EDITION 2

PANORAMA **CORED WIRES**

- High productivity
- Consistent quality of the weld
- High welding speed
- Responsiveness
- Technical advice

Selectarc
WELDING

FSH WELDING GROUP

INNOVATIVE WELDING CONSUMABLES

Innovation

Quality **Responsiveness**

Customization Flexibility

■ ■ ■

The FSH WELDING GROUP, a French manufacturer of innovative consumables for welding and brazing, is one of the leading players in the global market.

The quality of its products and services, the relevance of its research and development have made it over the years the supplier of choice for leading industry contractors around the world. Now present on every continent through subsidiaries and partners, our family business has transformed itself to offer the broadest range of products in the welding and brazing market. Our group stands out especially on specific markets, in highly technical industries such as aerospace, nuclear, chemical, petrochemical, M&R, ground transportation, heating and air conditioning. In line with our mission and our vision, our goal is to achieve excellence in quality, value, flexibility, responsiveness, ongoing improvement, R&D and commitment of our staff to satisfy our customers.

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CONTENTS

OUR INDUSTRY FOCUS:

- FORGING & FOUNDRY
- FOOD INDUSTRY
- NUCLEAR AND THERMAL PLANTS, POWER INDUSTRY
- MINING INDUSTRY
- SHIPBUILDING INDUSTRY
- METALLIC CONSTRUCTION
- CHEMICAL AND PETROCHEMICAL INDUSTRY
- M&R INDUSTRY

SELECTARC CORED WIRES

THE ECONOMICAL TECHNOLOGICAL SOLUTION

THE SELECTAR RANGE OF CORED WIRES
SUPPLEMENTS THE BROAD RANGE OF SELECTARC WELDING WELDING CONSUMABLES.

This selection covers all the main **assembly and hardfacing applications.**

- **For manufacturing:** This product technology provides **high productivity while ensuring the final quality of the assembly.**
- **For hardfacing:** the cored wire **increases the lifespan and performance of industrial parts of all sizes.**

The decision to use cored wire instead of full wire or electrodes **maintains the same level of quality while increasing performance:** increased productivity (reduced downtime, increased yield), and reduced production costs, consistent weld quality.

Technological and economic benefits required to gain competitiveness in certain industries, such as energy, mining and quarrying, cement, chemical and petrochemical industry, food processing, automotive, maintenance and repair and many others.

OF THE PRODUCT RANGE

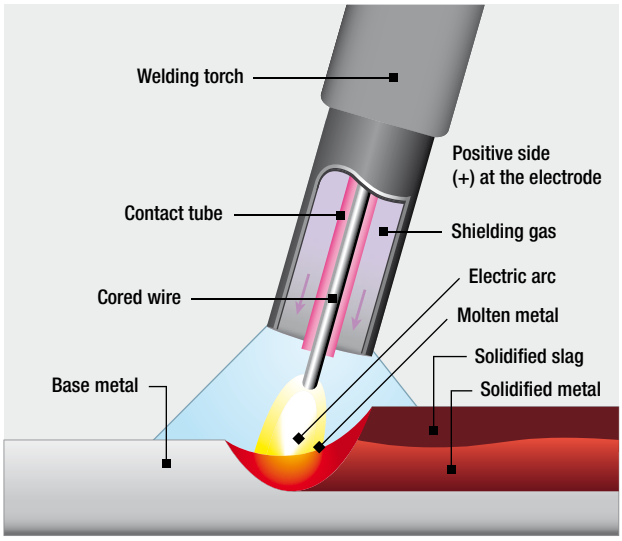
- ★ **Higher productivity than electrodes or solid wire**
- ★ **Constant weld quality**
- ★ **High welding speed**
- ★ **Ease of use**
- ★ **Excellent reliability**
- ★ **Beautiful seams**
- ★ **Good current transfer**
- ★ **Very good mechanical properties**
- ★ **Low diffusible hydrogen**
- ★ **Limited number of reworks**
- ★ **All position welding possible with certain cored wires**

WELDING **PROCESSES**

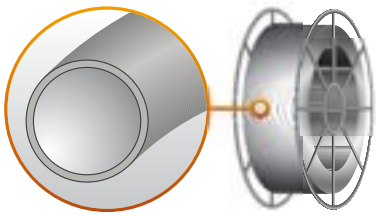
There are different types of cored wire processes for the same metal to be deposited.

The Selectarc range covers the welding processes:

- **Without gas (114), FCO range,**
- **With gas (136-138), FCW range.**

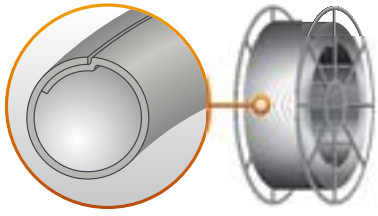


TUBULAR OR STAPLE **WIRES**



TUBULAR WIRES

So-called ***"seamless"*** tubular wires can limit the moisture absorption and improve the conductivity of the arc. Tubular wires are mostly made of copper.



STAPLE WIRES

So-called ***"strip"*** or ***"staple"*** wire allows a higher deposit rate and lower cost relative to tubular wire. However, it is more susceptible to moisture absorption.

CLASSIFICATION & STANDARDS

FOR ALL REQUESTS: >> CONSULT US!

UN-ALLOYED & LOW ALLOYED STEELS

Type	Characteristic	Classification			
		AWS A5.20	AWS A5.18	ISO 17632-A	
SELECTARC FCW 51-R	Universal rutile non alloy all positions	E71T1-1M	-	T 46 2 P M 1 H10	p 8
SELECTARC FCW 51-M	Universal metal cored non alloy	-	E 70C-6M H4	T 42 3 M M 1 H5	p 8
SELECTARC FCO 56	Without gas	-	E71T-11	T 38 Z Z N 1	p 8
		AWS A5.28	ISO 18276-A		
SELECTARC FCW 77-M	High strength metal cored wire for steel HLE	E110C-K4 H4	T 69 4 Mn2NiCrMo M M 1 H5		p 8

STAINLESS STEELS

Type	Characteristic	Classification		
		AWS A5.22	ISO 17633-A	
SELECTARC FCW 308L	Downhand 308L	E308LT0-1/-4	T 19 9 L R M21(C1) 3	p 9
SELECTARC FCW INOX 8	Standard 308L	E308LT0-1/-4	T 19 9 L R M 3	p 9
SELECTARC FCW 308LP	All position 308L	E308LT1-1/-4	T 19 9 L P M21(C1) 1	p 9
SELECTARC FCW 316L	316L in high productivity	E316LT0-1/-4	T 19 12 3 L R M21(C1) 3	p 10
SELECTARC FCW 316LP	All position 316L	E316LT1-1/-4	T 19 12 3 L P M21(C1) 1	p 10
SELECTARC FCW 309L	All position 309L	E309LT0-1/-4	T 23 12 L R M21(C1) 3	p 10
SELECTARC FCW 309LP	All positions for repairing	E309LT1-1/-4	T 23 12 L P M21(C1) 1	p 10
SELECTARC FCW 2209	Duplex	E2209T0-1/-4	T 22 9 3 N L R M21(C1) 3	p 11
SELECTARC FCW 2209P	All position duplex	E2209T1-1/-4	T 22 9 3 N L P M21(C1) 1	p 11
SELECTARC FCW 2509Mo	Downhand super-duplex	E2594T0-4	T 25 9 4 Cu N L R M21 3	p 12
SELECTARC FCW 2509MoP	All position super-duplex	E2594T0-1	T 25 9 4 Cu N L P M21 1	p 12
SELECTARC FCO 307	Open arc 307	~E307T0-3	T 18 8 Mn U N 3	p 12

NICKEL ALLOYS

Type	Characteristic	Classification		
		AWS A5.15	ISO 1071	
SELECTARC FCW NI182	All posisiton for Nickel Inconel® type 600	ENiCrFe3T0-4	-	p 13
SELECTARC FCW NI625	All position for Nickel Inconel® type 625	ENiCrMo3T0-4	-	p 13
SELECTARC FCW FENI	Ferro-Nickel alloy for foundries	-	T C NiFe-2	p 13

COBALT ALLOYS

Type	Characteristic	Classification		
		AWS A5.21	EN 14700	
SELECTARC FCW CO6	Cobalt Grade 6	ERCCoCr-A	TCo2	p 14
SELECTARC FCW CO21	Cobalt Grade 21	ERCCoCr-C	TCo1	p 14

