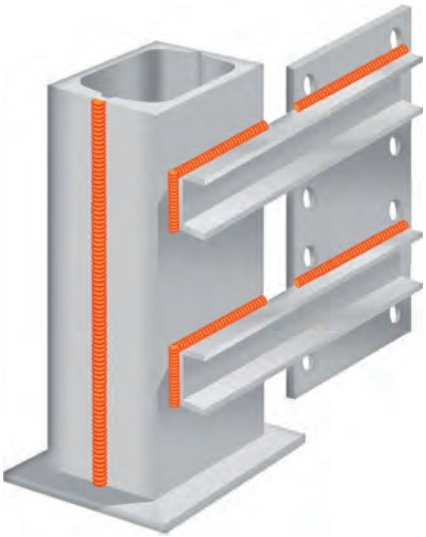
1009

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.0 - 2.5 - 3.2 - 4.0 - 5.0	1 - 2 - 3 - 5 - 6	Special

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 550	N/mm² 440	%30	J (-20° C) 60

Universal wire for the welding of carbon steel

2201



Welding of non-alloy carbon steel of all types and thicknesses.

The KOY 2201 wire is a **non-copper** wire of the latest generation with high added value technology created after years of study and research and which represents a healthy break from old habits. Ductile joints, with optimum mechanical characteristics and radiographic properties. High stability of the arc, smooth melting and well-controllable.

The advantages compared to traditional wire relative to the stability of the arc, less maintenance of the torch, less spatter, lower smoke emissions, and to less oxidised welds were achieved by substituting the copper with a superficial non-invasive protective treatment. Copper plating was introduced towards the middle of the last century to protect the welding wire surface from oxidation so as to avoid impediments to electrical contact with the contact tip of the torch.

The partial loss of copper during the steps required from the coil to the contact nozzle causes clogging and subsequent irregularities in the output of the wire.

This situation leads to an unstable arc and the formation of spatter, increasing the cost of the subsequent finishing work on the welded pieces. The inevitable pollution resulting from the presence of copper in the deposit influences the mechanical characteristics of the welded joint. Furthermore, toxic fumes are produced by copper evaporating in the arc.

Main applications: boilers, tanks, conduits and general steel carpentry.

Universal wire for the welding of carbon steel

2201

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
0.8 - 1.0 - 1.2 - 1.6	Argon-CO_2 mix • CO_2

TYPICAL MECHANICAL VALUES				
R_m	R_s	A%	KV	KV
N/mm² 560	N/mm² 440	%26	J (20° C) 110	J (-30° C) 35

High resistance joining on carbon steel and low alloy steels with high elastic limit

1002 A **202 S** **300 S**

The welding of low-alloy steels of the types TI, 38NCD4, EN 39 Ni Cr Mo 3, etc., fine grain and high resistance of any thickness, whose use is expected even at very low temperatures (to -30°C. the resilience exceeds 35 J).

The electrode KOY 1002 A welds in all positions except in the vertical down. The beads deposited are ductile, aesthetic and well-penetrating. The slag can be removed without difficulty. Due to its increased resistance, the KOY 1002 A electrode may also be used for the refilling of equipment and on machine parts subjected to high impact and low wear. The deposit is perfectly workable. **The solid wire KOY 202 S and the basic copper-coated cored wire KOY 300 S** deposit a material with the same characteristics of the electrode and is to be preferred in cases where the increased productivity represents a savings.

Main applications: crane booms, crane beams, stressed parts of earth moving machines, buckets and steel structures with tensile strength up to 900 N / mm2.

High resistance joining on carbon steel and low alloy steels with high elastic limit

1002 A

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Basic

TYPICAL MECHANICAL VALUES				
R_m	R_s	A%	KV	KV
N/mm² 770	N/mm² 690	%20	J (-40° C) 60	J (20° C) 120

202 S

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
0.8 - 1.0 - 1.2 - 1.6	Argon-CO_2 mix • CO_2

TYPICAL MECHANICAL VALUES				
R_m	R_s	A%	KV	KV
N/mm²>770	N/mm²>690	%20	J (20° C) 100	J (-40° C) >47

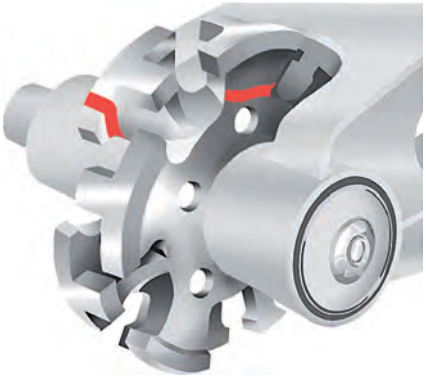
300 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	SHIELDING GAS
1.2 - 1.6	1 - 2 - 5	Argon-CO_2 mix • CO_2

TYPICAL MECHANICAL VALUES				
R_m	R_s	A%	KV	KV
N/mm² 800	N/mm² 690	%18	J (20° C) 110	J (-60° C) >47

Tough joints resistant to cracking on steels of high, medium and low alloys

75



Joints of alloy steels, even stainless (18 Cr - 8 Ni) or with carbon steel, ferritic steel to chrome-only or chrome nickel austenitic steel, of an unknown composition or containing impurities. Workable facings, resistant to friction and for intermediate or final layers of non-alloy steel, in order to obtain a stainless deposit. The deposit possesses an increased elongation and mechanical strength and resistance to impacts as well as to high temperatures (up to 900°C). The structure is austenitic with approximately 10% ferrite. This alloy characterised by an increased elongation, is used successfully in the welding of alloy steels when the base material, due to shrinkage caused by the welding, tends to crack in the area adjacent to the bead.

The KOY 75 electrode creates aesthetic beads which are regular and well-connected, as well as easily removed slag. The electrode welds in all positions except in the vertical down. The coating has an efficiency of 105%.

Main applications: refilling and repair of rails and switches, blade graders, crawler drive shafts, belt pulleys, turbine blades, hardening and heat treatment plants and autoclaves.

75

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Rutilbasico

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 570	N/mm² 470	%36	J (20° C) 60

Welds and facings with high elongation on semi-hard carbon steel

74 HL | **507 S** | **425**

Joint of carbon steel and alloys, 14% Mn steel, tool steel of difficult curability or of an unknown composition. The deposits are resistant to cracking, impact, high and low temperatures (+ 850°C/- 120°C), have high values of elongation and ductility, and harden if subjected to shock compression up to a hardness of 500 HB.

The KOY 74 HL electrode is amagnetic (austenitic) and has a highly efficient coating (170%). It is indicated for the execution of intermediate layers before hardfacing. Weld with a short arc and can be used in contact with the base metal. The melt is mild, the arc is stable and the beads are highly regular and finely striated, without marginal incisions. During welding, the electrode does not heat up excessively, even if the current used is relatively high.

The correspondent **KOY 507 S rod** used with TIG procedures, is characterised by a notable fluidity and possesses the same technical characteristics. It is advised for precision work and for root pass welds.

The **KOY 425 wire** in MIG procedures deposits a material with the same composition and technical characteristics of the electrode and is preferred in cases where high productivity represents a savings.

Main applications: tracks, protective sheet metal, dredgers, earth moving equipment, mills, facings on tramway switches and rails, wheel hubs, jaw and cone crushers, hydraulic turbines (cavitation), mill cylinders. Deep layers and dimensional restoration, before the execution of facings, on mould carriers in the hot working of metals, forging hammers and other equipment which must be resistant to impacts and hot and cold compression. Welding and facing on ballistic metals, armoured doors, shatter-proof barriers, cars and other armoured vehicles. Repairs and modifications to amagnetic steel parts used for the construction of harvesters, and land and marine vehicles.

Welds and facings with high elongation on semi-hard carbon steel

74 HL

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0 - 5.0	1 - 2 - 5	Basic rutile electrodes

TYPICAL MECHANICAL VALUES					
R_m	R_s	A%	KV	▼	▼
N/mm² 680	N/mm² 520	%>30	J (-105° C) 25	HB 200	hardened HB 500

507 S

AVAILABLE DIAMETERS (mm)
0.8 - 1.0 - 1.2 - 1.6 - 2.0 - 2.4 - 3.2

TYPICAL MECHANICAL VALUES					
R_m	R_s	A%	KV	▼	▼
N/mm² 650	N/mm² 450	%42	J (20° C) 140	HB 200	hardened HB 500

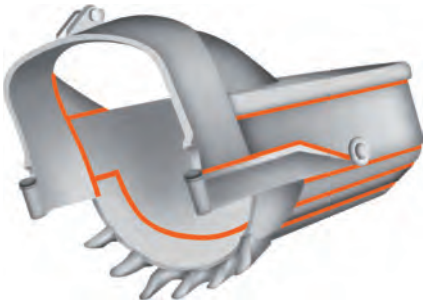
425

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
0.8 - 1.0 - 1.2 - 1.6	Argon +2% O_2/Argon +2% CO_2

TYPICAL MECHANICAL VALUES					
R_m	R_s	A%	KV	▼	▼
N/mm² 620	N/mm² 360	%35	J (20° C) 80	HB 200	hardened HB 500

High resistance welding on all types of steel with optimum resistance to hot and cold cracking

429 S



Joints of medium to high level carbon steels, tool steels, cast steels; heterogeneous welding between steels of a different nature and unknown composition. Substrates before the refilling with anti-wear materials; deposits with an optimum resistance to crushing. Deposits with a tough stainless austenitic-ferritic structure, resistant to oxidation up to 900°C and to hot and cold cracking. Deposits insensitive to hardening and workable with tools.

The cored wire KOY 429 S is made up of a strip of austenitic stainless steel with low level of carbon containing rutile flux. Curability is optimal, the slag is easily removed and the deposit has a regular and smooth aesthetic.

Main applications: buckets and earth moving equipment, shearing blades, hot cutters, cams, drill rods, cone crushers, gears, frames, cylinders, extrusion screws, chains, etc.

429 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	SHIELDING GAS
1.0 - 1.2 - 1.6	1 - 2	Argon-CO_2 mix • CO_2

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	▼
N/mm² 720	N/mm² 600	%28	HB 240

Crack resistant welds on medium alloy steels

515 S **429**

Unions of construction steel, high resistant, tempering, tool steel, manganese austenitic and ferritic chromium steel, difficult to weld. Heterogeneous welds, workable facings and substrates before hardfacing.
The deposit is insensitive to hardening, and easily workable with tools, resists oxidation up to 900°C, to hot and cold cracking. Tough, austenitic ferritic stainless steel structures.

The KOY 515 S rod for TIG welding possess the same characteristics as the electrode. It is used, above all, for the restoration of die-cast mould profiles and for plastic materials since the procedure guarantees executive advantages and the total absence of imperfections.
The KOY 429 wire is indicated for facings on extended surfaces or for automated welding on alloyed steels. The deposit possesses the same characteristics as the electrode provided the measures specific to the procedure are adhered to.

Main applications: joints and facings on gears of reclaimed steel, hardened or cemented, camshafts, hot cutters, stamping tools, burrs and hot pressings (up to 900°C), bearings, lifting arms, shafts, hydraulic cylinders, leaf springs, wear plate applications on excavation teeth, highly stressed welding on joined frames, wheel and roller facings.

Crack resistant welds on medium alloy steels

515 S

AVAILABLE DIAMETERS (mm)
1.0 - 1.2 - 1.6 - 2.4 - 3.2

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 750	N/mm² 530	%25	J (20° C) 40

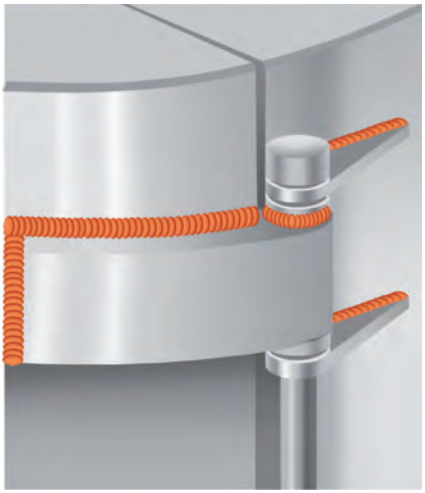
429

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1,0 - 1,2 - 1,6	Argon + 2% O_2 mix / Argon + 2% CO_2

TYPICAL MECHANICAL VALUES				
R_m	R_s	A%	KV	▼
N/mm² 720	N/mm² 510	%25	J (20° C) 80	HB 220

Universal rutile for alloy steels

85



Difficult to weld steels, low and medium alloys, refractory materials, construction, tools and claws, heterogeneous joints of stainless steels, transition layers on manganese steel before hardfacing. Austenitic-ferritic structures with approximately 15% ferrite. Increased toughness, maximum mechanical strength to impact, corrosion and wear. Cannot be hardened. Optimum hardness in hard cutting, where the temperature permanence exceeds 650°C and the successive slow cooling allows an increased hardness of the deposit up to about 350 HB.

The KOY 85 electrode with an austenitic-ferritic structure assures an optimum penetration and secure reliability in all positions except the vertical down. The ignition is quick to contact thanks to the metallisation point, the deposit is bright, homogeneous, without marginal incisions and is insensitive to hardening. The slag is easy to remove.

Main applications: restoration of components worn due to metal friction, broken or with construction defects or manufacture errors. Welding and refilling of moulds, on dredger teeth, excavator buckets, bucket blades, hot cutters, trailer chassis, springs and leaf springs, cutting tools, concrete mixers and valve seats.

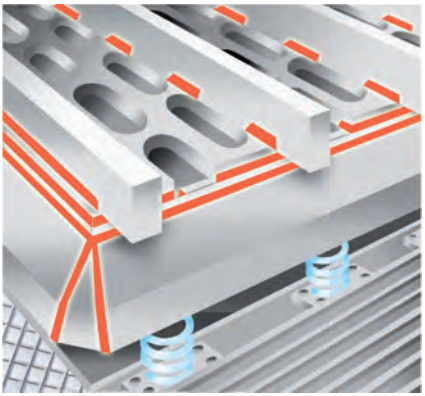
85

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
1.6 - 2.0 - 2.5 - 3.2 - 4.0 - 5.0	1 - 2 - 3 - 5 - 6	Basic rutile electrodes

VALORI MECCANICI TIPICI				
R_m	R_s	A%	▼	▼
N/mm² 810	N/mm² 670	%22	HB 230	hardened HB 350

Joints on stressed, secured cast steel of a considerable thickness

1351



Welding between austenitic and ferritic steels, cryogenic steels with 5÷9 of nickel and chromium nickel steel alloys resistant to corrosion and heat oxidation. Thick, forged, laminated or cast low and medium alloyed steels. Austenitic structures with a high level of nickel and optimum mechanical strength, elastic limit and elongation to high and low temperatures (from +1100 °C to - 196°C), maximum resistance to cracking caused by heat and thermal shock. In the welding of steels with a high level of carbon, the nickel contains the diffusion of the carbon from the base metal to the filler metal in the heated area, avoiding a weakening of the joint. The low thermal expansion coefficient of this super-alloy filler reduces the stresses in the base metal due to shrinkage of the welding bead often resolving unresolvable problems with the same high resistance austenitic-ferritic electrodes.

The KOY 1351 has an alluminised point for ignition of the arc on contact. The electrode welds in all positions except in the vertical down. The electrode is characterised by a special basic coating with a efficiency of 140% which, if on the one hand creates difficulty for less expert welders, on the other hand produces a low heat output which further limits the tensions of shrinkage and allows a low dilution with the base metal. And right from the first pass we find its properties and characteristics intact. The radiographies of the deposits are excellent, in flat welding, in angles and in vertical up.

Main applications: secured constructions in thick steel, plants for the liquefaction of air, gas turbines, highly stressed pipes even at a high temperature. Uprights and foundations of presses at work, agricultural and earth moving machinery, mill flanges, rotating rings for cement kilns, transportation chains, structural parts of a press.

Joints on stressed, secured cast steel of a considerable thickness

1351

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Basic

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 620	N/mm² 380	%32	J (-196° C) 80

Stainless steel

It is fundamental to work with filler materials which are easy to weld but with proven reliability and with increased values of resistance to corrosion.

Stainless steels are divided into two main types.
Stainless steels with **chromium** which are used for their economy and their resistance to heat, which in turn can be divided into **martensitic** stainless steels (AISI 410 and similar) **semi-ferritic** (AISI 430 - 410S and similar) and **ferritic** (AISI 405 - 446 and similar).
The austenitic chromium nickel with possible other elements added, represent the most numerous and well-known type (AISI 304L - 316L-321 - etc.)
The welding of chromium stainless steels is carried out using filler materials of the same composition with pre-heating and post-weld treatment. It is possible to opt for a cold weld using the austenitic electrode **KOY 75** or corresponding wires.
The welding of **chromium nickel** austenitics is generally carried out with filler materials of a composition similar to the base material.
Welding with coated electrodes negatively influences the low **electrical conductivity** of stainless steel, which involves the heating up of the electrode, which with excessive currents becomes red hot and flickers. It is therefore necessary to accurately choose the diameter in relation to the thickness to be welded. For this reason, the **KOY 55 H - KOY 64 H - KOY 76 S** have shown themselves to be highly versatile electrodes, constructed of carbon steel core and alloy elements Cr - Ni - (Mo) pressed in the coating.

The characteristics a **good electrode** must have for stainless steel are the following:

1. It must be metallised or alluminised on the tip to help ignition since often the welding machine has a low load voltage, which can lead to problems at the start.
2. Support the widest range of current possible.
3. Have a fine and compact coating, the core must be perfectly centred.
4. Absorbs little humidity and is well protected by the packaging.
5. The electric arc during welding, even with a limited current must not drown in the slag.
6. The bath must be well visible.
7. The slag must detach easily when cold.

Let's now look at the most recurrent **defects** in electrode welding on stainless steel and their related remedies:

Porosity	• unclean piece • humid electrode
Incisions at the edge of the bead	• current too high • arc too long • inclination of the electrode is too great • diameter too wide
Inclusion of slag in the deposits with the beads overlapping	• slagging of the underlying beads • preparation with too tight an angle • oscillation in the pass too high • inclination of the electrode is too great
Poor penetration	• current too low • electrode too thick in relation to the angle opening of the chamfer at the bottom of the gap. • insufficient distance between the ends • inclination of the electrode is too great

In MIG welding with a solid austenitic stainless steel wire the following rules must be followed: The protective gas commonly used is Argon+2%O2: with this protection good penetration and surface tension are both achieved; this means better aesthetics of the beads and less risk of marginal incisions which are typical of pure Argon. The use of an Argon+2%CO2 mixture is increasingly widespread and with which increased penetration is obtained compared to the classic Argon+2%O2 mixture; however, 2÷3% of CO2 must not be exceeded. The welding torch must be of a water cooled type to avoid overheating of the gas with a consequent reduction of its protective function.
Hard Teflon and steel sheaths are subjected to high wear and therefore must be changed frequently.

The cables should be as short as possible and the wire feed drive rollers in perfect order. The insertion and feed of the rolls to the wire guide must be as close as possible to the rolls, to avoid free flow of the wire. If not, the number of machine stoppages is multiplied due to an inconstant feed or blockage of the wire. It may be useful to use the intermediate straightening device between the rolls (in the case of a 4 to 6 roll wire feed drive) to limit bending of the wire due to unwinding.
For automatic welding it is recommended that preference is given to KOY SATIN GLIDE wires, whose surfaces are treated in a way which guarantees a more regular feed; while on the other hand, the sheath, contact tip and rollers wear more and must be changed more frequently. In relation to the welding width, the position of the weld and the characteristics required by the joint, with solid stainless steel wire it is possible to weld using short arc and spray arc varying the voltage of the welding machine.

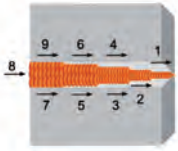
Stainless steel

WELDING PARAMETERS IN RELATION TO THE DIAMETER OF THE WIRE								
Wire diameter (mm)	**0.8 mm**		**1.0 mm**		**1.2 mm**		**1.6 mm**	
	Amperage	**Volts**	**Amperage**	**Volts**	**Amperage**	**Volts**	**Amperage**	**Volts**
Short Arc	80-110	16-18	90-130	18-20	140-160	18-20	180-220	18-22
Spray Arc	180-240	26-28	220-280	28-30	240-300	28-32	280-320	30-32

HEAD
HEAD IN VERTICAL UP

ANGLE
OF THE OVERHEAD

ANGLE
OF THE VERTICAL UP



FRONTAL HORIZONTAL
OF THE HEAD

Increased advantages have been obtained in recent years with the introduction of the pulsating arc: at regular intervals a high intensity current is overlapped with a relatively low base current which restores the conditions of the spray arc, with the transfer of the droplets to the weld pool. A highly versatile technique, suitable for both thin and thick shims, which help to limit the heat input typical in spray arc welding.

In welding with solid stainless steel wire several flaws may occur, all of which can be explained by the incorrect application of the previously explained procedures.

Let's look at a few:

- the preparation of the chamfer angle is insufficient or the ends are too close leading to a lack of penetration or adhesion.

The joints must be better prepared or the intensity of the current and welding voltage increased. If, however, you "penetrate" you will have to do the opposite and, if possible, apply a support on the back step of the weld.

- excessive overlay, if well connected, is not a defect in itself, but adds to the cost. In some cases it may also lead to a decrease in the number of passes of the product.

Flatter beads may be obtained by increasing speed in the advancement of the torch, or decreasing the feed speed of the wire.

- a groove in the centre of the weld seam in a long arc is due to shrinkage caused by too high a current.

Faster advancement of the torch, a decrease in the wire or lowering the welding voltage is required.

- an irregular mesh caused by operational problems.

A more regular and slower advancement is required.

- cracks at the edge of the bead result from the speed of advancement and voltage.

Move more slowly and lower the voltage.

- blow holes appear in the absence of gas, if the torch is too distant or loses water (if cold), or if the pieces are dirty or the wire is substandard.

If the benefits of both high metallurgical quality and aesthetics typical of welds done with coated wires, are desired, along with high productivity characteristic of semi-automatic procedures, the best choice is to use cored wire.

Corrosion resistant joints of stainless steels 18 – 8 Cr-Ni with optimum mechanical strength

54 S | **510 S** | **453**

Welding sheet metal, pipes and profiles in stainless steel 18/8 with a low carbon level (C < 0.03%) type AISI 301 - 302 - 302 S - 303 - 304 - 305 - 308. Excellent intercrystalline resistance. Austenitic structure with approximately 6% ferrites which assure an optimum mechanical strength and avoids hot cracks.

The KOY 54 S electrode, with extremely low carbon content, has a perfectly centred rutilic coating and low sensitivity to humidity. Therefore a large part of the sources which produce porosity are eliminated. The radiographies are perfect. The tip of the electrode is alluminised for an immediate trigger of the arc on contact. The advancement and the deposit speed is increased.
The highly stable arc favours a melting and transfer of the filler metal without splatter even with a low intensity current, facilitating welds on thin and medium thicknesses. The slag is easily eliminated exposing regular aesthetic watertight beads. The KOY 54 Swelds in all positions except in the vertical down.
The correspondent **KOY 510 S** rod used with TIG procedures, has the same characteristics as the electrode. It is recommended for precision work and on pipes for root pass welds with protection on the back step.
For assembly at work, to eliminate costs originating from the saturation of the pipes with inert gas, the cored rod **TGX** is advised.
The **KOY 453 wire** deposits a material of the same composition and the same technical characteristics as the electrode in MIG procedures. It is to be preferred in case where greater production represents a real savings in cost. For automated welding, it is preferable to use a wire with "SATIN GLIDE" finish. A program of cored wires of increased quality is also available for which extensive documentation can be supplied.

Main applications: containers and pipes for the canning industry, housewares, sinks, crockery, washing machines, window and door frames and metal furniture, façade cladding, boilers, manhole covers , conduits, mixers, autoclaves, surgical instruments, hydraulic turbines, machines for grape harvesting and the treatment of water, transmission shafts, separators, centrifuges and filters.

Corrosion resistant joints of stainless steels 18 – 8 Cr-Ni with optimum mechanical strength

54 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
1.6 - 2.0 - 2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Rutile

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 610	N/mm² 440	%40	J (20° C) >75

510 S

AVAILABLE DIAMETERS (mm)
1.0 - 1.2 - 1.6 - 2.0 - 2.4 - 3.2 - 4.0

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 610	N/mm² 420	%42	J (20° C) 120

453

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
0,8 - 1,0 - 1,2 - 1,6	Argon +2% O_2/Argon +2% CO_2

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 610	N/mm² 420	%42	J (20° C) 120

An increased production and limited heat input in joints of stainless steels 18 – 8 Cr-Ni

55 H

Electrode type AISI 308L with an increased efficiency for the welding of stainless steel AISI 301 - 304 - 304 L - 304 S as well as 321 - 347 (up to 350°C) characterised by a deposit entity of 50% to 70% superior to those which traditional electrodes. The speed of advancement contributes limiting distortion of the pieces. The notable length of the beads deposited minimises the risks of radiographic defects often present.

The **KOY 55 H electrode**, synthetic with an efficiency of 165% contains all the alloy elements in the coating. The PURE IRON core, as well as increasing the electrical conductibility, optimises the use of increased amperages and profits from a drastic reduction in welding time.

Main applications: boilers, conduits, autoclaves, pipe covers, hydraulic turbines, containers, tubs, transmission shafts and heat exchangers.

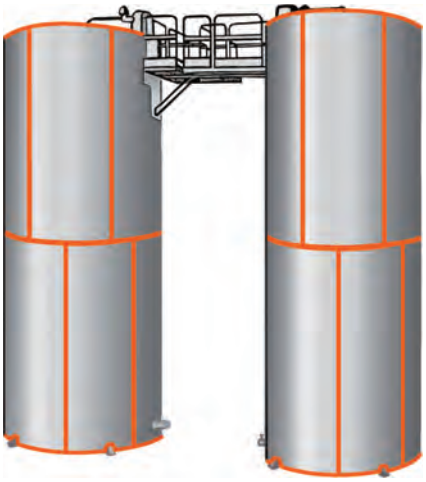
55 H

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
1.6 - 2.0 - 2.5 - 3.2 - 4.0	1 - 2 - 3	Rutile

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 600	N/mm² 450	%45	J (20° C) >60

An increased production and limited heat input in joints of stainless steels 18 – 8 Cr-Ni

66 S **512 S** **466**



Welding stainless steel AISI 316L with low carbon content (C<0.03%) as well as stainless steels containing chromium between 16% and 21%, nickel between 6% and 13% and molybdenum less than 3% (when an alloy containing Mo greater than 3% is required, the electrode KOY 91 can be supplied) stabilised, between them (AISI 316-318-304-321-347. Optimum crack resistance and resistance to corrosion up to 400°C. Increased mechanical values and elongation. Good resilience down to -105°C. Austenitic structures with approximately 6% ferrites highly resistant to intercrystalline corrosion. Optimum resistance to corrosion from ammonias, phosphoric acid, acetic acid, citric acid, formic acid, petrol, caustic soda and sodium bi-sulphate.

The **KOY 66 S electrode** has an alluminised tip for an ignition of the arc on contact which is highly stable and produces a mild melt, without splatter or porosity. The intensity may be reduced for profile welding, tubes or thin sheet metals. It is easy to use in all positions except in the vertical down. The slag lifts automatically exposing a regular, smooth bead, well connected and the highest aesthetic.

The **KOY 512 S rod** has the same characteristics as the electrode. They are used in TIG welding. It is extremely fluid and is particularly used for precision work and root pass welds with protection on the back step. For assembly at work, to eliminate costs originating from the saturation of the pipes with inert gas, the cored rod **TGX** is advised.

The **KOY 466 wire** in MIG procedures deposits a material with the same composition as AISI 316 L and is preferred in cases where higher speed of the deposit represents a savings. For automated welding, it is preferable to use the same KOY 466 wire with "SATIN GLIDE" finish. A program of cored wires of increased quality is also available for which extensive documentation can be supplied.

Main applications: maintenance of containers, pipes, salt plants and equipment, the industries of canning, cellulosics, photography, petrochemicals, food, confectioneries, paper, textile, dye, paints, mixers, shakers, heat exchangers, acid resistant valve seat facings, also in low alloy steel, for vapour, gas and liquid, decanting tubs plastic sheeting on stainless steel siding.

An increased production and limited heat input in joints of stainless steels 18 – 8 Cr-Ni

66 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
1.6 - 2.0 - 2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Rutile

TYPICAL MECHANICAL VALUES				
R_m	R_s	A%	KV	KV
N/mm² 580	N/mm² 460	%40	J (20° C) >70	J (-120° C) >35

512 S

AVAILABLE DIAMETERS (mm)
1.0 - 1.2 - 1.6 - 2.0 - 2.4 - 3.2

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 580	N/mm² 390	%38	J (20° C) 100

466

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
0.8 - 1.0 - 1.2 - 1.6	Argon +2% O_2/Argon +2% CO_2

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 600	N/mm² 420	%41	J (20° C) 120

An increased production and limited heat input in joints of stainless steels 18% Cr, 8% Ni, 2.5% Mo

64 H

Welding of stainless steel AISI 316 L with a low carbon content, as well as stabilised stainless steel, among them (AISI 316 - 316 L - 318). Austenitic structures with ferrites ~ 6%.
The electrodes at an increased efficiency are characterised by a deposit entity of 50% to 70% superior to traditional electrodes.
The speed of advancement contributes limiting distortion of the pieces. The notable length of the beads deposited minimises the risks of radiographic defects often present.

The **KOY 64 H electrode**, synthetic with an efficiency of 160% contains all the alloy elements in the coating. The PURE IRON core, as well as increasing the electrical conductibility, optimises the use of increased amperages and profits from a drastic reduction in welding time.

Main applications: reservoir pipes, pump motors and bodies, distillation plants, mixers, stainless steel reinforced boilers in mild steel and facings resistant to corrosion on the steels.

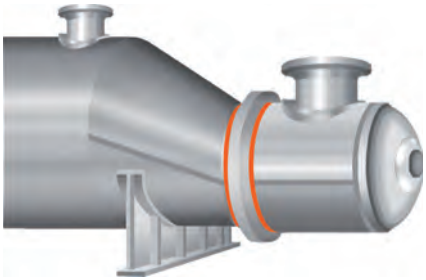
64 H

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.0 - 2.5 - 3.2 - 4.0	1 - 2 - 3	Rutile

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 580	N/mm² 420	%40	J (20° C) 80

Joints of austenitic steels with ferritic or martensitics steels, as well as carbon steels

76 S | **509 S** | **477** | **477 S**



Welding of stainless steels series AISI 400. Joints between austenitic steels, ferrites or martensitics with mild steel or highly alloyed steel. The austenitic-ferritic structure results in an increased mechanical strength and optimum elongation values. The deposit consists of a stainless steel resistant to corrosion and heat up to 950°C.

The coating of the **KOY electrode** contains metallic elements which raise welding efficiency to 180%. Flat joints, head to head joints and angle joints, facings and fillings of chamfers. Angle welding may be done on contact; the length of the perfectly constant arc results in a uniform composition of the deposit and very regular beading. The melt is mild without projections; the tip of the electrode is alluminised for an immediate trigger of the arc on contact. The beads are of the highest aesthetic, in the joints and facings, and the slag is easy to remove. The speed of the deposit is extremely high, from 50 to 70% higher compared to an electrode of normal returns, in that the KOY 76 S can be used with an intensity of the current 20%÷30% greater than the maximum possible with a traditional electrode. Since a part of this energy serves to melt the metal contained in the coating, the heat input to the piece being worked is often less. The higher speed of advancement contributes to a further reduction in distortion of the base metal. The elongation of the bead deposited compared to an electrode of the same diameter is higher, minimising the pauses and restarts which often result in radiographically detectable defects.

The KOY 509 S rod possesses the same characteristics and is used for TIG welding, in particular precision work and thin shims.

The **KOY 477 wire** is used with MIG procedures with high speed of the deposit; chemical analysis and the mechanical characteristics are comparable to coated electrodes.

The **KOY 477 S cored wire** is used with MIG procedures and the curability is comparable to the KOY 76 S rutile electrode. High speed of the deposit, regular melt and without protection. Easy slagging, a regular deposit and maximum aesthetic.

Main applications: valves, pumps, bulkheads and diffusers subject to wear, corrosion and marine water cavitation, gear work, chains, levelling blades, pulleys, excavator arms.

Joints of austenitic steels with ferritic or martensitics steels, as well as carbon steels

76 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2	1 - 2 - 3	Basic rutile electrodes

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 560	N/mm² 430	%38	J (20° C) 80

509 S

AVAILABLE DIAMETERS (mm)
1.0 - 1.2 - 1.6 - 2.0 - 2.4 - 3.2

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 600	N/mm² 430	%36	J (20° C) 110

477

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
0.8 - 1.0 - 1.2 - 1.6	Argon +2% O_2/Argon +2% CO_2

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 620	N/mm² 410	%38	J (20° C) 130

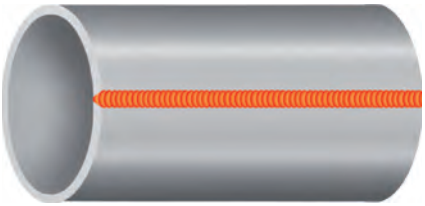
477 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
0.9 - 1.2 - 1.6	1 - 2 - 5	Argon CO_2 mix • CO_2

TYPICAL MECHANICAL VALUES				
R_m	R_s	A%	KV	KV
N/mm² 600	N/mm² 480	%36	J (20° C) 100	J (0° C) 40

Joints of refractory austenitic steels resistant to heat up to 1100°C

86 S **518 S** **219 S**



Welding of stainless steels 25% chromium, 20% nickel (AISI 310). Joints of refractory austenitic steels containing chromium between 20% and 27% and nickel between 18% and 22%. Austenitic structures, deposits which can filed but not hardened. Increased mechanical strength and elongation as well as resistance to heat oxidation.