HARFACING - REPAIR AND MAINTENANCE

Type	Characteristic	Classification		
		EN 14700	DIN 8555	
SELECTARC FCW 45	Harfacing abrasion - 450 HB	T Fe1	MSG-1-GF-45-SP	p 16
SELECTARC FCW 60	Harfacing abrasion - 600 HB	T Fe 2	MSG 6 GF 55 GSP	p 16
SELECTARC FCO 65A	Open arc hardfacing for abrasion (Bore carbide)	T Z Fe13	MF-10-GF-65-G	p 16
SELECTARC FCO 65	Harfacing for abrasion/impact (Nobium & Chromium carbides)	T Fe15	MF-10-GF-65-GCZ	p 17
SELECTARC FCO 63	Open arc hardfacing for abrasion/impact (Chromium carbide)	T Fe15	MF-10-GF-60-GRZ	p 17
SELECTARC FCO 63TI	Open arc hardfacing for abrasion/impact (Chromium & Titanium carbide)	T Fe8	MF-6-GF-55-GP	p 17
SELECTARC FCO FE60WC	Open arc hardfacing (Tungsten carbide)	T Fe20	MF-21-GF-50-GR	p 17

SELECTION CRITERIA
FOR SELECTARC JOINING CORED WIRES

TABLE FOR COMPARING PRODUCTS
ACCORDING TO THEIR CHEMICAL COMPOSITIONS AND METHODS.

Type	Weld metal composition (%)												FCW (with gas)	FCO (without gas)
	C	Si	Mn	Ni	Al	Cr	Cu	Mo	V	P	S	Fe		
SELECTARC FCW 51-R	0.04	0.35	1.28	-	-	-	-	-	-	0.012	0.012	Balance	✓	
SELECTARC FCW 51-M	0.04	0.7	1.25	0.03	-	0.04	0.04	0.01	0.01	0.012	0.012	Balance	✓	
SELECTARC FCO 56	0.1	0.3	0.5	-	1.4	-	-	-	-	0.012	0.012	Balance		✓
SELECTARC FCW 77-M	0.06	0.5	1.5	2.5	-	0.5	<0.35	0.5	<0.03	0.015	0.015	Balance	✓	

Type	Weld metal composition (%)											FCW (with gas)	FCO (without gas)
	C	Si	Mn	Ni	Cr	Cu	Mo	N2	P	S	Fe		
SELECTARC FCW 308L	0.03	0.7	1.3	10.5	18.4	0.12	0.04	-	<0.02	<0.01	Balance	✓	
SELECTARC FCW INOX 8	0.03	0.7	1.3	9.5	18.4	0.12	0.02	-	<0.02	<0.01	Balance	✓	
SELECTARC FCW 308LP	0.03	0.7	1.3	10.5	18.4	-	-	-	<0.02	<0.01	Balance	✓	
SELECTARC FCW 316L	0.03	0.8	1.4	12.0	19.0	-	2.90	-	<0.02	<0.01	Balance	✓	
SELECTARC FCW 316LP	0.03	0.8	1.4	12.0	19.0	-	-	-	<0.02	<0.01	Balance	✓	
SELECTARC FCW 309L	0.03	0.7	1.5	13.6	23.4	-	2.70	-	<0.02	<0.01	Balance	✓	
SELECTARC FCW 309LP	0.03	0.7	1.5	13.6	23.4	-	2.70	-	<0.02	<0.01	Balance	✓	
SELECTARC FCW 2209	0.03	0.8	1.4	9.0	23.0	0.1	3.2	0.14	<0.02	<0.01	Balance	✓	
SELECTARC FCW 2209P	0.03	0.8	1.4	9.0	23.0	0.1	3.2	0.14	<0.02	<0.01	Balance	✓	
SELECTARC FCW 2509Mo	0.03	0.6	1.4	9.0	25.0	1.0	3.8	0.25	0.008	0.01	-	✓	
SELECTARC FCW 2509MoP	0.03	0.6	1.4	9.3	25.2	1.5	4.0	0.25	0.02	0.01	-	✓	
SELECTARC FCO 307	0.1	0.55	6.0	9.0	19.0	-	-	-	0.015	0.008	-		✓

Type	Weld metal composition (%)										FCW (with gas)	FCO (without gas)
	C	Si	Mn	Cr	Fe	Nb	Mo	P	S	Ni		
SELECTARC FCW NI182	0.02	0.2	6.0	17.0	6.0	1.7	0.1	<0.02	<0.01	Balance	✓	
SELECTARC FCW NI625	0.025	0.3	0.4	21.0	0.4	3.6	9.0	<0.01	<0.01	Balance	✓	
SELECTARC FCW FENI	0.75	0.6	4.0	-	Balance	-	-	<0.015	<0.015	45.0	✓	

Type	Weld metal composition (%)										FCW (with gas)	FCO (without gas)
	C	Si	Mn	Cr	W	Ni	Fe	Mo	P	S	Co		
SELECTARC FCW CO6	1.05	1.0	1.0	29.0	4.6	-	4.0	-	<0.02	<0.03	Balance	✓	
SELECTARC FCW CO21	0.25	1.0	1.0	28.5	-	3.0	4.0	5.5	<0.02	<0.03	Balance	✓	

Type	Weld metal composition (%)											FCW (with gas)	FCO (without gas)
	C	Si	Mn	B	Ni	Cr	Nb	Mo	Ti	P	S	Fe		
SELECTARC FCW 45	0.4	0.7	1.5	-	-	2.5	-	0.5	-	<0.015	<0.010	Balance	✓	
SELECTARC FCW 60	0.5	0.7	1.2	-	-	6.0	-	0.7	-	<0.015	<0.010	Balance	✓	
SELECTARC FCO 65A	0.5	1.3	2.0	4.5	2.0	-	-	-	-	-	-	Balance		✓
SELECTARC FCO 65	5.0	0.7	0.5	-	-	22.0	7.0	-	-	-	-	Balance		✓
SELECTARC FCO 63	5.0	1.5	1.5	-	-	27.0	-	-	-	-	-	Balance		✓
SELECTARC FCO 63TI	1.8	0.7	1.2	-	-	6.5	-	0.8	5.0	-	-	Balance		✓
SELECTARC FCO FE60WC	-	-	-	-	-	-	-	-	-	-	-	-		✓

UN-ALLOYED & LOW ALLOYED STEELS

SELECTARC FCW 51-R

UNIVERSAL RUTILE NON ALLOY ALL POSITIONS

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.20	C	0.04	▪ Rutile flux cored wire for gas shielded arc welding low alloys in all positions for Ar-CO2 mix. ▪ **APPLICATIONS: General steel constructions, foundries, shipyards.**	Re (MPa)	560	1.2	120-350	18-24	12-25	= +
E71T1-1M	Si	0.35		Rm (MPa)	591					
ISO 17632-A	Mn	1.28		A5 (%)	28					
T 46 2 P M 1 H10	S	0.012		KV (J)	-20°C → 71					
	P	0.012								
	Fe	Balance								

Shielding gas	
ISO 14175	20-25 l/min
M21 (Ar/CO_2)	

SELECTARC FCW 51-M

UNIVERSAL METAL CORED NON ALLOY

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.18	C	0.04	▪ Metal cored wire for gas shielded arc welding low alloys in all positions for Ar-CO2 mix. ▪ **APPLICATIONS: General steel constructions, foundries, shipyards.**	Re (MPa)	440	1.2	150-310	16-35	12-25	= +
E 70C-6M H4	Si	0.7		Rm (MPa)	530					
ISO 17632-A	Mn	1.25		A5 (%)	30					
T 42 3 M M 1 H5	Ni	0.03		KV (J)	-30°C → 60					
	Cr	0.04								
	Cu	0.04								
	Mo	0.01								
	V	0.01								
	S	0.012								
	P	0.012								
	Fe	Balance								

Shielding gas	
ISO 14175	12-15 l/min
M21 (Ar/CO_2)	

SELECTARC FCO 56

WITHOUT GAS

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.18	C	0.1	▪ Flux cored wire for welding low alloys without gaz in all positions. ▪ **APPLICATIONS: General steel constructions, foundries, shipyards.**	Re (MPa)	440	1.2	100-200	20-22	30-40	= -
E71T-11	Si	0.3		Rm (MPa)	600	1.6	150-300	20-24	30-40	*Using the arc, unprotected*
ISO 17632-A	Mn	0.5		A5 (%)	25					
T 38 Z Z N 1	Al	1.4		KV (J)	-					
	S	0.012								
	P	0.012								
	Fe	Balance								

Shielding gas
Without gas

SELECTARC FCW 77-M

HIGH STRENGTH METAL CORED WIRE FOR STEEL HLE

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.28	C	0.06	▪ Metal cored tubular wire for high strength steel for semi- and automatic gas shielded arc welding. ▪ **APPLICATIONS: Cranes, vessel and apparatus construction.**	Re (MPa)	760	1.2	100-350	15-35	12-25	= +
E110C-K4 H4	Si	0.5		Rm (MPa)	820	1.6	120-400	15-35	15-25	
ISO 18276-A	Mn	1.5		A5 (%)	17					
T 69 4 Mn2NiCrMo M M 1 H5	Ni	2.5		KV (J)	-40°C → 60					
	Cr	0.5								
	Cu	< 0.35								
	Mo	0.5								
	V	< 0.03								
	S	0.015								
	P	0.015								
	Fe	Balance								

Shielding gas	
ISO 14175	12-15 l/min
M21 (Ar/CO_2)	

STAINLESS STEELS

SELECTARC FCW 308L

DOWNHAND 308L

Classification	Weld metal composition (%)		Characteristics and applications	Caractéristiques mécaniques		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.22	C	0.03	▪ Flux cored wire for gas shielded arc welding for 304L stainless steel. Flux cored wire with high productivity in down hand and fillet welding. Easy slag removes. ▪ **APPLICATIONS: All type of steel construction with a service temperature do not exceed 400°C. Thermal Plant, piping, construction on sea coast.**	Re (MPa)	400	1.2	100-280	23-33	10-25	= +
E308LT0-1/-4	Si	0.7		Rm (MPa)	560	1.6	150-400	23-35	10-25	
ISO 17633-A	Mn	1.3		A5 (%)	40					
T 19 9 L R M21 3	Ni	10.5		KV (J)	+20°C → 60					
T 19 9 L R C1 3	Cr	18.4			+196°C → 32					
	Cu	0.12								
	Mo	0.04								
	P	<0.02								
	S	<0.01								
	Fe	Balance								

Shielding gas	
ISO 14175	12-20 l/min
C1 / M21	

SELECTARC FCW INOX 8

STANDARD 308L

Classification	Weld metal composition (%)		Characteristics and applications	Caractéristiques mécaniques		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.22	C	0.03	▪ Flux cored wire for gas shielded arc welding for 304L stainless steel. ▪ **APPLICATIONS: Current stainless steel joining.**	Re (MPa)	320	1.2	100-280	23-33	10-25	= +
E308LT0-1/-4	Si	0.7		Rm (MPa)	520					
ISO 17633-A	Mn	1.3		A5 (%)	35					
T 19 9 L R M 3	Ni	9.5		KV (J)	+20°C → 60					
	Cr	18.4								
	Cu	0.12								
	Mo	0.02								
	P	<0.02								
	S	<0.01								
	Fe	Balance								

Shielding gas	
ISO 14175	12-20 l/min
M21	

SELECTARC 308LP

ALL POSITION 308L

Classification	Weld metal composition (%)		Characteristics and applications	Caractéristiques mécaniques		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.22	C	0.03	▪ Flux cored wire for gas shielded arc welding for 304L stainless steel. Wire with rutile fast freezing to weld in all positions. ▪ **APPLICATIONS: All type of steel construction with a service temperature do not exceed 400°C. Thermal Plant, piping, construction on sea coast.**	Re (MPa)	460	1.2	130-270	20-32	12-25	= +
E308LT1-1/-4	Si	0.7		Rm (MPa)	620					
ISO 17633-A	Mn	1.3		A5 (%)	36					
T 19 9 L P M21 1	Ni	10.5		KV (J)	-196°C → 34					
T 19 9 L P C1 1	Cr	18.4								
	P	<0.02								
	S	<0.01								
	Fe	Balance								

Shielding gas	
ISO 14175	12-20 l/min
C1 / M21	

SELECTARC FCW 316L

316L IN HIGH PRODUCTIVITY

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.22	C	0.03	▪ Flux cored wire for gas shielded arc welding for 316L stainless steel. Flux cored wire with high productivity in down hand and fillet welding. Easy slag removes. ▪ **APPLICATIONS: All type of steel construction with a service temperature do not exceed 400°C. Thermal Plant, piping, construction on sea coast.**	Re (MPa)	490	1.2	100-280	23-33	10-25	= +
E316LT0-1/-4	Si	0.8		Rm (MPa)	590					
ISO 17633-A	Mn	1.4		A5 (%)	32					
T 19 12 3 L R M21 3	Ni	12.0		KV (J)	+20°C→60					
T 19 12 3 L R C1 3	Cr	19.0			-60°C→50					
	Mo	2.90								
	P	<0.02								
	S	<0.01								
	Fe	Balance								

Shielding gas	
ISO 14175	12-20 l/min
C1 / M21	

SELECTARC FCW 316LP

ALL POSITION 316L

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.22	C	0.03	▪ Flux cored wire for gas shielded arc welding for 316L stainless steel. Wire with rutile fast freezing to weld in all positions. ▪ **APPLICATIONS: All type of steel construction with a service temperature do not exceed 400°C. Thermal Plant, piping, construction on sea coast.**	Re (MPa)	490	1.2	140-220	23-30	15-20	= +
E316LT1-1/-4	Si	0.8		Rm (MPa)	600					
ISO 17633-A	Mn	1.4		A5 (%)	32					
T 19 12 3 L P M21 1	Ni	12.0		KV (J)	-110°C→35					
T 19 12 3 L P C1 1	Cr	19.0								
	Mo	2.90								
	P	<0.02								
	S	<0.01								
	Fe	Balance								

Shielding gas	
ISO 14175	12-20 l/min
C1 / M21	

SELECTARC FCW 309L

ALL POSITION 309L

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.22	C	0.03	▪ Flux cored wire for gas shielded arc welding for 309L stainless steel and for dissimilar joining type 304 or 316 on low alloys steels. The high ferrite content allows an important dilution without cracks. Flux cored wire with high productivity in down hand and fillet welding. Easy slag removes. ▪ **APPLICATIONS: Pressure vessels, maintenance and repair. Buttering before Low carbon cladding or Final hardfacing.**	Re (MPa)	460	1.2	140-220	23-30	15-20	= +
E309LT0-1/-4	Si	0.7		Rm (MPa)	580					
ISO 17633-A	Mn	1.5		A5 (%)	32					
T 23 12 L R M21 3	Ni	13.6		KV (J)	-60°C→40					
T 23 12 L R C1 3	Cr	23.4								
	Mo	2.70								
	P	<0.02								
	S	<0.01								
	Fe	Balance								

Shielding gas	
ISO 14175	12-20 l/min
C1 / M21	

SELECTARC FCW 309LP

ALL POSITIONS FOR REPAIRING

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.22	C	0.03	▪ Flux cored wire for gas shielded arc welding for 309L stainless steel and for dissimilar joining type 304 or 316 on low alloys steels. The high ferrite content allows an important dilution without craks. Wire with rutile fast freezing to weld in all positions. ▪ **APPLICATIONS: Pressure vessels, maintenance and repair. Buttering before Low carbon cladding or Final hardfacing.**	Re (MPa)	460	1.2	140-220	23-30	15-20	= +
E309LT1-1/-4	Si	0.7		Rm (MPa)	580					
ISO 17633-A	Mn	1.5		A5 (%)	35					
T 23 12 L P M21 1	Ni	13.6		KV (J)	-60°C→40					
T 23 12 L P C1 1	Cr	23.4								
	Mo	2.70								
	P	<0.02								
	S	<0.01								
	Fe	Balance								

Shielding gas	
ISO 14175	12-20 l/min
C1 / M21	

SELECTARC FCW 2209

DUPLEX

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.22	C	0.03	▪ Flux cored wire for gas shielded arc welding in flat and down hand positions duplex steels such as 2205, 2304. Resistant to severe corrosive environments (inter crystalline attack, pitting corrosion, crevice, stress corrosion). ▪ **APPLICATIONS: For pumps, vessels, piping systems etc. attacked by chloride containing solutions. But also for impellers and other components which require high strength combined with corrosion attack.** ** (Trademarks of CREUSOT LOIRE Industries)*	Re (MPa)	650	1.2	100-280	23-30	10-25	= +
E2209T0-1/-4	Si	0.8		Rm (MPa)	830					
ISO 17633-A	Mn	1.4		A5 (%)	28					
T 22 9 3 N L R M21 3	Ni	9.0		KV (J)	-50°C → 27					
T 22 9 3 N L R C1 3	Cr	23.0								
	Cu	0.1								
	Mo	3.2								
	N_2	0.14								
	P	<0.02								
	S	<0.01								
	Fe	Balance								