The **KOY 86 S electrode** is used with a weak intensity of current, which results in a low heat input to the piece with consequently low risk of hot cracking. The electrode tip is alluminised for an immediate ignition of the arc on contact; this produces a very mild melt, regular beading with an optimum aesthetic. Usage is easy as is the removal of the slag. The electrode welds in all positions except in the vertical down.

The **KOY 518 S rod** has the same characteristics and is used for TIG welding. It is very fluid and is particularly used for precision work and root pass welds and for the welding of thin sheet metal.

The **KOY 219 S wire** in MIG procedures deposits a material with the same composition and is preferred in cases where higher speed of the deposit represents a savings.

Main applications: grills, baskets and equipment for heat treatment, furnace coatings, burners and combustion chambers in the brick, ceramic and glass industries, hot air generators, crucibles and autoclaves.

Attention! in the specific case of repair on equipment for heat treatments in stainless steel AISI 310, when these pieces have suffered a degradation caused by carburation inherent in the process, it is often advised to intervene with **KOY 29 A** electrodes as their high nickel content confers a higher resistance to thermal stress of the deposit and its coating, at the expense of lower curability, allows for better adhesion to the base metal.

Joints of refractory austenitic steels resistant to heat up to 1100°C

86 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Rutile

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 590	N/mm² 420	%35	J (20° C) 80

518 S

AVAILABLE DIAMETERS (mm)
0.8 - 1.0 - 1.2 - 1.6 - 2.4 - 3.2

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 610	N/mm² 410	%38	J (20° C) 120

219 S

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.0 - 1.2	Argon +2% O_2 • Argon +2% CO_2

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 600	N/mm² 400	%40	J (20° C) 100

Cast Iron

For welding cast iron, the quality of the filler materials is important and the operational technique determining.

Below we will analyse, exclusively, the welding of grey cast iron since malleable cast iron requires the same treatment but poses fewer problems and spheroidal graphite cast iron even less. As far as alloyed cast irons are concerned, their weldability depends on the elements added and must be evaluated case by case; it is worthwhile, however, to act in the same manner as when in the presence of grey cast iron.

Among alloyed cast irons, type Ni Hard is relatively widespread with nickel added to increase abrasion resistance. This material cannot be welded.

Cast iron can be hot or cold welded.
Hot welding, by now in disuse for the disadvantages involved, above all if applied on thick pieces, consists of bringing the base material to a temperature of approximately 400°C, followed by welding without pauses, finally leaving it to cool slowly away from air currents or beneath ash. A further heat treatment may be done with time and temperature variables depending on the type of cast iron.

Grey cast iron, by its nature, tends to cool more quickly, therefore during welding, the piece needs to be kept hot using natural gas burners.

Hot welding is the only procedure which confers to the welded area, the same structure, mechanical characteristics and colour of the base material. Hard zones do not remain and the internal tensions are minimal in that the usable filler materials have the same nature as the base metal. Welding is done only on a flat surface after having accurately prepared the ends by rounding the edges. The advised technique in these cases is welding with an oxy-acetylene flame with **KOY 1514 S** rods. The flame is regulated by lightly adjusting the "fuel" and must be done from right to left using a well-formed flame.

Cold welding, depending on the type of cast iron, is done with electrodes which have a cored wire in pure nickel **(KOY 20 A)** or nickel-iron **(KOY 13 A - 2000)**.
The choice is made based on the thickness to join and the importance of the weld considering the following:

Cast Iron

The **KOY 20 A delayed melt** electrodes are used with the **negative** pole (-) melting very slowly in large drops, offer the best performance on thin walls and the deposit has optimum elongation.
The **KOY 13 A** electrodes have optimum mechanical strength and resistance to cracking; they lend themselves, aside from applications on cast irons of all types, also to joints of cast iron with iron and are equipped with optimum curability.

In cases of joints on cast iron for which the maximum mechanical seal is required the **KOY 2000** can instead be used, singular in its type for the bimetallic core which increases the weldability by limiting overheating even in the highest currents. To speed up the welding process a new cored wire formulation in the **KOY 348 FS** was introduced, ideal for welding and repairs of thick pieces.
Facing on cast iron can be carried out using all the precautions previously described and using the **KOY 13 A electrodes**. To avoid inconveniences contact our technical service.

Sequence of the passes on the face of a cast iron transmission shaft

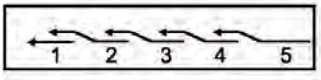
On **broken pieces** the preparation is done by chamfering the two ends with socket weld end preparation until the root of the crack is completely opened until a distance of 1 mm between the ends is achieved. Any missing parts can be reconstructed from mild steel.

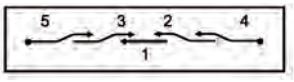
On **cracked pieces,** the end or the two ends of the crack (the extension of which is determined with the aid of a penetrating liquid) are drilled to a distance of approximately one centimetre from their apparent ends, with a point of about 6 mm in diameter by a width up to 10 mm, and with a larger point for higher thicknesses.
The **diameter of the electrode** should be chosen in relation to the thicknesses to be joined. The most commonly used diameter is **3.25** but in some cases it is wise to use **2.5** to produce less heat in the base material. The **welding current** is regulated on the low values compatible with a good adhesion to the walls.

It should be ensured that no grooves form in the side of the bead, symptoms of too great intensity. If an alternating current generator is available, it should be used, as it is more suitable for giving the correct penetration of the bead.
A light pre-heating of the pieces (to approximately 250÷300°C) in some cases is useful for the containment of risks and allow a faster weld. In general it is preferable to weld complete cold.

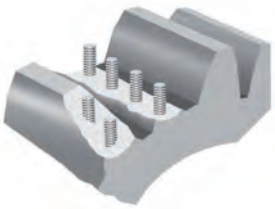
Cast Iron

The weld should be done in sections with the **"pilgrim step"** technique, taking care to fill the final crater, to detach the bead already deposited and to overlap the welded sections well which should be approximately 3 cm in length and vigorously hammered, to accompany the shrinkage. This operation is done with a hot bead, starting from the point of departure of the electrode. The hammer must have a rounded point. The holes are closed at the end of the operation.

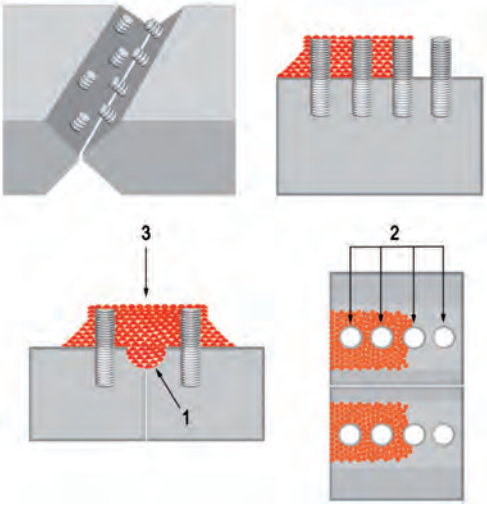




In the case of **reconstruction with missing parts**, such as gear teeth or other highly stressed restoration works, so that the hard and brittle heat altered zone may give rise to breakage, it is advisable to drown the threaded sections in the base material and to reconstruct the missing piece after, with electrodes type **KOY 2000**. The system is shown in the figure to the right.



The technique of executing overlapping beads requires an **accurate removal of the slag** between one pass and the next, so there are no internal inclusions in the joint which would reduce the resistance of the weld, as well as the **hammering** of the still hot bead. The passes, above all those of adherence, must not be oscillated.
Even in the welding of thick shims, as in the reconstruction of missing parts, the application of threaded sections represents a safe and convenient solution.

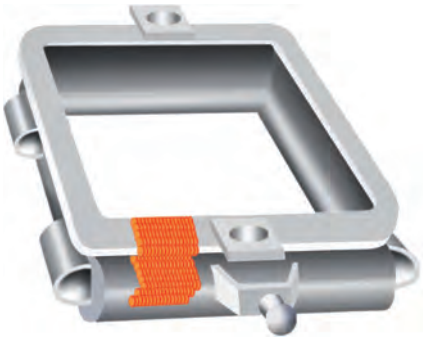


THIS IS CAST IRON

If there is any doubt about the nature of the cast which is to be welded (outwardly cast steel and cast iron are very similar) test with a hammer, file and chisel. Cast iron, unlike steel does not create metal shavings but crumbles; if a grinding wheel is used there are no sparks. If a hammer is used on spheroidal cast iron, the noise is dull while on grey cast iron, an acute echo is produced. As well, the latter dents much more easily leaving an impression.

Hot welding of cast iron. Beads of the same structure and colour

1514 S



Joints and facings on grey, white and malleable cast iron. Joints of cast iron with steel after pre-heating and maintenance of the temperature (> 500°C) for the entire execution of the weld. Repairs on cast iron of all types. After welding the pieces must be refired at variable temperature and times based on the type of cast iron. The deposit is enamelable.

The **KOY 1514 S rod** is a specially fluxing coated alloy whose deposit has the same colour and structure as cast iron. It has mechanical strength, toughness and resistance to corrosion similar to that of the base metal. The deposit and the zone of transition are easily filed and can be threaded as it is not the hardened zone.

Main applications: joints which are defective, broken, cracked, worn or porous. Pistons, pump rotor parts, levers, clamps, toothed wheels, pulleys, collectors, compressor guards, engine heads, parts, baseplates, electric motor flanges, parts and seats of valves.

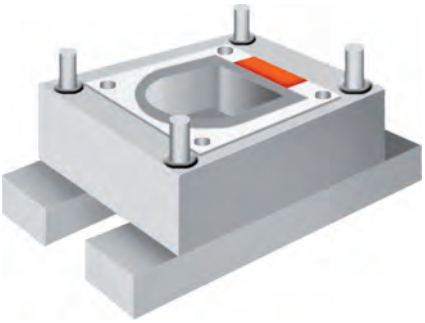
1514 S

AVAILABLE DIAMETERS (mm)
5.0

TYPICAL MECHANICAL VALUES		
R_m	▼	
N/mm² 300-330	HB 200	after PWHT HB 200

Electrode with a bimetal core and cored wire for tough joints on cast iron

2000 **348 FS**



Workable joints and facings among different types of spheroidal cast iron, grey and malleable or with steel. Easy to use, stable and concentrated arc, without the marked tendency to overheat typical of electrodes for cast iron.

The **KOY 2000 electrode** of the most recent formulation deposits a nickel-iron alloy characterised by an increased resistance to cracking and an excellent mechanical strength. The deposits and the zones of transition are workable by tool, the bead is smooth, absent of porosity and lateral cuts. The electrode welds in all positions except in the vertical down.

The **cored wire KOY 348 FS** has a chemical analysis and mechanical characteristics equivalent to the electrode. It is ideal for welding and repairs of thick pieces, it being understood there are limits to heat input.

Main applications: Diesel engine blocks and heads, columns and baseplates of presses and rolling mills, guides and machine tool benches, valve seats, parts of pumps, compressors, machines and differentials, flywheels and ring gears, pulleys, bearing supports.

Electrode with a bimetal core and cored wire for tough joints on cast iron

2000

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Basic

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	▼
N/mm² 550	N/mm² 380	%20	HB 220

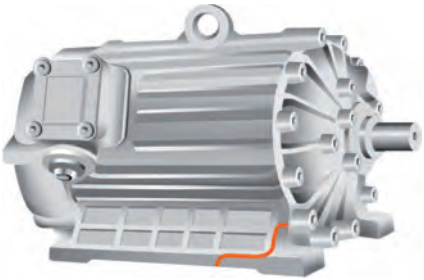
348 FS

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
1.2	1 - 2 - 5	Argon - 18% CO_2 mix • pure Argon

TYPICAL MECHANICAL VALUES
▼
HB 150

Workable joints, with a high resistance to cracking

13 A



Welding of spheroidal cast iron, grey and malleable and dissimilar joints between cast iron and steel. Maintenance work on aged cast iron, impregnated with oil or corroded, even pieces of a great thickness. The new formulation allows continuous globular transfer and generates beads of a maximum resistance to cracking. Welds in all positions including in the vertical down.

The **KOY 13 A electrode** is characterised by a stable concentrated arc. The speed of the melt is increased and the slag, which covers the bead well, is easily removed.
The coefficient of dilatation is very close to that of the cast iron and allows the facings of a notable volume to be carried out without cracks at an increased speed.

Main applications: pump and compressor pistons, supports and parts of presses, rolling mill cylinders, joints of greatly thick pieces, reinforcements of steel on levers, chassis and base plates, engine heads, gear teeth and chain wheel teeth, guards, oil sumps, casings, flanges.

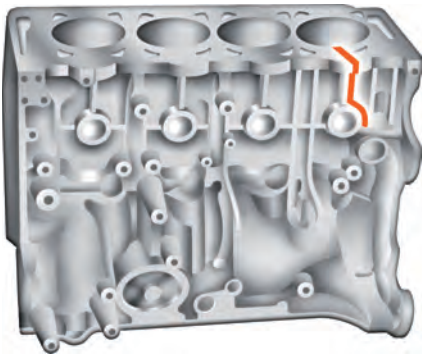
13 A

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2 - 3 - 4 - 5 - 6	Graphitic

TYPICAL MECHANICAL VALUES	
R_m	▼
N/mm² 480	HB 200

Delayed melt electrode for joints on thin walls

20 A



Assembly and repairs of cast iron of all types and heterogeneous joints with steel, copper alloys and nickel alloys, particularly of widths less than 10 mm.

The **KOY 20 A electrode** has a nickel core and has an extremely sweet melt and a transfer of large droplets, which facilitate the work and favour low penetrating beads without hard zones, grooves, porosity or projections. The deposit is smooth, aesthetic and homogeneous: The electrode welds in all positions except in the vertical down. The KOY 20 A electrode is connected exclusively to the negative pole (-) of the weld machine.

Main applications: machine guards, pump parts, differentials, engine blocks, shoulders of rolling mills for rubber and more general on repairs of thin broken walls.

20 A

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2	Graphitic

TYPICAL MECHANICAL VALUES	
R_m	▼
N/mm² >280	HB 160

Aluminium and its alloys

Operational issues and solutions

Aluminium presents two obstacles in terms of welding.

- **It is coated in a thin invisible layer of oxide (alumina) with a much higher melting point than that of pure aluminium.** This requires the use of an energetic deoxidizer if welding with a blowpipe and the use of an alternating current welding machine with a high frequency overlapping if TIG welding.
- **It has an increased heat conductivity** for which high heat input must be used otherwise there is the risk of sticking rather than welding. The negative aspect of increased heat input, which needs to be addressed, is distortion of the pieces.

The **filler material** is selected in relation to the composition and the characteristics of the alloy to be welded. The welding processes which can be used are:

- **Welding with a blowpipe**
- **Welding with coated electrodes**
- **TIG welding**
- **MIG welding**

The best results are obtained by TIG with an alternating current generator and high frequency overlapping. MIG welding with pure argon as a protective gas, is used for widths exceeding 3 mm and offers good results provided the chamfers are carefully prepared and the welding current is accurately adjusted.
With the electrode the base material needs to be pre-heated. It is difficult to obtain perfect welds. It is above all used for maintenance interventions on small pieces.
Welding with a blowpipe does not pose excessive problems: a rod with a melting point slightly lower than the base metal is used along with a very aggressive deoxidant. The elimination of deoxidant residues is done by immersing the welded piece in hot water in which caustic soda (approximately 20% of the weight) has been dissolved.

Aluminium and its alloys

NUMERIC CODE OF THE BASE MATERIAL	COMMERCIAL NAME	CHARACTERISITICS	ELECTRODE	BLOWPIPE	TIG ROD	MIG WIRE
5005 5050 5052 5083 5086 5154 5254 5454 5456 5754	Peraluman	Mechanical strength Corrosion resistance Anodizable			522 S	328 A
6060 6061 6082 6101	Anticorrosive	Mechanical strength Resistance to atmospheric corrosion			526 S	370 S
Alloy Ai-Si Alloy Al-Si-Mg	Melts	Lightness Resistance to corrosion	24	523 TS 526 S	524 S	370 S

Welding of aluminium alloys with high mechanical properties

522 S **328 A**

Joints of profiles, sheet metal, pipes, extrusions and fusions in Al Mg 5%; heterogeneous welding between alloys Ai-Mg, Al-Mn, Al-Mg-Si, Al- Zn-Mg (self-hardening). The deposit is of a similar colour to the base metal and may be treated by anodizing.
Joints with increased mechanical characteristics, resistance to atmospheric corrosion and to corrosion in humid environments such as salt farms or sea water.

The **KOY 522 S** rod is used in TIG processes with an alternating current generator; the deposit must be protected even on the back step of the weld with an inert argon atmosphere.
The **KOY 328 A wire** is suitable for use with traditional wire welding machines and above all in the use of pulsed arc welding.

Main applications: frames, tanks, repairs of castings, pumps, guards, pistons, accessories for combustion engines, brake shoes, pipework, side panels and bodies for lorries.