Shielding gas	
ISO 14175	12-20 l/min
C1 / M21	

SELECTARC FCW 2209P

ALL POSITION DUPLEX

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.22	C	0.03	▪ Flux cored wire for gas shielded arc welding in all positions duplex steels such as 2205, 2304. Resistant to severe corrosive environments (inter crystalline attack, pitting corrosion, crevice, stress corrosion). ▪ **APPLICATIONS: For pumps, vessels, piping systems etc. attacked by chloride containing solutions. But also for impellers and other components which require high strength combined with corrosion attack.** ** (Trademarks of CREUSOT LOIRE Industries)*	Re (MPa)	630	1.2	130-270	22-35	12-25	= +
E2209T1-1/-4	Si	0.8		Rm (MPa)	780					
ISO 17633-A	Mn	1.4		A5 (%)	28					
T 22 9 3 N L P M21 1	Ni	9.0		KV (J)	-60°C → 32					
T 22 9 3 N L P C1 1	Cr	23.0								
	Cu	0.1								
	Mo	3.2								
	N_2	0.14								
	P	<0.02								
	S	<0.01								
	Fe	Balance								

Shielding gas	
ISO 14175	12-20 l/min
C1 / M21	

SELECTARC FCW 2509Mo

DOWNHAND SUPER-DUPLEX

Classification		Weld metal composition (%)	Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.22	C	0.03	▪ Flux cored wire for gas shielded arc welding in flat and down hand positions for Super Duplex steels such as 2507. Resistant to severe corrosive environments (inter crystalline attack, pitting corrosion, crevice, stress corrosion).	Re (MPa)	830	1.2	130-250	24+35	12-20	= +
E2594T0-4	Si	0.6	▪ **APPLICATIONS: For pumps, vessels, piping systems etc. attacked by chloride containing solutions. But also for impellers and other components which require high strength combined with corrosion attack.**	Rm (MPa)	950					
ISO 17633-A	Mn	1.4		A5 (%)	22					
T 25 9 4 Cu N L R M21 3	Ni	9.0		KV (J)	-29°C → 30					
	Cr	25.0								
	Cu	1.0								
	Mo	3.8								
	N_2	0.25								
	P	0.008								
	S	0.01								
	WRC	40FN	** (Trademarks of CREUSOT LOIRE Industries)*							

Shielding gas	
ISO 14175	12-20 l/min
M21	

SELECTARC FCW 2509MoP

ALL POSITION SUPER-DUPLEX

Classification		Weld metal composition (%)	Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.22	C	0.03	▪ Flux cored wire for gas shielded arc welding in all positions for Super Duplex steels such as 2507. Resistant to severe corrosive environments (inter crystalline attack, pitting corrosion, crevice, stress corrosion).	Re (MPa)	660	1.2	130-250	24-35	12-20	= +
E2594T0-1	Si	0.6	▪ **APPLICATIONS: For pumps, vessels, piping systems etc. attacked by chloride containing solutions. But also for impellers and other components which require high strength combined with corrosion attack.**	Rm (MPa)	880					
ISO 17633-A	Mn	1.4		A5 (%)	25					
T 25 9 4 Cu N L P M21 1	Ni	9.3		KV (J)	+20°C → 90					
	Cr	25.2								
	Cu	1.5								
	Mo	4.0								
	N_2	0.25								
	P	0.02								
	S	0.01								
	WRC	~50FN								

Shielding gas	
ISO 14175	12-20 l/min
M21	

SELECTARC FCO 307

OPEN ARC 307

Classification		Weld metal composition (%)	Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.22	C	0.1	▪ Flux cored wire in stainless steel without gaz use for welding austenitic stainless steels and manganese steels considered difficult to weld or misidentified.	Re (MPa)	>400	1.2	130-250	24-35	12-20	= +
~E307T0-3	Si	0.55	▪ **APPLICATIONS: Civil engineering, road, rail and fluvial, quarry, cement. Ideal as buffer layer before hardfacing of grades sensitive to cracking or in case of dissimilar joints between stainless stell and steel construction.**	Rm (MPa)	650					
ISO 17633-A	Mn	6.0		A5 (%)	32					*Using the arc, unprotected*
T 18 8 Mn U N 3	Ni	9.0		KV (J)	-					
	Cr	19.0		Hardness	180 HB (as welded)					
	P	0.015								
	S	0.008			47 HRC (Work hardened)					

Shielding gas
Without gas

NICKEL ALLOYS

SELECTARC FCW NI182

ALL POSITION FOR NICKEL INCONEL® TYPE 600

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.15	C	0.02	▪ Flux cored nickel base wire for gas shielded arc welding in flat position of high nickel alloys such as Inconel* 600, 800. Used for special austenitic stainless steels or dissimilar joining (Low alloy/Stainless steel, Stainless steel/Nickel Base). Good resistance to various types of corrosions. ▪ **APPLICATIONS: Cladding ion steels of 5% and 9% Ni. Equipment subject to acid very high temperature, repair of difficult to weld steels, buffer layer.** ** "Inconel®" is registered trade names of INCO ALLOYS.*	Re (MPa)	380	1.2	130-250	24-32	12-25	= +
ENiCrFe3T0-4	Si	0.2		Rm (MPa)	610					
ISO 12153	Mn	6.0		A5 (%)	45					
T Ni 6182 B M 21 3	Cr	17.0		KV (J)	+20°C → 200					
	Fe	17.0			-196°C → 90					
	Nb	1.7		Hardness	-					
	Mo	0.1								
	P	<0.02								
	S	<0.01								
	Ni	Balance								

Shielding gas	
ISO 14175	10-20 l/min
M21	

SELECTARC FCW NI625

ALL POSITION FOR NICKEL INCONEL® TYPE 625

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
AWS A5.15	C	0.025	▪ Flux cored nickel base wire for gas shielded arc welding in flat position of high nickel alloys as well as for special austenitic stainless steels. Excellent resistance to pitting, crevice and stress corrosion cracking in the presence of chlorides. ▪ **APPLICATIONS: Cladding on steels of 5% and 9% Ni. Used in the construction of equipment submitted to oxidizing and corrosive attacks at high temperatures.** ** "Inconel®" is registered trade names of INCO ALLOYS.*	Re (MPa)	500	1.2	130-250	24-35	12-20	= +
ENiCrMo3T0-4	Si	0.3		Rm (MPa)	780					
	Mn	0.4		A5 (%)	40					
	Cr	21.0		KV (J)	-196°C → 70					
	Fe	0.4		Hardness	-					
	Nb	3.6								
	Mo	9.0								
	P	<0.01								
	S	<0.01								
	Ni	Balance								

Shielding gas	
ISO 14175	10-20 l/min
M21	

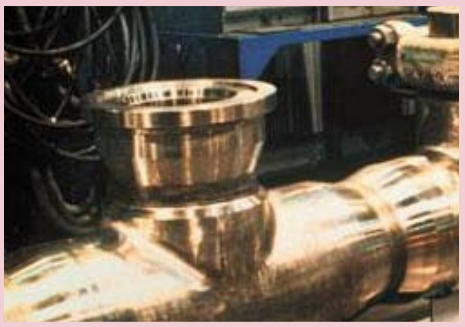
SELECTARC FCW FENI

FERRO-NICKEL ALLOY FOR FOUNDRIES

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
ISO 1071	C	0.75	▪ Flux cored wire for gas shielded arc welding grey, malleables, nodular cast irons. Also used for dissimilar weldments between cast irons and steels. ▪ **APPLICATIONS: Foundry defects, repairing of engine blocks, frames of tool machines, gearboxes, reducing pieces, valve and pump bodies.**	Re (MPa)	340	1.2	130-250	24-32	12-20	= +
T C NiFe-2	Si	0.6		Rm (MPa)	550					
	Mn	4.0		A5 (%)	16					
	Ni	45.0		KV (J)	-					
	P	<0.015		Hardness	165 HB (as welded)					
	S	<0.015								
	Fe	Balance								

Shielding gas	
ISO 14175	10-23 l/min
M21	

COBALT ALLOYS



SELECTARC FCW CO6

COBALT GRADE 6

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
A5.21	C	1.05	▪ Cobalt base tubular wire for gas shielded hardfacing type Cobalt Grade 6. Exceptional resistance to wear combined or not: abrasion, metal-metal wear, corrosion of 500°C to 800°C. ▪ **APPLICATIONS: Hot shear blades, valve seats and litters…**	Re (MPa)	-	1.2	100-250	16-30	15-30	= +
ERCCoCr-A	Si	1.0		Rm (MPa)	-	1.6	140-350	16-30	15-30	
EN 14700	Mn	1.0		A5 (%)	-					
TCo2	Cr	29.0		KV (J)	-					
	W	4.6		Hardness	~42 HRC					
	Fe	4.0								
	P	<0.02								
	S	<0.03								
	Co	Balance								

Shielding gas	
ISO 14175	10-20 l/min
I1	

SELECTARC FCW CO21

COBALT GRADE 21

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
A5.21	C	0.25	▪ Cobalt base tubular wire for gas shielded hardfacing type Cobalt Grade 21. Exceptional resistance to wear combined or not: shock, high temperature pressure in sulphurous atmosphere. ▪ **APPLICATIONS: Scope and valve seats, hot forging dies, gas turbine, large hardfacing areas…**	Re (MPa)	-	1.2	100-250	20-30	10-25	= +
ERCCoCr-C	Si	1.0		Rm (MPa)	-	1.6	140-350	20-30	10-25	
EN 14700	Mn	1.0		A5 (%)	-					
TCo1	Cr	28.5		KV (J)	-					
	Ni	3.0		Hardness	~33 HRC (as welded)					
	Fe	4.0								
	Mo	5.5			~47 HRC (Work hardened)					
	P	<0.02								
	S	<0.03								
	Co	Balance								

Shielding gas	
ISO 14175	10-20 l/min
I1	

CHOICE

SELECTION CRITERIA
FOR SELECTARC HARDFACING CORED WIRES

	Type	PROCESSES		WEAR PHENOMENA AND APTITUDES							HARDNESS (HRC)
		FCO (without gas)	FCW (with gas)	Mineral abrasion	Metal abrasion	Shock	Pressure	Corrosion	Temperature > 500 °C	Machining	
STAINLESS	SELECTARC FCO 307	✓		●	●	★★★	★★★	★★	●	★★★	Buffer layer
HARDFACING - REPAIR AND MAINTENANCE	SELECTARC FCW 45		✓	●	★	●	★★	●	●	★★	~45
	SELECTARC FCW 60		✓	★★	★	★★	★★	●	●	★	~55
	SELECTARC FCO 65A	✓		👍	●	●	●	★	●	●	~65
	SELECTARC FCO 65	✓		👍	★	★★	★	★★	★★★	●	~63
	SELECTARC FCO 63	✓		★★	★	★★	★★	★	★★	●	~61
	SELECTARC FCO 63TI	✓		👍	★	★★★	★★★	★	★★	●	~57
	SELECTARC FCO FE60WC	✓		👍	★	●	●	★	★★★	●	~61
COBALT	SELECTARC FCW C06		✓	★★	★★★	★★	★★	👍	★★★	★★	~42
	SELECTARC FCW C021		✓	●	👍	👍	★★★	👍	★★★	★★	~33

● UNSUITABLE ★ STANDARD ★★ GOOD ★★★ VERY GOOD 👍 EXCELLENT

DEFINITION OF WEAR PHENOMENA AND APTITUDES OF ALLOYS

- **MINERAL ABRASION:** Wear by relative movement of a mineral material characterized by its hardness, shape and texture, attacking by cutting the metal surface.
- **METAL ABRASION:** Contact exercised under pressure, with relative movement between the two metal surfaces, with or without lubricant. Degradation by the formation of micro-welds between contacting surfaces.
- **SHOCKS:** Impact of two materials one with another, one of the two causing the deformation or breakage of the surface of the other. This phenomenon is conditioned by the toughness or ductility of the materials present.
- **PRESSURE:** Application of stress to the material by the action of a fluid (often combined with abrasion) or a solid.
- **CORROSION:** Degradation of the material by chemical reaction with its environment. A complex phenomenon resulting from multiple parameters.
- **MACHINING:** Machinability by chipping, for example: turning, milling and drilling.

HARDFACING
REPAIR AND MAINTENANCE

SELECTARC FCW 45

HARDFACING ABRASION - 450 HB

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
EN 14700	C	0.4	▪ Flux cored wire for gas shielded arc hardfacing without slag. ▪ **APPLICATIONS: Conveyors and transport surfaces, tires. Can be used as buffer layer prior to a higher hardness overlay.**	Hardness	~450 HB (as welded)	1.2	100-290	24-32	12-25	= +
T Fe1	Si	0.7				1.6	150-300	24-32	12-25	
DIN 8555	Mn	1.5								
MSG-1-GF-45-SP	Cr	2.5								
	Mo	0.5								
	P	<0.015								
	S	<0.010								
	Fe	Balance								

Shielding gas	
ISO 14175	10-20 l/min
I1	

SELECTARC FCW 60

HARDFACING ABRASION - 600 HB

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
EN 14700	C	0.5	▪ Flux cored wire for gas shielded arc hardfacing without slag for an optimal balance between abrasion, friction and impact resistance. ▪ **APPLICATIONS: Dies transporter, cams, gear teeth.**	Hardness	~55 HRC (as welded)	1.2	100-280	23-33	10-25	= +
T Fe2	Si	0.7				1.6	150-400	23-35	10-25	
DIN 8555	Mn	1.2								
MSG 6 GF 55 GSP	Cr	6.0								
	Mo	0.7								
	P	<0.015								
	S	<0.010								
	Fe	Balance								

Shielding gas	
ISO 14175	12-20 l/min
M21	

SELECTARC FCO 65A

OPEN ARC HARDFACING FOR ABRASION (BORE CARBIDE)

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
EN 14700	C	0.5	▪ Tubular wire for self-shielded metal arc hardfacing. Alloy for unalloyed steels with C<0.5 % to achieve extreme abrasion resistance. ▪ **APPLICATIONS: Agriculture equipement, mining, quarring.**	Hardness	~65 HRC (as welded)	1.2	150-300	25-35	15-25	= +
T Z Fe13	Si	1.3				1.6	200-300	25-35	15-28	
DIN 8555	Mn	2.0								*Using the arc, unprotected*
MF-10-GF-65-G	B	4.5								
	Ni	2.0								
	Fe	Balance								

Shielding gas
Without gas

SELECTARC FCO 65

HARFACING FOR ABRASION/IMPACT (NOBIUM AND CHROMIUM CARBIDES)

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
EN 14700	C	0.5	▪ Tubular wire for self-shielded metal arc hardfacing. High chromium cast iron for hardfacing components subject to extremely severe abrasive wear and moderate impact. The deposits resists to corrosion due to the high chromium content as well as heat up to 200°C. ▪ **APPLICATIONS: For excavating and crashing equipment, surfacing of endless screws, mixer blades, pump bodies for abrasive materials, excavator teeth, concrete pumps, ore crushing.**	Hardness	~63 HRC	1.2	150-300	26-35	20-30	= +
T Fe15	Si	0.7				1.6	200-400	26-35	25-40	
DIN 8555	Mn	0.5								*Using the arc, unprotected*
MF-10-GF-65-GCZ	Cr	22.0								
	Nb	7.0								
	Fe	Balance								

Shielding gas
Without gas

SELECTARC FCO 63

OPEN ARC HARDFACING FOR ABRASION/IMPACT (CHROMIUM CARBIDE)

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
EN 14700	C	0.5	▪ Tubular wire for self-shielded metal arc hardfacing. High chromium cast iron for hardfacing components subject to extremely severe abrasive wear and moderate impact. The deposits resists to corrosion due to the high chromium content as well as heat up to 200°C. ▪ **APPLICATIONS: For excavating and crashing equipement, surfacing of endless screws, mixer blades, pump bodies for abrasive materials, excavator teeth, concrete pumps, ore crushing.**	Hardness	~61 HRC	1.6	180-330	26-30	~25	= +
T Fe15	Si	1.5				2.4	250-400	26-30	~40	
DIN 8555	Mn	1.5								*Using the arc, unprotected*
MF-10-GF-60-GRZ	Cr	27.0								
	Fe	Balance								