522 S

AVAILABLE DIAMETERS (mm)
1.0 - 1.2 - 1.6 - 2.0 - 2.4 - 3.2 - 4.0

TYPICAL MECHANICAL VALUES		
R_m	R_s	A%
N/mm² 240	N/mm² 130	%25

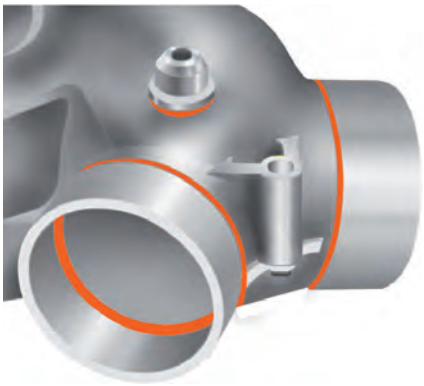
328 A

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.0 - 1.2 - 1.6	Pure Argon

TYPICAL MECHANICAL VALUES		
R_m	R_s	A%
N/mm² 240	N/mm² 130	%25

Welding at a low melting point of laminated and fused aluminium

524 S **526 S** **370 S**

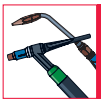


Joints on laminated and fused aluminium with a similar colour to the base metal and maximum aesthetic quality of the deposit.

The **KOY 526 S rod** is used in TIG welding with pure argon protection. It may also be used with an oxy-acetylene blowpipe using the **KOY 851** flux (residues are to be eliminated by careful washing). It is easy to use due to he high fluidity of the pool and the low melting point.
It is available in a version called **KOY 524 S** with a less restricted fabrication tolerance and therefore is more economical.
The **KOY 370 S wire** has characteristics and a composition similar to the KOY 524S - 526S rods and is used for MIG welding on widths exceeding 3 mm to obtain increased productivity.

Main applications: pipework, engine blocks and heads, guards, containers, pipes, flanges, tanks, baseplates, chassis, pump and compressor parts and repairs to joint defects.

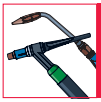
Welding at a low melting point of laminated and fused aluminium



524 S

AVAILABLE DIAMETERS (mm)
1.6 - 2.0 - 2.4 - 3.2 - 4.0

TYPICAL MECHANICAL VALUES		
R_m	R_s	A%
N/mm² 180	N/mm² 80	%8



526 S

AVAILABLE DIAMETERS (mm)
1.0 - 1.6 - 2.0 - 2.4 - 3.2

TYPICAL MECHANICAL VALUES		
R_m	R_s	A%
N/mm² 150	N/mm² 75	%10

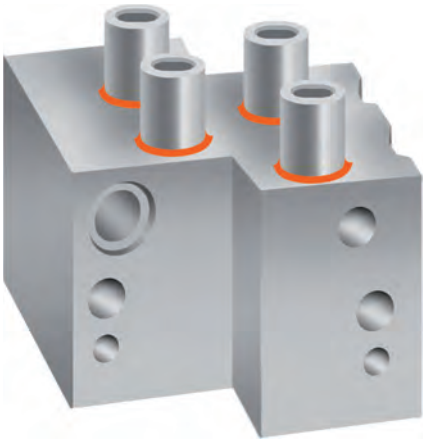
370 S

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.0 - 1.2 - 1.6	Pure Argon

TYPICAL MECHANICAL VALUES		
R_m	R_s	A%
N/mm² 150	N/mm² 75	%12

Universal for joints on fused aluminium of an unknown origin

24 **523 TS**



Welding of alloys Ai-Si and Al-Si-Mg with or without copper; joints on fused aluminium of an unknown composition.

The **KOY 24 electrode** is characterised by high fluidity and welding speed. It requires a continuous current generator, flat welding, a short arc and pre-heating to approximately 200° C. It obtains a homogeneous deposit, absent of porosity. The coating is sensitive to humidity and requires a dry, hot storage environment. When the work has been completed, the residual slag needs to be removed by washing.
The **KOY 523 TS rod** has the flux incorporated and is used with an oxy-acetylene blowpipe. Its high fluidity allows for very aesthetic joints and good penetration which often do not require any further mechanical processing.

Main applications: repairs to casts (guards, engine blocks, etc.) compressors, containers, pulleys, body constructions and side panels of lorries, flanges, pipes, radiators and coils.

Universal for joints on fused aluminium of an unknown origin

24

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2	1 - 2 - 5	Special

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	▼
N/mm² 130	N/mm² 90	%15	HB 50

523 TS

AVAILABLE DIAMETERS (mm)
2.0 - 3.0 - 4.0 - 5.0

TYPICAL MECHANICAL VALUES		
R_m	R_s	A%
N/mm² 130	N/mm² 55	%16

Copper and its alloys Nickel and its alloys

Operational issues and solutions

The welding of **copper** is carried out with various processes but, to avoid deterioration of the mechanical characteristics of the joints, the welding material must absolutely not contain impurities. For this reason the **KOY** products are sourced from selected prime materials and a carefully checked.

Choice of the process and of the product

Thin copper pipes used in refrigeration plants, for heating plants, for hydraulic and similar uses, are correctly welded by **blowpipe** with a neutral and mild flame using self-fluxing alloys **KOY 915 S - 917 S - 925 S**. These alloys contain silver and provide improved mechanical characteristics as well as an increased internal silver content.
In this case the preparations are socket welded enlarging one of the two ends and inserting one pipe into the other to a depth of at least 10 mm.

For head to head pipe joints or for highly stressed welds of a thickness exceeding 3 mm or which have been poorly prepared, a more expensive silver alloy must be used, which provides a more secure performance such as **KOY 923 S - 934 S** with flux **KOY 866** or the corresponding coated alloys.

Copper and copper alloys are characterised by an increased heat conductivity. To avoid sticking the weld must only be done after an energetic pre-heating.

Bronze must first be identified since it is always advisable to use a filler material with a chemical composition as similar as possible to the metal to be welded.

The following table provides further criteria for choice and operational recommendations:

	ALUMINIUM BRONZE	BRONZE HARDFACING ON STEEL
Electrode	34 S	36 A
Tig	532 S	-
Mig	334 S	-
Notes	Pre-heating 150° C	Pre-heating 150° C

Nickel and nickel alloys are used in the chemical industry for their mechanical strength, resistance to corrosion and to heat. Nickel-based filler materials, in addition to the welding of alloys of the same composition, are largely used for joints and hardfacings on **steel** when the welded joint must assume characteristics of mechanical strength, resilience (above all at low operating temperatures) and resistance to high temperatures.

Welding does not pose excessive problems in either case and the quality of the joint is usually good.

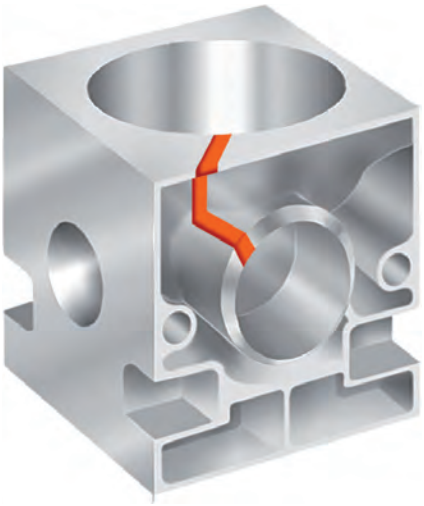
For homogeneous joints the choice of filler material is made taking into account the indications contained in the following table:

BASE MATERIAL	ELECTRODE	TIG	MIG
Inconel 600 - 602	29 A	529 A	338 S
Inconel 800	29 A	529 A	338 S

If specific copper and nickel based filler alloys not included in this catalogue are required, please contact our Technical Office which will be able to recommend the most suitable product to use.

Welding of aluminium bronze and highly-resistant hardfacings on steel

34 S **532 S** **334 S**



Welding of joints of aluminium copper (aluminium between 5% and 12%) or with steel, workable hardfacings resistant to friction under strong loads on steel, cast irons, stainless steels, nickel and its alloys. Increased resistance to compression and cavitation, to corrosion from sea water and from acids, good mechanical strength.

The **KOY 34 S electrode** is characterised by a well concentrated arc and from a mild melt, fast and without projections. The beads are compact and do not present inclusions of slag or porosity. The slag follows the arc well, uniformly covers the seam and is easily removed.
The **KOY 532 S rod** is used in TIG welding under the protection of pure argon and has similar characteristics to the KOY 34 S electrode, with a fluid, regular pool.
The **KOY 334 S wire** is used with MIG processes to deposit higher quantities of filler metal.

Main applications: transmission drives, rails, rail grooves, gear teeth, valves , pumps, pistons, turbines, propellers and propeller shafts of ships, desalination plants, screw conveyors, conduits and wear plates.

34 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
3.2	1 - 2 - 5	Basic

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	▼
N/mm² 440	N/mm² 200	%30	HB 170

532 S

AVAILABLE DIAMETERS (mm)
1.2 - 1.6 - 2.0 - 2.4 - 3.2

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	▼
N/mm² 420	N/mm² 200	%32	HB 130

334 S

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
0.8 - 1.0 - 1.2 - 1.6	Pure Argon

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	▼
N/mm² 420	N/mm² 200	%32	HB 130

Welding and hardfacings resistant to friction, corrosion, erosion and cavitation

36 A

Joints of aluminium copper to manganese and refills on different supports such as alloyed steels and non-alloyed steels, resistant to wear.

The **KOY 36 A electrode** is the hardest version (approximately 300 HB) particularly suited to the refilling of pieces stressed by rubbing of metal under strong pressures, also in the presence of corrosion from chemical agents (acids and sea water). The arc is stable and favours compact deposits without porosity with a watertight seal. The slag is easily removed.

Main applications: repairs and hardfacing on propellers and propeller shafts of ships, gear teeth, guides, pins, bushings, casings of pumps, flanges, pipes, valve seats, worms, bearings for pairs of cylinders rolling mills, construction of large bushings with steel base.

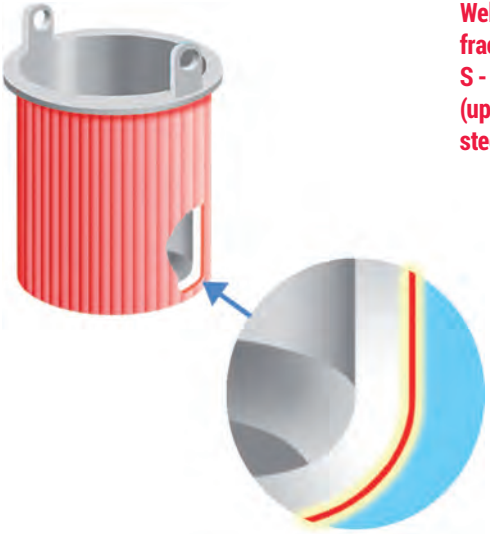
36 A

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
3.2 - 4.0	1	Basic

TYPICAL MECHANICAL VALUES		
R_m	R_s	▼
N/mm² 670	N/mm² 300	HB 290

Nickel based alloys resistant to heat stress

29 A **529 S** **338 S**



Welding of heat treatment equipment in refractive steel of any nature (AISI 310 - 310 S - Inconel - etc:) resistant to heat oxidation (up to +1100°C) and to corrosion. Joints of steels for cryogenic uses (down to -196° C).

The **KOY 29 A electrode** has a basic coating type with an efficiency of 140%. The high nickel content enormously reduces the diffusion of carbon at high temperatures in the transition zone. The austenitic deposit resists low and high temperatures, thermal shock, fragilisation and hot cracking. Welds with a continuous current in all positions except in the vertical down. Presents aesthetic well penetrating beads.
The **KOY 529 S rod** is used in TIG welding and has similar characteristics to the KOY 29 A electrode. The TIG process is preferred for work on thin shims and for root pass welds on pipes.
The **KOY 338 S wire** is used in MIG processes, presents a deposit of the same composition and a greater productivity compared to the KOY 29 A electrode.

Main applications: heat exchangers, die-cast pressure moulds, pickling tanks, turbine blades, baskets and various equipment for heat treatment, welding of cryogenic steels at 9% nickel for use at low temperatures.

Nickel based alloys resistant to heat stress

29 A

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Basic

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 620	N/mm² 400	%32	J (-196° C) 80

529 S

AVAILABLE DIAMETERS (mm)
1.0 - 1.2 - 1.6 - 2.0 - 2.4 - 3.2

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 610	N/mm² 400	%32	J (20° C) 160

338 S

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
0.8 - 1.0 - 1.2 - 1.6	Pure Argon

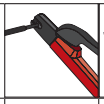
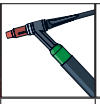
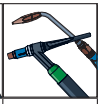
TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	KV
N/mm² 610	N/mm² 400	%32	J (20° C) 160

Hardfacings

- Anti-friction
- Resistant to abrasion
- Anti-wear from metal
- Resistant to heat

COMMERSALD

Hardfacings

Index Hardfacings						
Anti-friction	**36 A**	**559 A**	**342**			
Resistant to abrasion	**100 A**					
	102		**211**	**311** **311 GS**		
				230 GS		
	181 S	**563**	**223 A**	**1600 S**		
	160			**316**		
				316 GS		
	162			**267 GS**		
	165			**317 GS**		
	170 HS					
	195 S				**595 A**	
						596 L **596 B**
Anti-wear from metal	**151**					
	148 S			**313**		
	152					
	147 **147 S**	**582**				
		587 S **584 S** **586 S**				
			234 S **236 S** **233 S**			
Resistant to heat	**175 S**					**565 S**
	176 S					**576 S**
	172 S					**572 S**

The welded hardfacing

Hardfacing with precious alloys makes it possible to ennoble, at a contained cost, base materials of a low cost. Current knowledge puts this technology among those able to provide an increased benefit in terms of increasing production, due to fewer machine stops resulting in higher efficiency of the hardfaced pieces.
To obtain these results a careful analysis of the problem needs to be carried out to identify the ideal filler material and welding process for each individual situation. We all know that the cost of the material and the labour required to apply it, in relation to the operational result and adjusted for the costs due to a lack of production resulting from machine stoppages for maintenance interventions, represents the only comparable value among traditional solutions and the evaluation of the innovative proposal of hardfacing.
A correct analysis of the problem must take into account the life cycle of the hardfaced piece in relation to the life cycle of the entire complex where it is located, so as to obtain a uniform decline of all the equipment. Only in this way will it be possible to perform maintenance with the system still partially efficient in all its parts.

The proposal

Our company, founded and developed while operating mainly in the consumables industry, has invested a large part of it resources in research and the proposal of innovative superalloys and now presents itself as a partner for products and technologies, safe in the knowledge that it can deliver results and certainty. The synthesised program of materials in this catalogue only includes types used for universal application; our technicians can provide personalised proposals, following analytical schemes which have been tested and are reliable.

The types of hardfacing

The factors which determine wear can be summarised in four principal categories - **friction, abrasion, wear from metal and wear from heat** - which will be analysed here

1. Anti-friction hardfacing

It is normally carried out on shafts, bushings, and guides in carbon steel or cast iron, to give the surfaces in contact with another metal (carbon steel, tempered, stainless, etc.) characteristics similar to that obtained with **bearings**. The costs are much more contained as the dimensions of the pieces to refill increase. The hardfacing can be done on one side or the other of the coupling, preferably with the MIG/MAG process.

Anti-friction filler material of the **KOY "GOLDEN LINE"** range, listed in this catalogue are as follows:

WORKING CONDITIONS	ELECTRODE	TIG ROD	MIG WIRE
low load - increased sliding speed	34S	532 S	334 S
increased load - slow sliding speed	36 A	559 A	342

2. Hardfacings resistant to abrasion

Wear caused by abrasion from sand, silica, cement or carbon is the most frequent cause of system stoppages in many industries and is also the type of hardfacing to be most carefully planned as the pieces do not wear uniformly: the intervention must also be done with different products on the same piece or with different thicknesses to obtain a uniform decay of the piece.

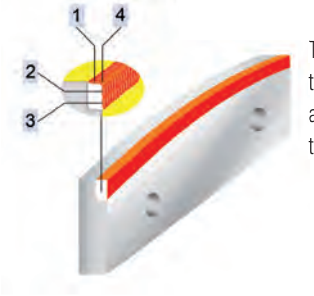
Wear resistant **KOY** products, of the **"GOLDEN LINE"** range listed in this catalogue are summarised in the following table:

Type of wear	Sector of application	Hardness of the deposited metal	Hardness after surface hardening.	Electrode	TIG rod or blowpipe	MIG/MAG wire	Cored wire
Compression at a maximum work temperature of < 300°C caused by high pressure	Earth moving machines, rolling stock, mineral crushers	200-250 HB 280-300 HB 54-60 HRC	400-520 HB	102 100 A 181 S	562 563	211 220 S 223 A	311 - 311 GS 230 GS 1600 S
Severe abrasive wear in the absence of increased impact stresses	Cement kilns, furnaces, mines, mining industry, ceramics Crushing mills for minerals of a limited size or brittle composition	54-60 HRC 60-62 HRC 62 HRC 55-63 HRC 64-66 HRC 65-66 HRC		181 S 160 164 S 162 165 170 HS	563	223 A	1600S 316 - 316 GS 267 GS 262 S 317 GS
Extreme cases of abrasive wear from minerals (sand, carbon, kaolin, etc.)	Foundries, furnaces, cement kilns, mining industry. Crushing mills, worm screw , buckets, scrapers, cylinders, drills, mixers, etc.	2000-2100 HV* 2600 HV*		195 S	595 A 596 L - 596 B		319S

* Hardness of tungsten carbide grains

3. Anti-wear from metal hardfacings

This category includes hardfacings carried out on parts of machines or equipment subjected to abrasive and adhesive wear for the sliding of one metal on another, with or without the presence of seizures. Examples are the knives for cutting sheet metal, stamping dies, hammers and knives for disintegrator mills, the teeth of large gears, etc.