Shielding gas
Without gas

SELECTARC FCO 63TI

FIL FOURRÉ DE RECHARGEMENT DUR SANS GAZ / ABRASION ET CHOC

Classification	Weld metal composition (%)		Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
							Intensity (A)	Voltage (V)	Stick out (mm)	
EN 14700	C	1.8	▪ Tubular wire for self-shielded metal arc hardfacing. High chromium cast iron with titanium carbide for hardfacing components subject to severe abrasive wear and heavy impact. ▪ **APPLICATIONS: For excavating and crashing equipement, surfacing of endless screws, mixer blades, pump bodies for abrasive materials, excavator teeth, concrete pumps, ore crushing.**	Hardness	~57 HRC	1.6	180-230	23-32	25-40	= +
T Fe8	Si	0.7								*Using the arc, unprotected*
DIN 8555	Mn	1.2								
MF-6-GF-55-GP	Cr	6.5								
	Mo	0.8								
	Ti	5.0								
	Fe	Balance								

Shielding gas
Without gas

SELECTARC FCO FE60WC

FIL FOURRÉ DE RECHARGEMENT DUR SANS GAZ + CARBURE DE TUNGSTÈNE

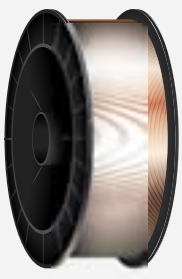
Classification	Weld metal composition (%)	Characteristics and applications	Mechanical properties		ø (mm)	Parameters			
						Intensity (A)	Voltage (V)	Stick out (mm)	
EN 14700	-	▪ Tubular wire for self-shielded metal arc hardfacing. Composite wire is made frome a steel wire with tungsten carbide particles flux. The deposit is extremely resistant to abrasion with low impact. ▪ **APPLICATIONS: Dust extracting ventilators (mining, steel industries), componants for agriculture.**	Hardness	~61 HRC	1.6	120-200	22-27	15-40	= +
T Fe20									
DIN 8555									*Using the arc, unprotected*
MF-21-GF-50-GR									

Shielding gas
Without gas

PACKAGING / STORAGE

ALL SPECIFIC PACKAGING
CAN BE STUDIED ON REQUEST:
>> CONSULT US!

GTAW-MAG / CASE

PACKAGING PLASTIC SPOOL D300		
	Dimensions: Outside diameter 300 mm	Diameters available in:
	Weight spool: 15 kg	1.20 mm
		1.60 mm

PACKAGING STAINLESS SPOOL BS300		
	Dimensions: Outside diameter 300 mm	Diameters available in:
	Weight spool: 15 kg	1.20 mm
		1.60 mm

SERVICE

• Advice and assistance

An experienced team of engineers and metallurgists help clients in choosing the most suitable materials for each application.

• Research and Development (R&D)

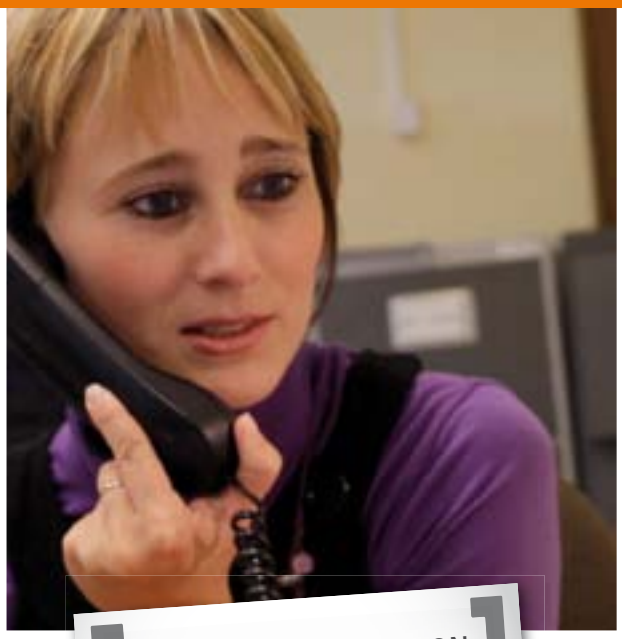
The R&D department ensures the tests products (mechanical and non-destructive testing) according to customer requests.

• Customer service

The sales department is available to respond promptly to all requests.

• Specific applications

RCCM, mechanical certificates 3.1, …



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QUALITY

ISO 9001 Certification.

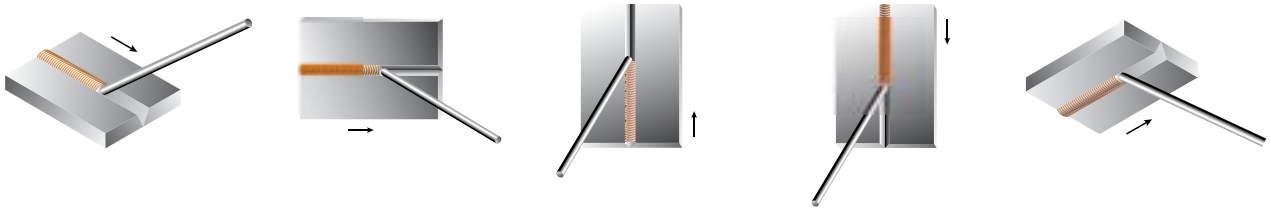
TECHNICAL ADVICE

WELDING POSITIONS:
BUTT WELDS - PLATES AND PIPES

ACCORDING TO: EN ISO 6947

BUTT WELDS - PLATES

PA	PC	PF	PG	PE
Horizontal flat position	Transverse position	Vertical up position	Vertical down position	Overhead position



PA HORIZONTAL FLAT POSITION:
plates are in horizontal position filler metal deposit over.

PC TRANSVERSE POSITION:
plates are in vertical up position, horizontal welding axis.

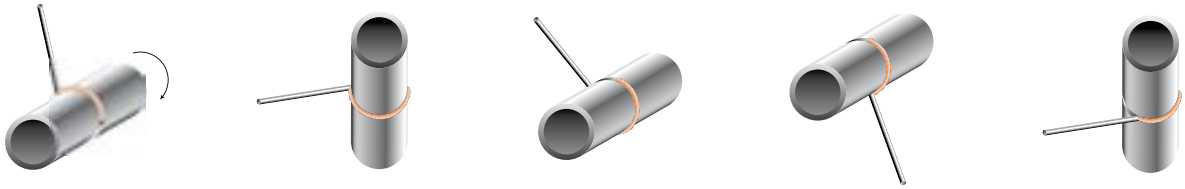
PF VERTICAL UP POSITION:
plates and welding axis are in vertical up position. Metal deposit from the bottom up.

PG VERTICAL DOWN POSITION:
plates and welding axis are vertical. Metal deposit from the top to the bottom.

PE OVERHEAD POSITION:
plates are in horizontal position, filler metal deposit from below.

BUTT WELDS - PIPES

PA	PC	PF	PG	H-LO45
Horizontal axis	Vertical axis	Horizontal axis	Horizontal axis	Lean axis



PA PIPE ROTATES WITH HORIZONTAL AXIS.
Pipe turns during welding Metal deposited in the most convenient area for the welder.

PC PIPE FIXED WITH VERTICAL AXIS.
Horizontal welding.
Welding is said **"fillet weld".**

PF PIPE FIXED WITH HORIZONTAL AXIS.
Welding from the bottom up in vertical up position.
Welding is said **"in position".**

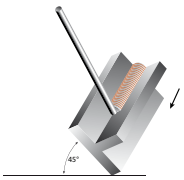
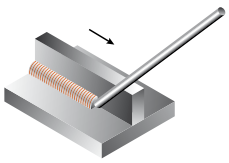
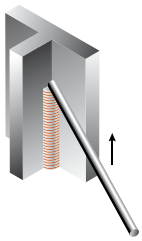
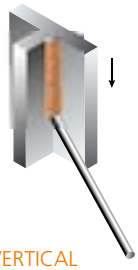
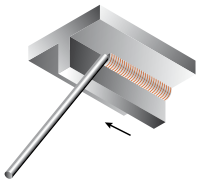
PG PIPE FIXED WITH HORIZONTAL AXIS.
Welding from the top to the bottom in vertical position.
Welding is said **"in position".**

H-LO45 PIPE FIXED WITH AXIS UNDER 45°.
Welding from the bottom up with axis under 45° compared to vertical position.
Welding is said **" inclined pipe buld".**