The hardfacing layers must have a hard, tough and resistant structure. The products in the table below have shown themselves to be appropriate, as well as some cobalt based materials which appear in the table relative to heat resistant hardfacings.

Type of wear	Sector of application	Hardness of the deposited metal	Hardness after surface hardening.	Electrode	TIG rod or micro laser welding blowpipe	MIG/MAG wire	Cored wire
Abrasion from metal sliding on cold metal or with a maximum operating temperature of 450°C	Work for plastic distortion of metals. Shearing, pressing, stamping or cold cutting	36-48 HRC 45-48 HRC 52-58 HRC 59-61 HRC	- - - -	151 148 S 152 147-147 S	587S 584S 586S 582	234S 236S 233S	313

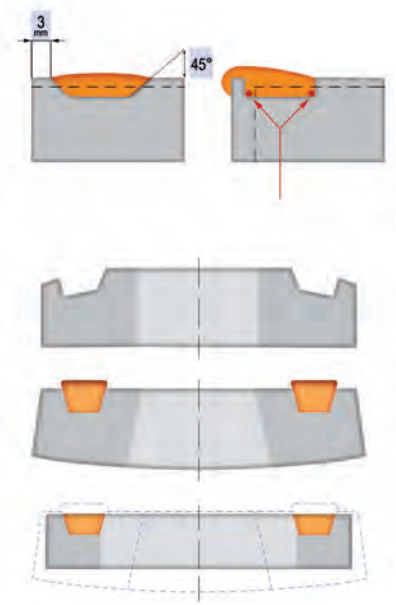
4. Hardfacing resistant to heat

Performed on forging hammers, presses and hot shearers, punches and dies for the extrusion of tubes and, in general, processing equipment used for hot deformation of metals. KOY products, of the "GOLDEN LINE" range listed in this catalogue are summarised in the following table:

Tipo di usura	Sector of application	Hardness of the deposited metal	Hardness after surface hardening	Electrode	TIG rod or blowpipe
Hot wear caused by metal sliding Compression or distortion caused by increased pressure at a high temperature. Heat shocks	Hot working of the metals, steels, processing of plastic materials. Forging, stamping, extrusion.	35-40 HRC 44-45 HRC 50-53 HRC	- - -	175 S 176 S 172 S	565 S 576 S 572 S

Erosion, cavitation, corrosion, high pressure are other factors which determine wear and may be present also in combination with the type of wear described above: in these cases interventions should be carried out with products different to those indicated.

As the choice taken plays an important role in a company's economy, we recommend **the intervention of our Technical Service which will assist in dealing with problems of hardfacing** and will identify the product and the executive technology which is most suitable to the situation.



Choice of the process

The detail of a system which has already been hardfaced through welding must respond, as mentioned above, to a primary requirement: that of offering a more favourable cost/performance ratio compared to the same detail constructed in any other way. To obtain this result, a low cost support material must be used, sufficiently resistant, with good weldability and an appropriate filler material applied with the most correct process. Carrying out maintenance of the constructed pieces without taking account of the need for hardfacing is an inevitable source of problems of incompatibility and the choice of the process becomes important if not decisive. The following table summarises some characteristics of the preventative deposits (filler and process materials) applied on commonly used steel in the various conditions of wear.

Type of wear	Welding process	Base material					
		Carbon steel (Steel c20-c30-c40)			High-alloyed steel from tempered steel or quenched and hardened steel		
		Reliability of the welding process	Damage caused by processing of the base metal	Adhesion to the base metal	Reliability of the welding process	Damage caused by processing of the base metal	Adhesion to the base metal
Cold abrasive wear from sand, silica, refractory, kaolin, carbon, etc.	MIG/MAG Electrode TIG LASER P.T.A. (Plasma Transferred Arc)	Good (Discrete)	Medium	Optimum (Good)	Poor	Notable	Discrete
	Blowpipe brazing	Very good	None	Good	Good	None	Discrete
	Metallisation for dust projection to the torch or with pistol	Optimum	None	Good	Discrete	None	Discrete
	Hardfacing with pistol	Poor	None	Insufficient	Poor	None	Insufficient
	Cold hardfacing with plasma spatter or similar systems	Good	None	Insufficient	Mediocre	None	Insufficient

Practical advice on the execution

Base layers

On one detail for which hardfacing was not provided, the execution of an elastic layer before hardfacing is usually carried out with austentic-ferritic electrodes to stop shrinkage cracks from proceeding in the base metal. This technique is not common due to certain difficulties such as:

- radical drop in hardness of the over-layered hardfacing;
- risk of cracking between one layer and the other, due to the variation in linear dilatation coefficient of the three metals in use, if the piece is used for processing at high temperatures;
- fragile zones due to an incompatibility between the different elements of the alloy, when hardfacing with nickel or cobalt based alloys.

The bottom layer with the austenitic-ferritic **KOY 74 HL, KOY 85**, etc, is performed when difficult to weld steels or steels aged from long periods in corrosive or high temperature environments are to be hardfaced.

Pre-heating

Pre-heating of the pieces is recommended to limit the damage of cracking from shrinkage in addition to carrying out the base layer with an austenitic-ferritic material when the dimensions of the piece permit. The temperature for pre-heating varies from 200°C to 600°C based on the carbon equivalent present in the base metal and its thickness.

Dilution and cracking

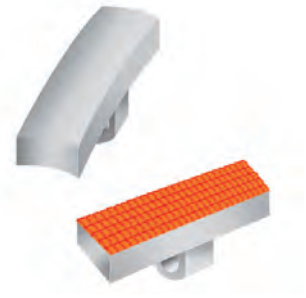
A **correct technique** in the execution of hardfacing must take into consideration the dilution, that has a detrimental effect on both the composition and hardness of the deposit.

In all processes, excluding brazing and **PTA Commersald welding** where the level of penetration has no effect, because of dilution the deposit in the first pass will be of a different alloy from that required.

It is therefore indispensable, to obtain the typical characteristics of the filler material, to carry out **more overlapping layers** as well as adopt procedures with low heat transfer and little penetration. It is also advisable to overlap the beads to lower penetrate in the base material and to tilt the electric arc from the part of the deposit just completed.

A filler material with low dilution will adhere better, harder and rich in precious elements; as a consequence the deposit will be more resistant to wear. Using a hard material this will lead to a greater brittleness with consequent formation of cracking, usually across the seam, but should not cause concern because it will stop at the base layer. At times a web will form, more or less dense, and this also will have little effect in relation to hardness, to the composition of the hardfacing and to the pre-heating temperature, as the higher the temperature, the lower the number and smaller size of the cracks.

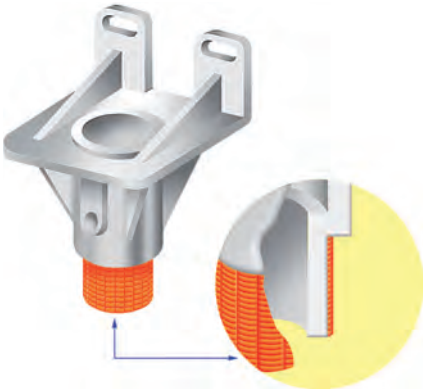
Distortion of the welded pieces



The charge to the electric arc, above all if performed on an extended surface area, causes a distortion of the piece. The thicker the hardfacing, the more limited the thickness of the base material, the lower the temperature of pre-heating and the tougher the filler material, the greater the distortion.
The cracks which form using a very hard, and consequently fragile, filler material cause the base material to distort relatively little.
Binding the piece to be hardfaced has a benefit, but often does not solve the problem; as with partially immersing the piece in water.
Attempting to re-straighten a piece distorted from the weld is a difficult process, which is often impossible. The ideal solution is to predistort, when possible, the base material before performing the hardfacing.

Joining objects at high pressures and at a low speed of sliding

36 A **559 A** **342**



Hardfacing of carbon steel, stainless steel and cast iron with a high resistance to wear from low speed sliding metals. Optimum resistance to high pressures and corrosive agents; the deposit resists corrosion from sea water and cavitation.

The **KOY 36 A electrode** has a basic coating, welds with a concentrated and stable arc, the melt is mild and without sprat, the slag is easily removed. The tip of the electrode is alluminised to promote trigger of the arc on contact. The hardfacings should be performed with low amperages, to limit dilution with the base metal.
The **KOY 529 A rod** is used in TIG hardfacing and has similar characteristics to the KOY 36 A electrode. The TIG process is preferred for refills on small and medium sized pieces.
The **KOY 342 wire** is used in MIG processes and is indicated for hardfacings on large surface areas for the increased heat input and the considerable speed of the deposit.

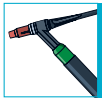
Main applications: anti-friction refills on gear teeth, pins, shafts, guide, eccentrics, hydraulic pistons, supports, bushings, and slides.

Joining objects at high pressures and at a low speed of sliding

36 A

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
3.2 - 4.0	1	Basic

TYPICAL MECHANICAL VALUES		
R_m	R_s	▼
N/mm² 670	N/mm² 300	HB 290



559 A

AVAILABLE DIAMETERS (mm)
2.4

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	▼
N/mm² 870	N/mm² 630	%12	HB 250

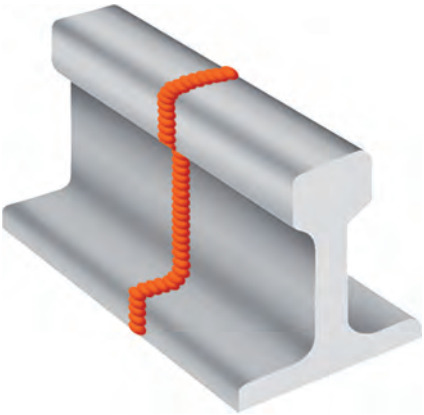
342

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
0.8 - 1.0 - 1.2 - 1.6	Pure Argon

TYPICAL MECHANICAL VALUES			
R_m	R_s	A%	▼
N/mm² 870	N/mm² 630	%12	HB 250

Joints and dimensional restoration on steel

100 A



Joints, hardfacings easily workable by tool, and base layers before hardfacing, with a high mechanical strength, to striking and high pressures. Welding of steels with a high elastic limit and restoration of worn profiles.

The **KOY 100 A electrode** has a basic coating and can be used in all positions except vertical down, with consistent results. The weld is characterised by a stable arc and mild melt, the thin slag is easily removed. This electrode may also be used for base layers, in cases of wear from metals, before hardfacing and facings with a high level of resistance to striking and high pressures, joints and restorations of worn profiles on alloyed steel. The deposit is easily worked by tool.

Main applications: welding and hardfacing on low-alloyed steels, where a joint with high mechanical characteristics is required, wheels, gear teeth, mill cylinders, chain wheels and earth moving machines Substrates on steel before the execution of hardfacings with an increased hardness. Substrates for restoration of sections on steel for hot working, before hardfacing.

100 A

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
4.0	1 - 2 - 3 - 5 - 6	Basic

TYPICAL MECHANICAL VALUES
▼
HB 280

Tough hardfacings and hardfacings subject to superficial hardening

102 | **211** | **311** | **311 GS**

Refills on carbon steel and austenitic steels with 14% manganese, with increased resistance to strong impacts and increase in the superficial hardening if subjected to striking or pressures; substrates resistant to compression. If the deposit is not hardened, it is workable by tool.

The **KOY 102 electrode** has an efficiency of 140% and is used in the flat position. It welds with a stable and determined arc.

The **KOY 211 solid wire** is used in MIG-MAG processes and has an excellent curability. It is used for work on highly worn pieces where an increase in productivity is desired, especially on automatic systems.

The **KOY 311 cored wire**, with a hardness of the deposit at the hardened state exceeding that of the KOY 102 electrode, is used without gas to speed up the welding process. Each diameter can be used with a wide range of parameters in relation to variations of penetration and speed of the deposit.

The **KOY 311 GS cored wire**, with characteristics similar to the KOY 311, is used with protective gas , to guarantee an excellent curability and aesthetic of the deposited beads.

Main applications: gearing of earth moving machines, rails and switches in manganese steel, brake shoes, armour and teeth on rollers for crushers, demolition plants and percussion tools.

Tough hardfacings and hardfacings subject to superficial hardening

102

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
3.2 - 4.0	1	Basic

TYPICAL MECHANICAL VALUES	
▼	▼
after welding HB 200-250	after hardening treatment HB 400-450

211

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
0.8 - 1.0 - 1.2 - 1.6	Argon +2% O_2/Argon +2% CO_2

TYPICAL MECHANICAL VALUES					
R_m	R_s	A%	KV	▼	▼
N/mm² 620	N/mm² 360	%35	J (20° C) 80	HB 200	hardened HB 500

311

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.2 - 1.6 - 2.4 - 2.8	Open Arc

TYPICAL MECHANICAL VALUES				
R_m	R_s	A%	▼	▼
N/mm² 860	N/mm² 580	%37	After welding HB 200	After hardening treatment HRC 52

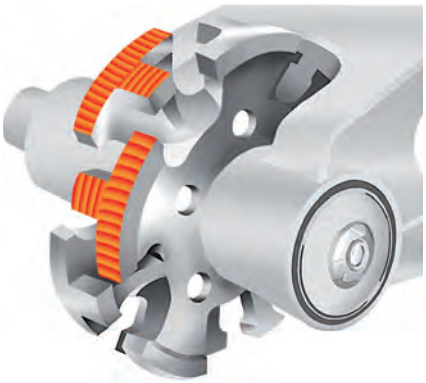
311 GS

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.6	Argon -2% O_2 mix

TYPICAL MECHANICAL VALUES				
R_m	R_s	A%	▼	▼
N/mm² 860	N/mm² 580	%37	After welding HB 200	After hardening treatment HRC 52

Anti-wear deposit at the limit of workability with tools

230 GS



Hardfacings with very high resistance to striking and good wear resistance also in the presence of high pressures. Buffer layers on carbon steel of a low or medium alloy, and quenched and tempered steel, when it is advisable to create a hard tough substrate before the execution of extra-hard facings. Deposit at the limit of workability with tools

The **KOY 230 GS cored wire** is used with protective gas, to guarantee an excellent curability and aesthetic of the deposited beads. It is used for work on highly worn pieces where an increase in productivity is desired.

Main applications: wheel drives on tracked vehicles, rollers, cylinders, guides, rolling idlers, track shoes and gear teeth.

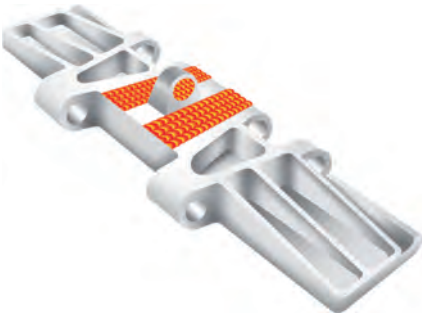
230 GS

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.2 - 1.6	Argon - CO_2 mix / 100% CO_2

TYPICAL MECHANICAL VALUES
▼
HB 350

Refills subject to abrasions, impacts and mechanical stress

181 S | **563** | **223 A** | **1600 S**



Strong and tough deposits, free of cracking and porosity, for hardfacings on steel, cast steel and manganese steel subject to striking and abrasive wear. Pliable seams with chromium carbides dispersed in the matrix and with a high resistance to cracking even if subjected to continuous striking and high pressures.

The **KOY 181 S electrode** has an efficiency of 110% and has excellent curability in the flat and vertical down, melts mildly with little projections. Thanks to its rutilic coating, the slag is easily removed and the seam has a fine, regular mesh and is aesthetic and well connected.
The **KOY 563 rod** is used in TIG processes and is used mainly for hardfacings on edges and on small sized pieces.
The **KOY 223 A wire** has a chemical analysis and mechanical characteristics equivalent to rods; it is used in MIG-MAG processes on especially large dimensions and with a high speed of deposit.
The **KOY 1600 S cored wire**, with similar characteristics, is used with active gas mixtures, with the benefit of an excellent aesthetic of the deposit and great ease of use.

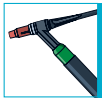
Main applications: refills of tracks on earth moving machines, diggers, cranes, tractors, blade teeth, crusher jaws and transporter rollers.

Refills subject to abrasions, impacts and mechanical stress

181 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Rutile

TYPICAL MECHANICAL VALUES	
▼	▼
after welding HRC 60	after PWHT 520°C/2h HRC 62



563

AVAILABLE DIAMETERS (mm)
1.2 - 1.6 - 2.4 - 3.2

TYPICAL MECHANICAL VALUES
▼
HRC 60

223 A

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.0 - 1.2 - 1.6	Argon + 2% O_2 • Argon CO_2 mix

TYPICAL MECHANICAL VALUES
▼
HRC 62

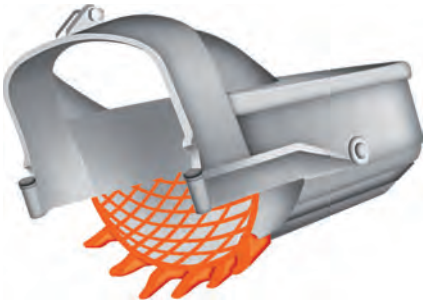
1600 S

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.2 - 1.6	Argon - CO_2 mix

TYPICAL MECHANICAL VALUES
▼
HRC 58-61

Refills of thicknesses resistant to wear

160 316



Refills in overlapping passes with excellent resistance to abrasion from sand, carbon and cement, combined with high pressures and light impacts. The hardfacing is performed on all types of steel, even high alloy and manganese. The deposit possesses an increasing hardness from the base to the surface layer and is not workable by tool.

The **KOY 160 electrode** has an efficiency of 160%, is easily used in the flat position and does not overheat if used with high amperages which increase the speed of the deposit. The slag is eliminated automatically and the beads have an excellent aesthetic.

The **KOY 316 cored wire** is used in an open arc (without gas) as inside, in addition to alloy grains, it has deoxidising elements which protect the pool; it is characterised by the high speed of the deposit and it is possible to overlay more passes without removing the slag. Low amperages are advised. The deposit is free of defects even if used in the wide range of adjustment of the parameters.

Main applications: dredges, earth moving machines, extrusion screws, crushers, sliding guides, pump impellers, blades and teeth of buckets, conveyor belts, plants for the crushing of minerals.

160

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1	Rutile

TYPICAL MECHANICAL VALUES
▼
HRC 60

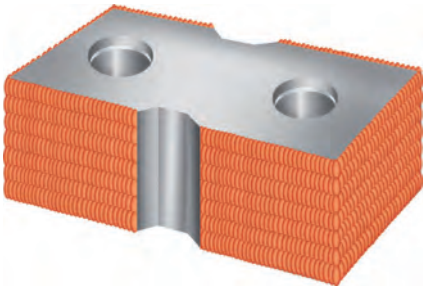
316

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.6 - 2.4 - 2.8	Open arc

TYPICAL MECHANICAL VALUES
▼
HRC 62

Homogeneous, regular and aesthetic anti-wear layers

316 GS



Deposits in increased passes with very high resistance to abrasive wear from minerals and resistance to average striking. Refills on carbon steel and low-medium-high alloys subjected to abrasion from sand, gravel, carbon, clay, and stones where there are light impacts; the seam is aesthetic with chromium carbides.

The **KOY 316 GS cored wire**, is used with protective gas, to guaranty an excellent curability and aesthetic of the hardfacing. The deposit has a bright and shiny appearance, free of spatter and projections on the sides of the beads. The welding pool is highly visible and free of oxides.

Main applications: crushing hammers, extrusion screws, crushers, conveyor belts, bucket teeth, pump impellers, mixing blades, rollers and anti-wear shoes.

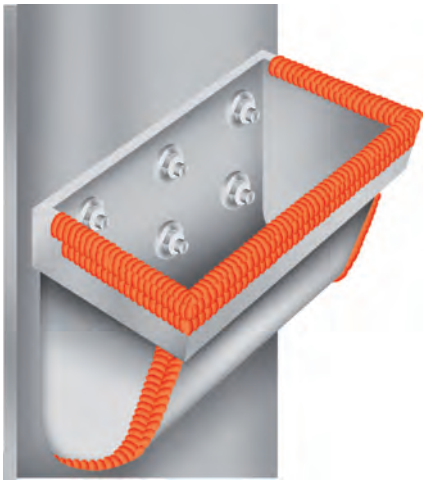
316 GS

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.6	Argon -2% O_2 mix

TYPICAL MECHANICAL VALUES
▼
HRC 59

Universal high performance for armour

162 **267 GS**



Hardfacings on pieces subjected to high wear from abrasion from sand, gravel, carbon and minerals where there are medium impacts. Refills on steels of various origins, in increased overlay passes, which promote the formation of a buffer layer due to the dilution with the base material in the first pass. The deposit has a low friction coefficient and due to its increased hardness, it is not workable by machine tool.

The **KOY 162 electrode**, with a new formulation, has a basic graphite coating with an efficiency of 190%; in welding it stands out for its high ease of use, high speed of the deposit, mild melt, thin slag and ease of removal. The seam has a smooth, regular mesh, free of defect.
The **KOY 267 GS cored wire** is a metallic type without slag. The required hardness is obtainable from the first pass of the deposit. It is used with protective gas, to guarantee an excellent curability and aesthetic of the hardfacing, and is free of cracks from shrinkage. The deposit has a good workability with tungsten carbide inserts.

Main applications: bucket excavators, hardfacings on earth moving machines, conveyor propellers, extrusion screws, details of mills for the grinding of minerals, mixer blades, scrapers and teeth of buckets and, more generally, for maintenance refilling of parts used in the ceramic, brick, cement and mining industries.

162

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
3.2 - 4.0	1	Basic

TYPICAL MECHANICAL VALUES
▼
HRC 60-63

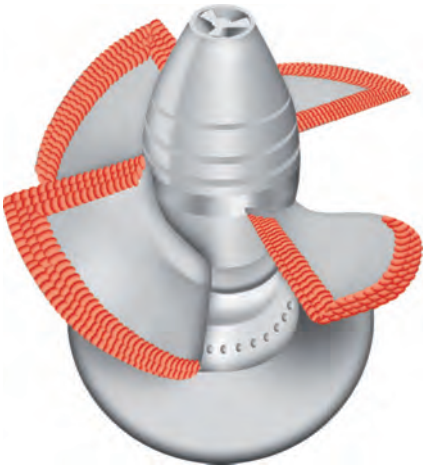
267 GS

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.2 - 1.6	Argon -2 %O_2 mix

TYPICAL MECHANICAL VALUES
▼
HRC 60

Deposits highly resistant to abrasion from silica-carbon-kaolin

165 **317 GS**



Hardfacings in two overlapping layers, with a very high resistance to abrasive wear from dry bulk materials (sand, carbon, kaolin, cement) also where there are moderate impacts, up to a temperature of 450°C. The deposit is made of extremely fine chromium carbides and niobium dispersed in the austenitic structure. The increased hardness of the deposited metal cracks the seam but this phenomenon has no impact on the result of the hardfacing as the cracking stops at the base metal.

The **KOY 165 electrode** has an efficiency of 190%; it is used with a long arc and can be performed with oscillated beads.
The **KOY 317 GS cored wire**, has similar characteristics to the above, is used with protective gas, to guarantee an excellent curability and aesthetic of the hardfacing. The deposit has a bright and shiny appearance, free of spatter and projections on the sides of the beads. The welding pool is highly visible and free of oxides.

Main applications: screws for extrusion and the transport of highly abrasive materials and mixing blades.

Deposits highly resistant to abrasion from silica-carbon-kaolin

165

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
3.2 - 4.0	1	Basic

TYPICAL MECHANICAL VALUES
▼
HRC 64

317 GS

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.2 - 1.6	Argon -2 %O_2 mix

TYPICAL MECHANICAL VALUES
▼
HRC 66

Maximum resistance to hot and cold abrasive wear

170 HS

Hardfacings with a very high resistance to wear from cold and hot abrasive wear, where there are no violent impacts. Deposits with compact austenitic matrix with approximately 40% chromium carbide, molybdenum, niobium and vanadium, which assume a mirrored appearance after being partly worn; excellent resistance, up to a working temperature of 600°C, to abrasion from sand, carbon and refractory materials. The cracks present in the deposit do not create problems and do not reduce the resistance of the hardfacing: they are caused by an increased hardness and may be reduced by pre-heating or with a substrate buffer in austenitic ferritic steel.

The **KOY 170 HS electrode** has a basic coating containing super alloy granulates and has an efficiency of 200%; easy to use in flat or inclined welding. In the vertical position, an electrode is used with a long arc and an oscillation amplitude equal to 4 times the diameter of the electrode. The deposit is smooth, compact and has a good aesthetic.

Main applications: crushing hammers, knives, scrapers, bucket elevators, dredger blade, drilling tools, chisels, transportation screws, impellers, gear blanking, planes for coal, mixer tools, mixer paddles, extruders, blast furnace mill bells, foundry mills.

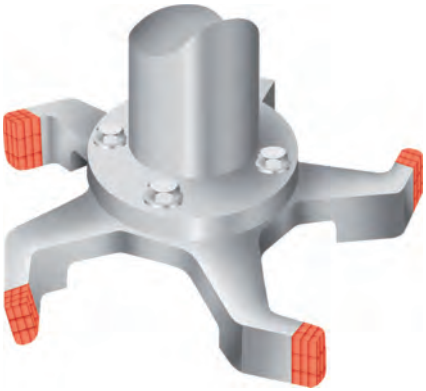
170 HS

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
3.2 - 4.0	1	Basic

TYPICAL MECHANICAL VALUES	
▼	▼
(20°) HRC 66	(600° C) 52

Tungsten carbide for hardfacings highly resistant to wear

195 S **595 A**



Extra hard refills on steel of every type. Deposit of a maximum resistance to abrasive wear from sand, carbon, gravel, kaolin and all dry bulk minerals. The deposited beads are composed of 60% tungsten carbide granules, dispersed in the tough steel matrix.

The **KOY 195 S electrode** is made of an alloyed steel pipe containing tungsten carbide granules, and covered by a thin graphite coating. The weld has a mild melt with excellent control of the pool, limited penetration, inconsistent slag and compact, homogeneous beads.

The **KOY 595 A rod** is used with an oxy-acetylene blowpipe without the aid of a flux; a uniform pre-hearing of the base material to 250°C is advised so as to contain cracking in the deposit. It can also be used in TIG processes but the resistance to wear is inferior compared to hardfacing with an oxy-acetylene blowpipe due to the inevitable dilution with the base metal.

Main applications: crushers for foundry mixtures, screw edges, hammer mills, mill scrapers, drilling tools, mixer blades, transport propellers and dredge buckets.

Tungsten carbide for hardfacings highly resistant to wear

195 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
3.2 - 4.0 - 5.0	1 - 2	Graphitic

TYPICAL MECHANICAL VALUES	
▼	▼
of the matrices HRC 58	of the grains $HV_{0,1}$ 2000

595 A

AVAILABLE DIAMETERS (mm)
5.0

TYPICAL MECHANICAL VALUES	
▼	▼
of the matrices HRC 55	of the grains $HV_{0,1}$ 2100

Deposits with a high percentage of hard binding carbides

596 L **596 B**

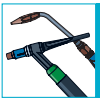
Hardfacing on steels with a high wear resistance to abrasion also in the presence of light impact. The deposit is composed of tungsten carbide, in a percentage exceeding 65%, in nickel based matrix with increased hardness; it obtains a hardfacing with excellent characteristics of hardness and toughness of the bond which prevents separation of the carbide until completely worn. The bead deposited combines the excellent abrasion resistance to minerals, sand, kaolin, gravel and dry bulk materials, and also has a high resistance to corrosion.

The **KOY 596 L alloy rolls** are used with the oxy-acetylene blowpipe **KOY MAXY** or with the TIG process. It is composed of a nickel core and a coating which contains crushed tungsten carbide granules of an accurately controlled dimension. When using a blowpipe, a preventative substrate adhered with **KOY 37 VX** powder is advised. This precaution avoids oxidation of the hardfacing and the resulting risk of separation during operation.

The **KOY 596 B alloy rod** is the same product described above, supplied in rods for hardfacing of smaller dimensions.

Main applications: Ploughshare and scrapers of foundry mills, hardfacings on edges of screws for clay, refractory material, mixing blades, stabilisers and cutters in the extraction sector, die spools, internal liners for sludge pumps, liners and screws for "FULLER" and "PETERS" pumps for cement plants and excavation buckets.

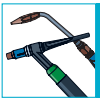
Deposits with a high percentage of hard binding carbides



596 L

AVAILABLE DIAMETERS (mm)
6.0 - 8.0

TYPICAL MECHANICAL VALUES	
▼	▼
of the matrices HRC 45	of the grains $HV_{0,3}$ 2600



596 B

AVAILABLE DIAMETERS (mm)
6.0 - 8.0

TYPICAL MECHANICAL VALUES	
▼	▼
of the matrices HRC 45	of the grains $HV_{0,3}$ 2600

Armouring for tools for hot working subjected to impacts

151

Refills on edges and restoration of worn parts of tool for hot or cold working of metals; deposits in alloy with chromium, tungsten and vanadium of a martensitic structure with primary carbides. Hardfacing of low or medium alloyed steels workable up to 550°C with excellent resistance to metal on metal wear, heat shock or hot cracking. Good impact resistance and the possibility of working the deposit with machine tools.

The **KOY 151 electrode** is easily used in all positions except in the vertical down. The electrode has a graphite tip to promote ignition on contact; it welds with a short arc and the electrode almost vertical. On edges a chamfer facing away from the edge should be carried out with a machine tool; on steel with carbon exceeding 0.4% preheat the base material to between 250° and 400°C; perform a buffer layer with the **KOY 85** electrode.

Main applications: hardfacing matrices to be ground when the thickness of the burr exceeds 2 mm and the stamped piece is of a large dimension, hot shear blades, forging dies and die-casting, hot cutting and cams.

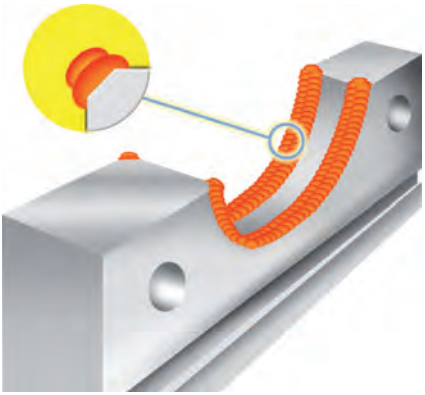
151

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Rutile

TYPICAL MECHANICAL VALUES		
▼	▼	▼
after welding HRC 46	after rebaking 750°C HRC 27	after tempering 1100°C/oil HRC 52

Cold refilling of truncated blades

148 S **313**



Hardfacing with a high resistance to compression combined with moderate abrasion, excellent resistance to wear from metal where there are strong thermal and mechanical shocks. Tough deposit up to a temperature of 550°C; the possibility to carry out a tempering treatment to stabilise the structure.

The **KOY 148 S electrode** has a low hydrogen coating for which the deposit is tough and free of micro-cracking. It welds in all positions except vertical down; the slag is easily removed and an aesthetic seam is obtained even on edges. The base material, if it contains carbon exceeding 0.4% should be pre-heated to 300°C or a buffer layer should be performed.
The **KOY 313 cored wire** has physical and mechanical characteristics superior to the electrode KOY 148 S thanks to the addition of alloy elements which raise the percentage of primary carbides. It stands out for the speed of the deposit and is used without protective gas. Deposit is workable only with a grinder.

Main applications: cold truncated blades, punches and matrices for hot and cold cutting on presses of a large dimension, chisel blades, mill cylinders.

Cold refilling of truncated blades

148 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
3.2	1 - 2 - 3 - 5 - 6	Basic

TYPICAL MECHANICAL VALUES
▼
HRC 48

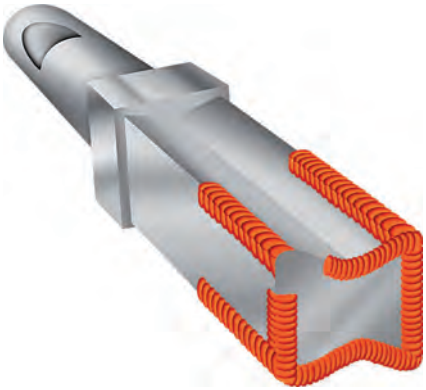
313

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.6 - 2.4	Open arc

TYPICAL MECHANICAL VALUES
▼
HRC 56

Hardfacing of tools for hot stamping subjected to strong abrasion and pressure

152



Refills on steel tools workable up to a temperature of 500°C. Excellent resistance to wear from metal and thermal shocks, good impact resistance. Deposit of a martensitic structure with primary carbides of chromium-molybdenum and with characteristics between the KOY 147 and KOY 151 electrodes.

The **KOY 152 electrode** welds easily in all positions except in the vertical down. Excellent stability of the arc, high speed of the melt, easy removal of the slag, immediate trigger and re-trigger. In the execution of hardfacing on quenched and tempered steels with a high level of carbon, pre-heating or a buffer layer using the **KOY 85 electrode** should be performed. The deposit is workable by tool only after drawing down: to reacquire hardness, it must be subject to tempering with oil cooling.

Main applications: matrices and punches of all types to be ground, cutting knives, matrices and punches for forging, mill rollers, presses.