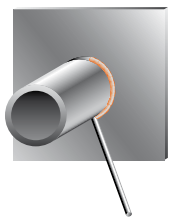
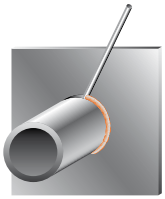
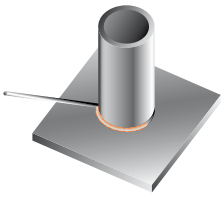
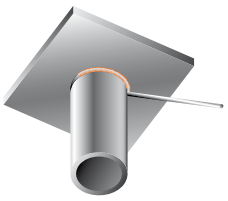
WELDING POSITIONS:
FILLET WELDS - PLATES AND PIPES

ACCORDING TO: EN ISO 6947

FILLET WELDS - PLATES

PA	PB	PF	PG	PD
Horizontal flat position	Horizontal downhand position	Vertical up position	Vertical down position	Horizontal overhead position
				
PA HORIZONTAL FLAT WELD	PB HORIZONTAL DOWNHAND POSITION	PF VERTICAL UP WELD	PG VERTICAL DOWN WELD	PD HORIZONTAL OVERHEAD WELD

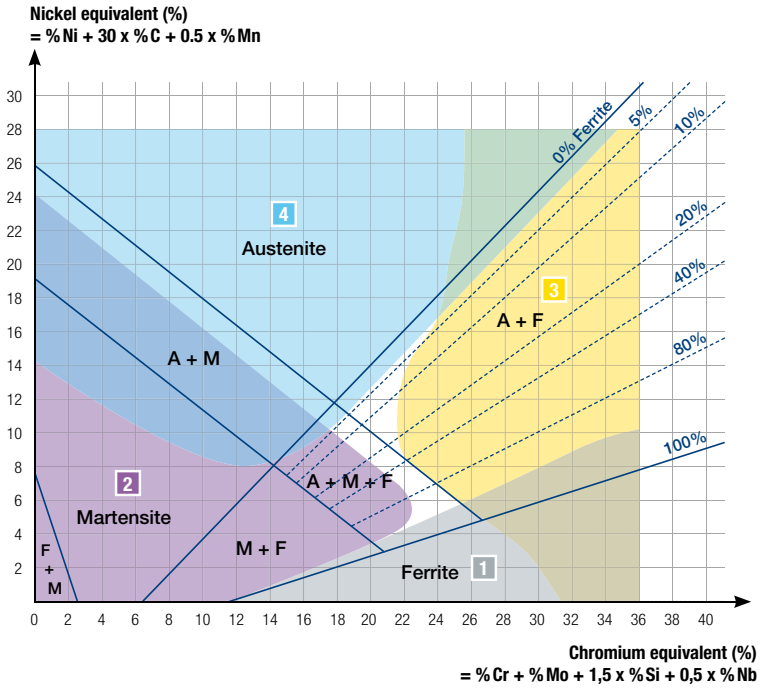
FILLET WELDS - PIPES

PB	PG	PF	PB	PD
Horizontal axis	Horizontal axis	Horizontal axis	Vertical axis	Vertical axis
				
PB PIPE: ROTATED AXIS: HORIZONTAL	PG PIPE: FIXE AXIS: HORIZONTAL	PF PIPE: FIXE AXIS: HORIZONTAL	PB PIPE: FIXE AXIS: VERTICAL	PD PIPE: FIXE AXIS: VERTICAL

TECHNICAL ADVICE

SCHAEFFLER DIAGRAM

SCHAEFFLER DIAGRAM IS USED TO CALCULATE APPROXIMATELY THE CRISTAL STRUCTURE OF A HIGH-ALLOYED STEEL WELDING, AFTER COOLING AT AMBIENT AIR.



Chemical composition is required to calculate:

CHROMIUM EQUIVALENT =

%Cr + %Mo + 1.5 x %Si + 0.5 x %Nb

NICKEL EQUIVALENT =

%Ni + 30 x %C + 0.5 x %Mn

1 AREA 1
Risk of grains thickness > 1150°C.

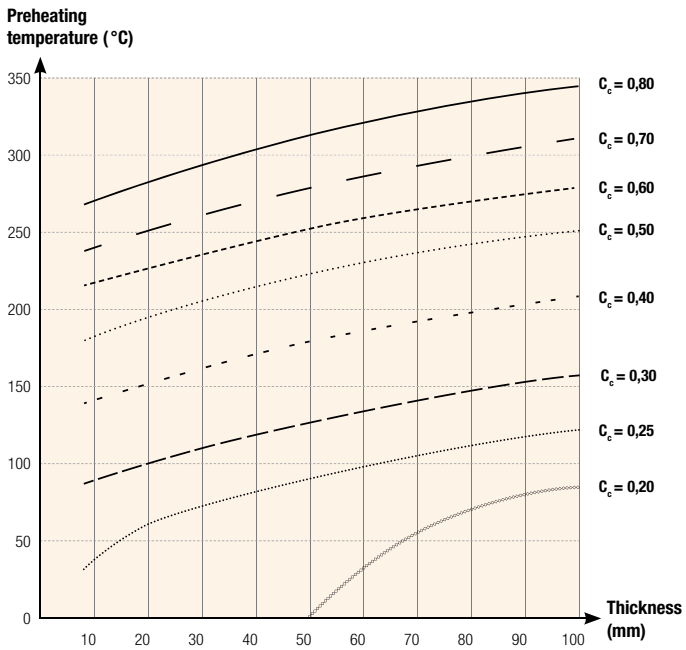
2 AREA 2
Risk of fragilisation: cold cracking. Quench cracks < 400°C.

3 AREA 3
Risk of formation of sigma phase between 450°C and 900°C.

4 AREA 4
Risk of fissuration of hot cracking > 1250°C.

CARBON EQUIVALENT AND PREHEATING TEMPERATURE

CALCULATION METHOD OF THE PREHEATING TEMPERATURE OF A STEEL ACCORDING TO ITS CHEMICAL COMPOSITION.



FORMULA ACCORDING TO IIS DOC. IX 646-69

$$C_c = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

$$C_{e.c} = C_e + 0.0254\ e$$

(e: piece thickness in cm)

WELD METAL VOLUME AND WEIGHT
PER METER

IN BUTT WELDING BEVEL WITH NO STANDARD

Plates thickness (mm) (e)	Bevel angle (α)	Gap (mm) (E)	Weld metal volume (cm^3)	Weld metal weight (kg/m)
5	80°	0	26	0.20
6	80°	1	42	0.323
8	70°	1	69	0.534
10	70°	1	100	0.78
12	60°	1.5	125	0.97
14	60°	1.5	164	1.28
16	60°	2	211	1.64
18	60°	2	259	2.02
20	60°	2	310	2.42

CONVERSIONS

ALLOYS	ALUMINIUM d: 2,7 g/cm^3		TITANIUM d: 4,5 g/cm^3		STAINLESS STEEL d: 7,85 g/cm^3		COPPER d: 8,9 g/cm^3	
ø	g/m	m/kg	g/m	m/kg	g/m	m/kg	g/m	m/kg
0.6	0.76	1310	1.27	786	2.22	450	2.52	397
0.8	1.36	735	2.26	442	3.94	254	4.47	224
1.0	2.12	472	3.53	283	6.16	162	6.98	143
1.2	3.05	328	5.08	197	8.87	113	10.06	100
1.6	5.42	184	9.04	111	15.77	63	17.88	56
2.0	8.48	118	14.13	71	24.65	41	27.95	36
2.4	12.21	82	20.34	49	35.48	28	40.23	25
3.0	19.07	52	31.79	31	55.46	18	62.88	16
3.2	31.70	46	36.17	28	63.10	16	71.54	14
4.0	33.91	29	56.52	18	98.59	10	111.78	9
5.0	52.99	19	88.31	11	154.06	7	174.66	6

d: density, **g/m**: gr. per meter, **m/kg**: meter per kg

1" = 1 inch = 25,4 mm		
ø (mm)	ø (inch)	ø (inch)
0.6	1/44	0.0236
0.8	1/32	0.0315
1.0	1/26	0.0393
1.2	3/64	0.0472
1.6	1/16	0.0629
2.0	5/64	0.0781
2.4	3/32	0.0945
3.2	1/8	0.1259
4.0	5/32	0.1574