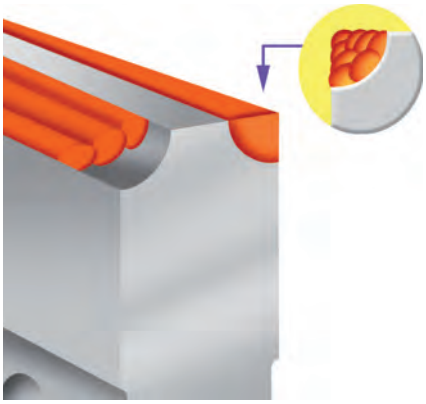
152

AVAILABLE DIAMETERS (mm)	AVAILABLE DIAMETERS (mm)	COATING
2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Rutile

TYPICAL MECHANICAL VALUES	
▼	▼
after welding HRC 54	after PWHT 520°C/2h HRC 56

Hardfacing of hot and cold cutters

147 | **147 S** | **582**



Refilling on parts subject to strong metal on metal wear up to a temperature of 550°C where there are no excessive thermal shocks. Extra hard deposit of a heat treatable martensitic matrix.

The **KOY 147 electrode** has an efficiency of 135%, excellent curability and stability of the arc in all positions except vertical down; immediate trigger and re-trigger of the arc, high work rate and easy removal of the slag.

The **KOY 147 S electrode** already described in the anti-abrasion section as being suitable for the fabrication of cutting tools, possesses characteristics similar to KOY 147 to which it differs for its higher control during fabrication, the use of carefully selected prime materials, and therefore complete reliability.

The **KOY 582 rod** welds with TIG processes and has a similar compositions to the deposit obtained with the electrode and is used mainly on edges and for the execution of delicate work.

Main applications: shear blades and cold cutters to a maximum thickness of 4 mm, matrices to grind when the thickness of the base is thin and stampings of small sizes, punches with a thickness of the sheet to grind is less than 3 mm.

147

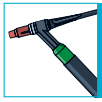
AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Rutile

TYPICAL MECHANICAL VALUES
▼
HRC 59

147 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2 - 3 - 5 - 6	Rutile

TYPICAL MECHANICAL VALUES	
▼	▼
after welding HRC 54	after PWHT 520°C/2h HRC 62



582

AVAILABLE DIAMETERS (mm)
1.6 - 2.4 - 3.2

TYPICAL MECHANICAL VALUES
▼
HRC 61

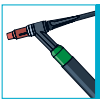
Hardfacings and restorations on tools for the hot working of metals

587 S **584 S** **586 S**

The products presented in this section consist of steel alloys for quick refills resistant to abrasion and impacts. They are used for hardfacings on steel tools with a high carbon content and alloy elements (type AISI HIT) for the hot working of metals.
The choice between one of these alloys is determined by the need to obtain a harness more or less increased in the refilled zone.
The deposit has an elevated stability on letting down, increased resistance and toughness to high temperatures, up to an operating temperature of 550°C to 600°C.
These characteristics guarantee an excellent resistance to heat wear from abrasion, pressure and thermal stresses.
The deposit is thermically treatable to modify its characteristics and may be worked with machine tools. It is advised to uniformly pre-heat the base material to approximately 300°C before refilling followed by a slow cooling in an oven or under a insulation.

The **KOY 587 S - 584 S - 586 S rods** are used in TIG processes and are used mainly for hardfacings on edges and on small sized pieces.

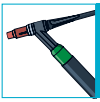
Main applications: Hardfacing on moulds for plastic material and die-casting, injection moulds for low alloys, moulds for flat and shaped die forging , knives for hot cutting, extrusion dies, punches, hot sawing, mill cylinders, matrix grinders, forging hammers, shafts and cams.



587 S

AVAILABLE DIAMETERS (mm)
1.2 - 1.6 - 2.4 - 3.2

TYPICAL MECHANICAL VALUES
▼
HRC 41



584 S

AVAILABLE DIAMETERS (mm)
1.2 - 1.6 - 2.0 - 2.4 - 3.2

TYPICAL MECHANICAL VALUES
▼
HRC 46

586 S

AVAILABLE DIAMETERS (mm)
1.2 - 1.6 - 2.4 - 3.2

TYPICAL MECHANICAL VALUES
▼
HRC 52

Hardfacings and restorations on tools for the hot working of metals

234 S **236 S** **233 S**

The products presented in this section consist of steel alloys for quick refills resistant to abrasion and impacts. They are used for hardfacings on steel tools with a high carbon content and alloy elements (type AISI HIT) for the hot working of metals.
The choice between one of these alloys is determined by the need to obtain a harness more or less increased in the refilled zone. The deposit has an elevated stability on letting down, increased resistance and toughness to high temperatures, up to an operating temperature of 550°C to 600°C. These characteristics guarantee an excellent resistance to heat wear from abrasion, pressure and thermal stresses.
The deposit is thermically treatable to modify its characteristics and may be worked with machine tools. It is advised to uniformly pre-heat the base material to approximately 300°C before refilling followed by a slow cooling in an oven or under a insulation.

The **KOY 234 S - 236 S - 233 S wires** are coiled wires correspondent to the rods KOY 587 S - 584 S - 586 S. They are used in MAG processes on parts of a large size and with a high speed of deposit. Particular care in the drawing allows an extremely smooth flow in the torch, even if the torch is not perfectly efficient.

Main applications: Hardfacing on moulds for plastic material and die-casting, injection moulds for low alloys, moulds for flat and shaped die forging , knives for hot cutting, extrusion dies, punches, hot sawing, mill cylinders, matrix grinders, forging hammers, shafts and cams.

234 S

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.2	Argon + 2% O_2 • Argon CO_2 mix

TYPICAL MECHANICAL VALUES
▼
HRC 41

236 S

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.2	Argon + 2% O_2 • Argon CO_2 mix

TYPICAL MECHANICAL VALUES
▼
HRC 46

233 S

AVAILABLE DIAMETERS (mm)	SHIELDING GAS
1.2	Argon + 2% O_2 • Argon CO_2 mix

TYPICAL MECHANICAL VALUES
▼
HRC 52

Cobalt based superalloy resistant to cracking

175 S **565 S**

Hardfacings on parts subjected to wear from metal, with a high toughness up to very high working temperatures (exceeding 1000°C); excellent resistance to cracking in the presence of thermal shocks. A deposit in cobalt based alloy with a good resistance to abrasion, corrosion, heat and medium-strong impacts and can be worked by machine tool.

The **KOY 175 S electrode**, with a rutile-basic coating, welds with a stable arc, mild melt and without spatter; it is characterised by excellent curability, immediate trigger, smooth, regular beads without marginal incisions. The slag is easily eliminated and the beads have an excellent aesthetic. Before performing the hardfacing, pre-heating to 300°C to 350°C should done.
The **KOY 565 S rod** has physical and mechanical characteristics similar to the KOY 175 S electrode; it is used in TIG processes under the protection of pure argon, or with an oxy-acetylene blowpipe with regulation of the carbureted flame.

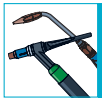
Main applications: cylindrical and shaped calibration punches, forging dies, mould parts and truncated bladed used in the hot working of metals, dies, valve seats and guides for the petrochemical industry.

Cobalt based superalloy resistant to cracking

175 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
3.2 - 4.0	1 - 2 - 5	Basic rutile electrodes

TYPICAL MECHANICAL VALUES	
▼	▼
(20°C) HRC 40	(600°C) HRC 32



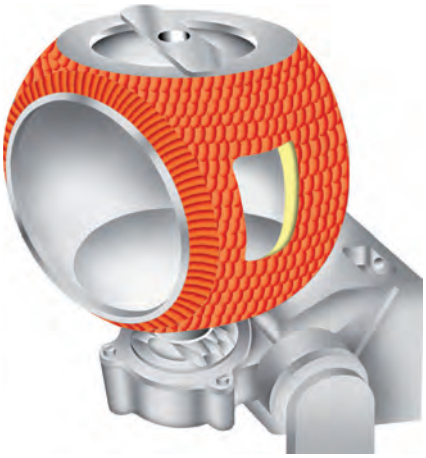
565 S

AVAILABLE DIAMETERS (mm)
3.2 - 4.0

TYPICAL MECHANICAL VALUES	
▼	▼
(20°C) HRC 35	(600°C) HRC 24

Cobalt based superalloy workable by tool

176 S **576 S**



Hardfacings resistant to wear from metal and corrosion at high temperatures. The ductilty and structural characteristics of the deposited superalloy gives increased resistance to thermal changes.

The **KOY 176 S electrode** has an extrusion formed core and a rutile-basic coating; it is characterised by an immediate trigger, exceptional curability, mild melt and without spatter; the arc is stable and concentrated, the slag is self-lifting when the piece cools and the beads have a smooth, regular mesh without incisions at the edges.

The **KOY 576 S rod** is produced in continuous casting and is used in both TIG processes and with an oxy-acetylene blowpipe with regulation of the carbureted flame. It results in characteristics similar to those of the KOY 176 S. In TIG deposits the hardness is slightly inferior to those obtained with a blowpipe.

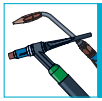
Main applications: fittings for the chemical and petrochemical industry, punches for cylindrical and shaped burrs, moulds, matrices, shear blades, pliers for ingots, rods and valve seats, cutting tools, wire guides, rings and bars for mechanical seals.

Cobalt based superalloy workable by tool

176 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0	1 - 2 - 5	Basic rutile electrodes

TYPICAL MECHANICAL VALUES	
▼	▼
(20°C) HRC 44	(600°C) HRC 32



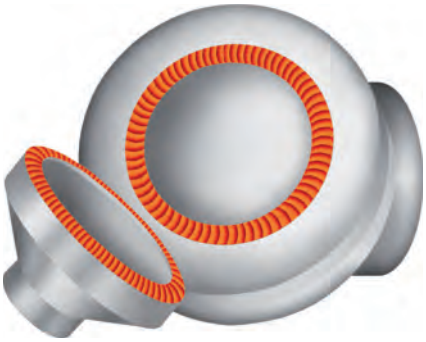
576 S

AVAILABLE DIAMETERS (mm)
3.2 - 4.0 - 5.0

TYPICAL MECHANICAL VALUES	
▼	▼
(20°C) HRC 45	(600°C) HRC 33

Cobalt based superalloy of medium-high hardness

172 S **572 S**



Refills resistant to corrosion and wear from metal even at high working temperatures (exceeding 800°C) The cobalt based deposit with chromium and tungsten carbides, has good abrasion resistance and limited thermal changes; processing with machine tool is possible but difficult.

The **KOY 172 S electrode** has an extrusion formed core and a rutile-basic coating; it is characterised by an immediate trigger, exceptional ease of handling, mild melt and without spatter; the arc is stable and concentrated, the slag is self-lifting when the piece cools and the beads have a smooth, regular mesh without incisions at the edges.

The **KOY 572 S rod** is produced in continuous casting and is used in both TIG processes and with an oxy-acetylene blowpipe with regulation of the carbureted flame. It results in characteristics similar to those of the KOY 172 S. In TIG processes the hardness of the deposits is slightly inferior to those obtained with a blowpipe.

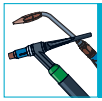
Main applications: petrochemical valves, wood saw teeth, paper and cardboard cutting tools, shear blades, wire guides, forging and extrusion matrices.

Cobalt based superalloy of medium-high hardness

172 S

AVAILABLE DIAMETERS (mm)	WELDING POSITIONS	COATING
2.5 - 3.2 - 4.0 - 5.0	1 - 2 - 5	Basic rutile electrodes

TYPICAL MECHANICAL VALUES	
▼	▼
(20°C) HRC 53	(600°C) HRC 42



572 S

AVAILABLE DIAMETERS (mm)
3.2 - 4.0 - 5.0 - 6.0 - 6.4

TYPICAL MECHANICAL VALUES	
▼	▼
(20°C) HRC 50	(600°C) HRC 40

Brazing

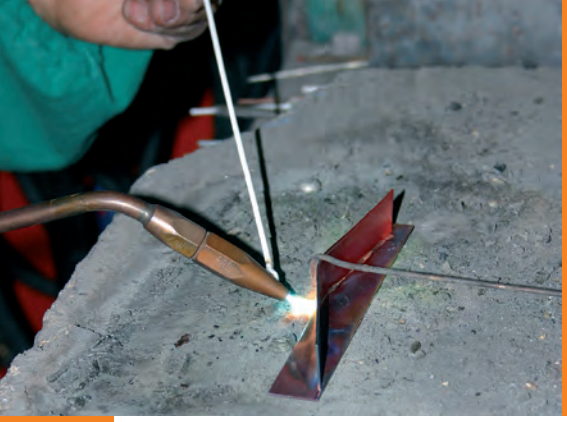
- Alloys for hard brazing
- Self-fluxing alloys for copper
- Ternary silver alloys
- Fluxes for silver alloys

COMMERSALD

Brazing

Index Brazing

					
Alloys for hard brazing	**911**	**911 F**	**855 S**		
	936 A	**936 AF**			
Self-fluxing alloys for copper	**917 S**				
	925 S				
	915 S				
Ternary silver alloys	**923 S** **934 S**	**923 FS** **934 FS**			
	945 S **937 S**	**945 FS**			**937 SNT**
Fluxes for silver alloys				**866**	



Joint with low heat input

An ancient but still modern method

Brazing

Brazing is the process of joining two metals carried out using an alloy with a melting point which is lower than the two metals to be joined.
The joint is made through diffusion of the liquid metal filler in the intergranular spaces of the base metal which remains in its solid state, resulting in an intimate molecular union. Brazing is carried out when it is not possible or expedient to fusion weld two ends, especially when there is the possibility of distortion caused by working at high temperatures.
To obtain this condition, it is necessary that the piece to be brazed is brought to a temperature of "wetting" which is seen when the filler metal relaxes on the surfaces. This temperature is always greater than the melting point of the filler alloy. To facilitate brazing, the surface areas to be brazed must be perfectly clean and the edges rounded.

The purpose of the flux

The filler alloy, apart from phosphorous-copper, is always used in combination with the relative **flux** whose main purpose is that of preserving the metal from atmospheric oxidation (the higher the working temperature, the greater the oxidation) and to help the capillary action of the alloy. In the phosphorous-copper alloy, deoxidation is carried out by the phosphorous contained in the alloy.
The flux must not be heated directly by the flame but rather from the heat developed in the piece or, in any case, indirectly.

To eliminate the flux residues

In general it is sufficient to use hot water, with the possible addition of 20 % caustic soda and vigorous cleaning with a non metallic brush.
In the most difficult cases the following acid solutions may help:

- Copper alloys = a 10-15% sulphuric acid solution.
- Steels and nickel alloys = a 10-15% hydrochloric acid solution.
- Stainless steel = **KOY KLEENOX**

Regulation of the flame

Brazing is carried out mainly with an oxy-acetylene blowpipe heating the entire adjoining area to be brazed, avoiding the concentration of localised heat and regulating the flame as described below.

The filler materials

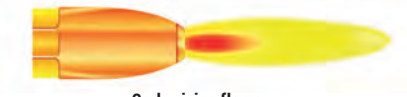
Brazing is carried out at different temperatures according to the filler materials used as described below:

- Sweet brazing with tin based alloys
- Hard brazing with copper-zinc alloys
- Brazing with phosphorous-copper alloys
- Brazing with silver alloys.

Sweet brazing with **KOY Golden Line** filler is carried out at temperatures between **170-300°C** using tin based alloys on lead, silver and possibly cadmium and other elements. These alloys, compared to common rods or tin lead wires, have a much greater mechanical strength . Their use must however be limited to joints where the resistance is not a determining factor. It is good practice to "degrease" both the ends to be joined (above all if working on aluminium). The procedure is carried out using an abundant quantity of deoxidant and removing the excess alloy with a cloth when it is still in the liquid state on the piece.

Neutral flame =
balanced oxygen and acetylene FOR GENERAL USE

Oxidation flame =
too much oxygen ALLOYS FOR HARD BRAZING - BRASS -ALLOYS WITH A HIGH MELTING POINT



Carburizing flame =
too much acetylene ALUMINIUM AND ITS ALLOYS-STAINLESS STEEL-SOFT BRAZING HARDFACINGS WITH STRONG ALLOYS

Sweet brazing with KOY Golden Line filler is carried out at temperatures between 170-300°C using tin based alloys on lead, silver and possibly cadmium and other elements. These alloys, compared to common rods or tin lead wires, have a much greater mechanical strength . Their use must however be limited to joints where the resistance is not a determining factor. It is good practice to "degrease" both the ends to be joined (above all if working on aluminium). The procedure is carried out using an abundant quantity of flux and removing the excess alloy with a cloth when it is still in the liquid state on the piece.