TECHNICAL ADVICE

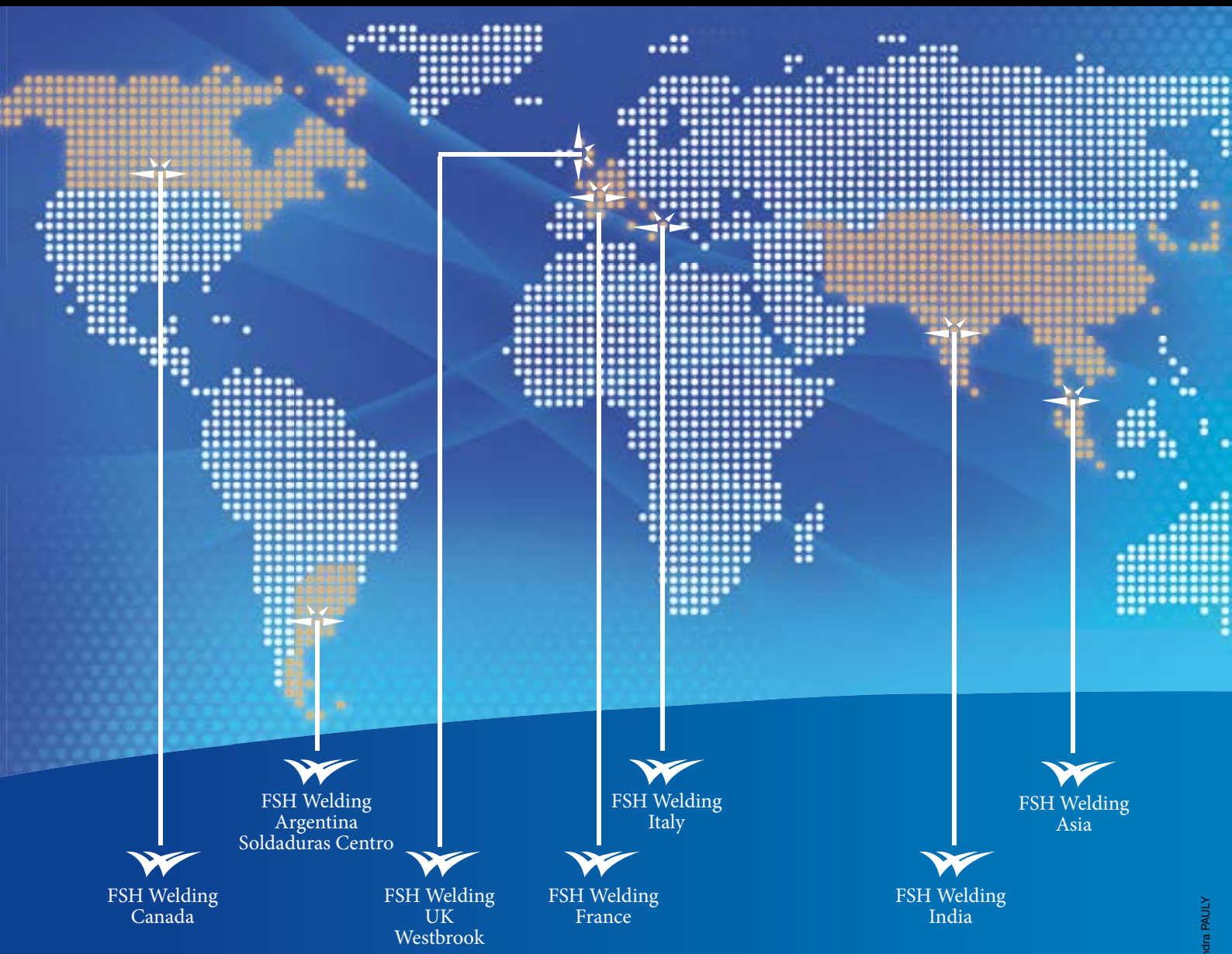
HARDNESS CONVERSION TABLE:
BRINELL - VICKERS - ROCKWELL - SHORE

Tensile strength (kg/mm²)	BRINELL HB Hardness (P = 30 D2)	ROCKWELL Hardness		VICKERS HV Hardness (P = 30 kg)	ROCKWELL DIAMOND		SHORE Hardness
		HRB	HRC		Charge 30 kg (N)	Charge 15 kg (N)	
28	80	36,4		80			
30	85	42,4		85			
32	90	47,4		90			
33	95	52,0		95			
35	100	56,4		100			
37	105	60,0		105			
39	110	63,4		110			15
40	115	66,4		115			18
42	120	69,4		120			19
43	125	72,0		125			20
45	130	74,4		130			-
47	135	76,4		135			-
48	140	78,4		140			21
50	145	80,4		145			22
51	150	82,2		150			23
53	155	83,8		155			-
55	160	85,4		160			25
56	165	86,8		165			-
58	170	88,2		170			26
60	175	89,6		175			-
62	180	90,8		180			28
63	185	91,8		185			-
65	190	93,0		190			29
67	195	94,0		195			30
68	200	95,0		200			31
70	205	95,8		205			32
72	210	96,6		210			-
73	215	97,6		215			33
75	220	98,2		220			-
77	225	99,0		225			-
78	230		19,2	230	41,9	69,7	34
80	235		20,2	235	42,9	70,3	35
82	240		21,2		43,9	70,9	36
84	245		22,1				-
85	250		23,0		45,1	71,7	37
87	255		23,8		46,2	72,5	38
89	260		24,6	260			-
90	265		25,4	265	47,3	73,1	39
92	270		26,2	270	48,3	73,7	40
94	275		26,9	275			-
96	280		27,6	280	49,3	74,4	41
97	285		28,3	285			-
99	290		29,0	290	50,3	75,0	42
101	295		29,6	295			-
103	300		30,3	300	51,2	75,5	43
106	310		31,5	310	52,2	76,1	45
110	320		32,7	320	53,3	76,7	46

VALID ON UN-ALLOYED AND ANNEALED STEELS

Tensile strength (kg/mm²)	BRINELL HB Hardness (P = 30 D2)	ROCKWELL Hardness		VICKERS HV Hardness (P = 30 kg)	ROCKWELL DIAMOND		SHORE Hardness
		HRB	HRC		Charge 30 kg (N)	Charge 15 kg (N)	
113	330		33,8	330	54,3	77,3	47
117	340		34,9	340	55,4	78,0	48
120	350		36,0	350	56,4	78,6	50
123	359		37,0	360	57,6	79,3	51
126	368		38,0	370			
129	376		38,9	380	58,7	80,0	52
132	385		39,8	390	59,9	80,6	54
135	392		40,7	400			
138	400		41,5	410	61,1	81,4	56
141	408		42,4	420	62,3	82,0	58
144	415		43,2	430			
146	423		44,0	440	63,5	82,8	59
149	430		44,8	450			
153	439		45,5	460	64,6	83,4	61
159	444		46,3	470	65,8	84,0	63
160			47,0	480	66,0	84,1	-
165	461		47,7	490	67,2	84,7	65
167			48,3	500	67,4	84,9	-
171	477		49,0	510	68,2	85,3	66
174			49,7	520	68,7	85,6	-
178	495		50,3	530	69,4	85,9	68
182			50,9	540	69,9	86,3	-
185	514		51,5	550	70,3	86,5	70
192	534		52,1	560	71,6	87,2	71
200	555		52,8	570	72,7	87,8	73
208	578		53,3	580	73,9	88,4	75
217			53,8	590	75,1	89,0	77
227			54,4	600	76,3	89,6	79
228			54,9	610	76,4	89,7	-
231			55,4	620	76,8	89,8	80
			55,9	630			
			56,4	640			
			56,9	650			
			57,4	660			
			57,9	670	77,2	90,1	
			58,4	680	77,5	90,2	81
			58,9	690	77,6	90,3	-
			59,3	700	78,4	90,7	83
			60,2	720	79,0	91,0	84
			61,1	740	79,1	91,0	-
			61,9	760	79,7	91,2	86
			62,8	780	80,4	91,5	87
			63,5	800	81,1	91,8	88
			64,3	820	81,7	92,0	90
			65,0	840	82,2	92,1	91
			65,7	860	82,7	92,3	92
			66,3	880	83,1	92,5	93
			66,9	900	83,6	92,7	95
			67,5	920	84,0	92,9	96
			68,0	940	84,4	93,0	97
				970	84,8	93,4	
				1000	85,3	93,6	
				1050	85,8	93,9	
				1100	86,4	94,1	
				1200	87,2	94,5	

VALID ON UN-ALLOYED AND ANNEALED STEELS



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