Hard brazing is carried out with the aid of copper-zinc (brass) and copper-zinc-nickel (German silver) with the possible addition of silver, manganese, etc. The relative powder or paste flux must be used in each case to make the alloy flow. The increased melting point (exceeding 800°C) limits the capillary penetration considerably and makes its use difficult on brass, leaded steel and in other circumstances. These alloys are still used for some facings and when the joints to assemble are poorly prepared. A careful analysis of the total costs of the weld often makes its use disadvantageous compared to silver alloys. Phosphorous-copper alloys differ from silver alloys for their antioxidant properties. They are produced with greater or lesser increased levels of phosphorous and silver which characterise their curability and mechanical values. When they are used for the brazing of copper, the oxidation of the phosphorous creates a thin fluid layer of copper-phosphate which has the effect of deoxidation. Therefore phosphorous-copper alloys are above all suitable for the brazing of, without fluxes, pure copper or copper-based alloys, provided these alloys do not contain more than approximately 10% of other components and are

absent of elements such as aluminium, which form resistant oxides. It is important to remember that brazing alloys containing phosphorous must never be used on steel, ferrous metals or on alloys with a high nickel content. This causes the formation of fragile layers of intermetallic compounds. All phosphorous containing alloys are suitable for brazing in protected atmospheres on copper and high copper containing alloys, with excellent results.
The mechanical properties of self-fluxing alloys vary in relation to the percentage of silver they contain, but the values remain a grade below the silver alloys which will be described further on, as the deposits are harder and have a relatively little ductility.

Brazing with **silver alloys** remains one of the fundamental procedures in the welding sector as, in spite of the high cost of the alloys, their use is justified by the following benefits:

- the working temperature of between **600°C and 800°C** allows the distortion of the welded joints to be contained
- the strong capillary penetration which benefits the mechanical strength, the joint seal and the limited alloy filler required.
- it is possible to braze almost all metals or alloys which have a melting point exceeding 700°C using any heat source
- the joints have good mechanical characteristics as well as ductility and high resistance to chemical corrosion in normal conditions of use
- the limited consumption of alloy, due to the almost total absence over layering, reduces the need for further processing and contains costs
- low internal tensions and low structural change of the base material as a result of the low working temperature
- less oxidation
- less consumption of thermal energy
- greater ease of joining different thicknesses.

As for the relative problems in the execution of the welds, it should be noted that only pure metals and eutectic alloys have a specifically defined melting point below which they are solid and above which they are liquid while all other alloys have a melting interval during which the solid transforms into liquid. This interval is defined by the starting point of the melt, "SOLIDUS", and the end of the melt, "LIQUIDUS". During the melting interval, liquid and solid materials coexist. This situation causes more difficulty in the application of the alloy. As the level of silver in the alloy is increased, the shorter the interval of the melt; it is therefore advisable to use alloys with a high silver content when an impeccable joint is desired.

In the application of silver alloys the following rules should be observed:

1. The lower the working temperature of the alloy, the more accurate the coupling must be (on average 0.1 mm).
2. The pieces must be perfectly clean and deoxidised.
3. With alloys having a long melt interval, the heating must be carried out as quickly as possible.

Universal fluids for steel and cast iron

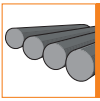
911 | **911 F** | **855 S**

Copper-zinc-nickel alloy of an easy and secure application with a blowpipe for tough, resistant joints having an excellent aesthetic on carbon steel, low alloy steel, C40, quenched and tempered steels, grey cast iron and spheroidal cast iron.

The **KOY 911 alloy rod** is used with an oxy-acetylene blowpipe, in an oven or with an induction system for batch work.
The **KOY 911 F rod** is coated in flux, measured out in optimum, active and efficient quantity. It has the same chemical composition, characteristics and fields of use as the KOY 911 alloy.
The **KOY 855 S fluxing powder** is used in combination with the KOY 911 alloy, it must be applied on the rod and on the joint before brazing to obtain a good deoxidation and capillary penetration; it attaches evenly to the heated rod and can be reduced to a paste state by adding clean water.

Main applications: in the construction of furniture in steel of any type, container baskets and furnishings in profiled or laminated tubing, grilles, scaffolding, trolleys, luggage racks, shelving and auto bodywork.

Universal fluids for steel and cast iron



911

TYPE	AVAILABLE DIAMETERS (mm)
Rod	1.5 - 2.0 - 3.0 - 4.0 - 5.0

TYPICAL MECHANICAL VALUES			I.F.	RECOMMENDED FLUX
R_m	A%	▼	°C	
N/mm² 490-550	%25	HB 180	880-910	855 S

911 F

TYPE	AVAILABLE DIAMETERS (mm)
Covered rod	1.5 - 2.0 - 3.0

TYPICAL MECHANICAL VALUES			I.F.
R_m	A%	▼	°C
N/mm² 490-550	%25	HB 180	880-910

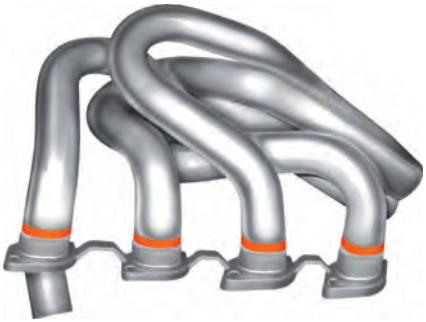
855 S

TYPE
Powder

T.L.
°C
600-1000

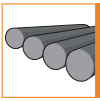
Refills on steel and cast iron

936 A **936 AF**



The **KOY 936 A rod** is characterised by its excellent curability and strong deoxidant properties which make it suitable for joints and hardfacing on details in cast iron and rusted or unclean steel in difficult conditions including uneven positions.
The deposits are smooth, regular and free of porosity and inclusions. "Drop by drop" deposits are possible which favours its use on wide or poorly prepared joints.

The **KOY 936 A alloy** is used, preferably with large quantities of fluxing powder **KOY 855 S**. The fluxing coated alloy **KOY 936 AF** is used preferably with the initial aid of **KOY 855 S** flux added after being transformed into a paste. No further aid is needed before the refilling stage can be carried out.
Main applications: automotive mufflers, bodywork and general steel carpentry.



936 A

TYPE	AVAILABLE DIAMETERS (mm)
Rod	2.0 - 3.0 - 4.0 - 5.0 - 6.0

TYPICAL MECHANICAL VALUES			I.F.	RECOMMENDED FLUX
R_m	A%	▼	°C	
N/mm² 420	%25	HB 100	888-930	855 S

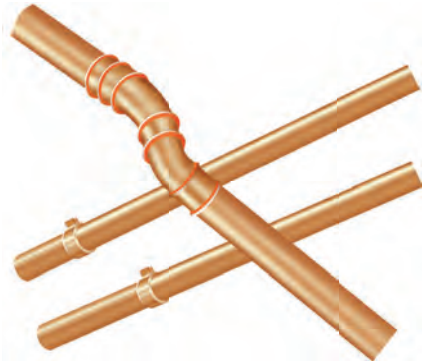
936 AF

TYPE	AVAILABLE DIAMETERS (mm)
Covered rod	2.0 - 3.0

TYPICAL MECHANICAL VALUES			I.F.	RECOMMENDED FLUX
R_m	A%	▼	°C	
N/mm² 420	%33	HB 100	888-930	855 S in paste

Universal for copper with excellent capillary penetration

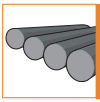
917 S



Copper based alloys and phosphorous additives for joints without the aid of fluxes having an excellent capillary penetration.

The **KOY 917 S alloy rod** contains antimony which reduces its fragility. The wide melting interval allows even less expert welders to work easily and confidently. This is what makes it universal and the most widely used of the range.

Main applications: rotors for electric motors, coils and copper fittings. Refrigeration and air conditioning systems and sanitary appliances.



917 S

TYPE	AVAILABLE DIAMETERS (mm)
Rod	1.5 - 2.0 - 2.2 - 3.0

TYPICAL MECHANICAL VALUES	I.F.
R_m	°C
N/mm² 560	710-860

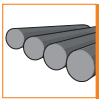
Copper pipes and laminates, excellent mechanical values and perfect capillary penetration

925 S

Copper alloy, phosphorous and silver for use in safe operational conditions on copper pipework prepared for socket joints and, more generally, the welding of copper without fluxes.

The **KOY 925 S glossy alloy bar** has good characteristics of fluidity and ductility and is used with an oxy-acetylene blowpipe, with air-gas burners, oven or induction.

Main applications: electric rotors, copper wire terminals and cables, industrial electronics and electrical engineering, breweries, the dairy industry, pipes for the transport of hot and cold water.



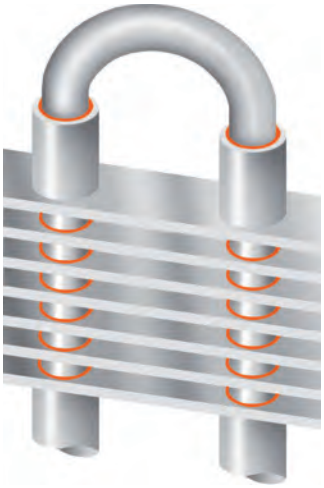
925 S

TYPE	AVAILABLE DIAMETERS (mm)
Rod	1.5 - 2.0 - 3.0 - 4.0

TYPICAL MECHANICAL VALUES	I.F.
R_m	°C
N/mm² 680	645-790

Copper pipes and laminates, high resistant joints

915 S



Copper, silver, phosphorous alloys with a high silver content, increased mechanical values for use on copper in conditions of maximum safety even at low temperatures.

The **KOY 915 S alloy rod** possesses excellent characteristics of fluidity and capillary penetration, an increased breaking load and elongation values of any other antioxidant alloy. It has a singular simplicity of use. The field of application of the **KOY 915 S alloy** overlaps that of the **KOY 917 S - 925 S** series, in that is possesses all the prerequisites to substitute them.

Its higher cost, due to an increased silver content, is recommended for use in situations where security of the joints and the quality of the weld are a priority.
Main applications: electric rotors, cables, wire terminals, hot water conduits, refrigeration and air conditioning systems, even if subject to vibration during operation.

TYPE	AVAILABLE DIAMETERS (mm)
Rod	1.5 - 2.0 - 3.0

TYPICAL MECHANICAL VALUES	I.F.
R_m	°C
N/mm² 730	645-770

Joints and refills at low bonding temperatures on all metals

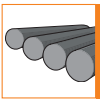
923 S | **923 FS** | **934 S** | **934 FS**

Ternary alloys, free of cadmium and other polluting elements, are characterised by an absolute absence of toxicity which makes them suitable for use in the food industry, electrics and in insufficiently ventilated areas. The products listed on this page have a relatively wide melting interval which makes them suitable for capillary braze welding, even for head to head joints and for refills on poorly prepared joints on steel of all types, cast irons, stainless steels, hard metals, copper, bronze, brass, aluminium bronzes, nickel, monel, cupronickel, and more generally, all metals with the exception of aluminium. The bonding temperatures of these alloys is approximately 100°C higher than those of the quaternary alloys with an equal silver content. On the other hand, they are less subject to overheating and resulting "bubbling" and formation of porosity; they have better mechanical characteristics, are more ductile and therefore more suitable to braze welding on massive pieces. They also possess a better electrical conductivity. They are applied with an oxy-acetylene blowpipe, with air-gas burners and with induction.

The **KOY 923 S rod (KOY 923 FS** in the fluxing coated version) is one of qualities most widely used. Recently reformulated to provide better characteristics of curability while maintaining the same mechanical values. It is used with slightly excessive acetylene and has a similar colour to brass.
The **KOY 934 S rod (KOY 934 FS** in the fluxing coated version) has a higher silver content and a melting point lower than the former.

Main applications: hard metal and diamond plate welding on steel supports for tool construction, band saws and circular saws, bronze and brass joints, precision mechanics, industrial refrigeration, lighting, heat exchangers, taps, contact tip for traction bars and wire terminals, armoured resistances for heating.

Joints and refills at low bonding temperatures on all metals



923 S

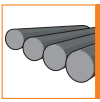
TYPE	AVAILABLE DIAMETERS (mm)
Rod	1.5 - 2.0

TYPICAL MECHANICAL VALUES		I.F.	RECOMMENDED FLUX
R_m	▼	°C	
N/mm² 510	HB 18	680-760	866

923 FS

TYPE	AVAILABLE DIAMETERS (mm)
Covered rod	1.5 - 2.0

TYPICAL MECHANICAL VALUES		I.F.
R_m	▼	°C
N/mm² 510	HB 18	680-760



934 S

TYPE	AVAILABLE DIAMETERS (mm)
Rod	1.5 - 2.0

TYPICAL MECHANICAL VALUES		I.F.	RECOMMENDED FLUX
R_m	▼	°C	
N/mm² 500	HB 20	630-730	866

934 FS

TYPE	AVAILABLE DIAMETERS (mm)
Covered rod	1.5 - 2.0 - 3.0

TYPICAL MECHANICAL VALUES		I.F.
R_m	▼	°C
N/mm² 500	HB 20	630-730

Tough joints at a low bonding temperature and increased capillary penetration

945 S | 945 FS | 937 S | 937 SNT

Ternary alloys, free of cadmium and other polluting elements, are characterised by an absolute absence of toxicity which makes them suitable for use in the food industry, electrics and in insufficiently ventilated areas. The products listed on this page have a relatively wide melting interval which makes them suitable for capillary braze welding, even for head to head joints and for refills on poorly prepared joints on steel of all types, cast irons, stainless steels, hard metals, copper, bronze, brass, aluminium bronzes, nickel, monel, cupronickel, and more generally, all metals with the exception of aluminium. The bonding temperatures of these alloys is approximately 100°C higher than those of the quaternary alloys with an equal silver content. On the other hand, they are less subject to overheating and resulting "bubbling" and formation of porosity; they have better mechanical characteristics, are more ductile and therefore more suitable to braze welding on massive pieces. They also possess a better electrical conductivity. They are applied with an oxy-acetylene blowpipe, with air-gas burners and with induction.

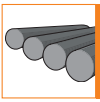
The **KOY 945 S alloy rod (KOY 945 FS** in the fluxing coated version) possess excellent characteristics of fluidity and capillary penetration, combined with singular tensile strength and elongation values. It therefore indicated for braze welding subject to high static and dynamic stresses in all conditions and on all metals.

The **KOY 937 S alloy rod** contains added nickel and manganese. It is suitable for the brazing of hard metal plating. It is recommended for materials which are difficult to weld, on highly stressed pieces subject to corrosion. The tensile strength of the adhesion in the brazing of hard steel plating is very high (250 - 300 N/mm2) and varies depending on the level of cobalt content in the plating itself.

The **KOY 937 SNT alloy tape** is an ecological tri-metallic tape composed of two sheets of alloy containing a high level of silver, nickel and manganese encasing a copper laminate, developed for brazing hard metal plating. The copper laminate forms a buffer layer between plates and tools support, guaranteeing a higher resistance to stresses.

Main applications: desalination systems, compressors, vibrators, automotive air conditioners, water and oil conduits (even under pressure and at a high temperature), trinkets, jewellery, hard metal plating for embossing, electrical contacts.

Tough joints at a low bonding temperature and increased capillary penetration



945 S

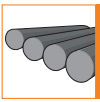
TYPE	AVAILABLE DIAMETERS (mm)
Rod	1.5 - 2.0

TYPICAL MECHANICAL VALUES		I.F.	RECOMMENDED FLUX
R_m	A%	°C	
N/mm² 480	%16	630-670	866

945 FS

TYPE	AVAILABLE DIAMETERS (mm)
Covered rod	1.5 - 2.0 - 3.0

TYPICAL MECHANICAL VALUES		I.F.
R_m	A%	°C
N/mm² 480	%16	630-670



937 S

TYPE	AVAILABLE DIAMETERS (mm)
Rod	1.0 - 1.5

TYPICAL MECHANICAL VALUES		I.F.	RECOMMENDED FLUX
R_m	▼	°C	
N/mm² 340	HB 37	660-700	866

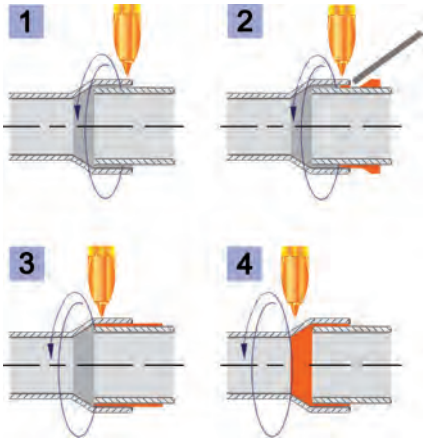
937 SNT

TYPE
Tape

TYPICAL MECHANICAL VALUES		I.F.	RECOMMENDED FLUX
R_m	A%	°C	
N/mm² 500	%33	630-710	866

Flux in the melting interval of all ternary silver alloys

866



Flux is a chemical compound which when brazing with silver based alloys has a fundamental purpose: it reduces and dissolves oxides present in both the base and filler metals, protects the alloy from atmospheric oxidation and aids the flow and capillary penetration. In the past, all these tasks, required a large number of products due to the impossibility of realising a flux which remained active and sufficiently viscous at temperatures between 500°C and 850°C (which are the working temperatures of the fluxes) to fulfil the needs of all alloys for brazing.
In that period, those who proposed the "so called" universal flux were rewarded with mediocre results even using excellent alloys.

With the new **KOY 866** paste flux, this problem has been resolved. The new composition offers surprising results in its use with all silver based alloys for brazing, thanks to an original and innovative formulation combined with a rigorous fabrication technique which guarantees quality and consistency. The **KOY 866** is applied as an elastic coating, resistant to all alloys of the **KOY** range.

866

TYPE
Paste

T.L.
°C
570-900

COMMERSALD

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