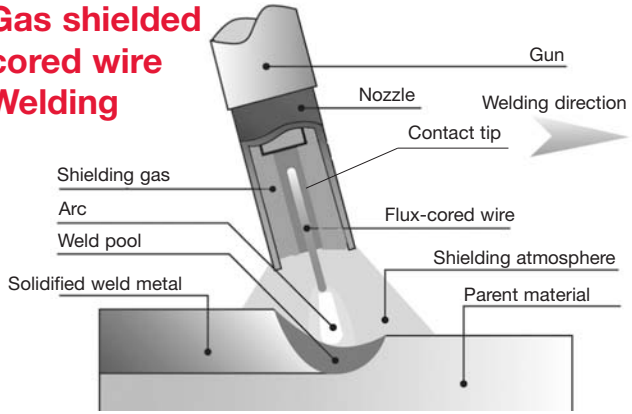
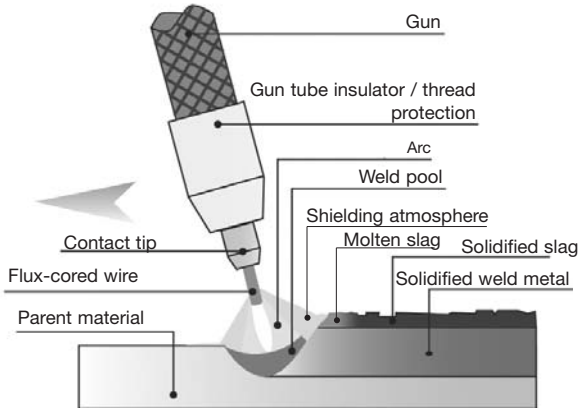
Gas shielded cored wire Welding



The Flux Cored Arc Welding process is when an electric arc is created between a continuous (flux or metal) cored wire and the work piece to be welded, protected within a gas atmosphere. This atmosphere can be either inert (Argon) or active (CO_2 or a mixture of Argon and CO_2). The wire is continuously fed through a gun to the weld pool by a wire feeder. For metal cored wires, both the dragging and the pushing weld technique can be used, for flux cored wires the dragging technique is recommended.

Self shielded Flux-Cored welding



Innershield welding is an Arc welding process in which welding heat is created from an arc between a continuous flux cored wire and the work piece. The flux provides gas shielding for the arc and a slag covering of the weld deposit.

Mild steel rutile cored wire

Classification

AWS A5.20/A5.20M : E70T-9C-H8 / E70T-9M-H8
EN 758 : T 46 0 R C 3 H10 / T 46 0 R M 3 H10

General description

Gas shielded flux cored wire for semi-automatic or mechanized downhand welds
Low spatter, good slag removal, smooth appearance, excellent operator appeal
High deposition rate and deep penetration, good resistance to scale and rust
Reliable weld metal properties
Low hydrogen content (H_{DM} < 8 ml/100g)
Excellent wire feeding
Superior product consistency with optimal alloy control

Welding positions

ISO/ASME PA/1G PB/2F PC/2G

Current type/Shielding gas

DC +
100% CO_2 (ISO 14175: C1)
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H_{DM} ml/100g
C1	0.06	1.30	0.50	0.015	0.010	< 8
M21	0.06	1.70	0.35	0.015	0.010	< 8

FCAW

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) 0°C	-29°C	-30°C
Required: AWS A5.20			min. 400	min. 480	min. 22		min. 27	
EN 758			min. 460	530-680	min. 20	min.47		
Typical values	C1	AW	480	560	26	80		40
	M21	AW	530	610	27	70		40

Packaging and available sizes

Unit type	Diameter (mm) 1.6	2.4
15 kg spool B300	X	
25kg wire reel B435		X

Outershield® 70: rev. EN 22

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.6	20	320	170	23-25	2.1	1.15
		510	235	25-27	3.4	1.15
		635	275	25-28	4.2	1.15
		760	310	27-29	5.0	1.15
		955	365	29-31	6.4	1.15
2.4	28	320	340	24-27	4.5	1.15
		510	450	28-31	7.3	1.15
		635	510	30-32	9.1	1.15
		700	535	31-34	10.0	1.15
		825	585	33-35	11.8	1.15

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G
1.6	290-380A	210-375A	290-340A
	25-34V	25-32V	25-32V
2.4	410-560A	410-510A	
	27-34V	28-32V	

Outershield® 70-H

Mild steel rutile cored wire

Classification

AWS A5.20/A5.20M : E70T-1-H4 / E70T-1M-H4
EN 758 : T 46 0 R C 3 H5 / T 46 0 R M 3 H5

General description

Gas shielded flux cored wire for semi-automatic or mechanized downhand welds
Low spatter, good slag removal, smooth appearance, excellent operator appeal
High deposition rate and deep penetration, good resistance to scale and rust
Reliable weld metal properties
Very low hydrogen (H_{DM} < 5 ml/100g)
Excellent wire feeding
Superior product consistency with optimal alloy control
New formulation results in 50% less fume emission!

Welding positions

ISO/ASME PA/1G PB/2F PC/2G

Current type/Shielding gas

DC +
100% CO_2 (ISO 14175: C1)
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Approvals

Shielding gas	DB
M21	+
C1	+

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H_{DM} ml/100g
C1	0.06	1.30	0.50	0.015	0.010	< 5
M21	0.06	1.70	0.35	0.015	0.010	< 5

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) 0°C	-18°C	-30°C
Required: AWS A5.20			min. 400	min. 480	min. 22		min. 27	
EN 758			min. 460	530-680	min. 20	min. 47		
Typical values	C1	AW	480	560	26	80		50
	M21	AW	530	610	27	70		40

Packaging and available sizes

Unit type	Diameter (mm) 2.4
25kg wire reel B435	X
270kg wooden reel	X

FCAW

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM 131	Grade A, B, D, AH32 to DH36
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
2.4	28	320	340	24-27	4.5	1.15
		510	450	28-31	7.3	1.15
		635	510	30-32	9.1	1.15
		700	535	31-34	10.0	1.15
		825	585	33-35	11.8	1.15

Welding parameters, optimum fill passes in shielding gas 100% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F
2.4	410-560A 27-34V	410-510A 28-32V

Outershield® 70E-H

Mild steel rutile cored wire

Classification

AWS A5.20/A5.20M : E70T-1-JH4 / E70T-1M-JH4
EN 758 : T 46 3 R C 1 H5 / T 46 3 R M 1 H5

General description

Gas shielded flux cored wire for high quality welding in downhand position
Excellent operator appeal due to superior welding characteristics
Capability with high deposition rate
Exceptional mechanical properties (CVN > 47J at -30°C)
Very low hydrogen (H_{DM} < 5 ml/100g)
Superior product consistency with optimal alloy control
Excellent wire feeding
Very suitable for welding of root runs on ceramic backing and welding on primed plate

Welding positions

ISO/ASME PA/1G PB/2F

Current type/Shielding gas

DC +
100% CO_2 (ISO 14175: C1)
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H_{DM} ml/100g
C1/M21	0.04	1.45	0.6	0.015	0.010	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -30°C	Impact ISO-V(J) -40°C
Required: AWS A5.20			min. 400	min. 480	min. 22		min. 27
EN 758			min. 460	530-680	min. 20	min. 47	
Typical values	C1/M21	AW	570	620	25	55	40

Packaging and available sizes

Unit type	Diameter (mm) 1.6
15 kg spool B300	X
200kg Accutrak® drum	X

Outershield® 70E-H: rev. EN 22

Outershield® 70E-H

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH36
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-25	3.1	1.20
		635	275	24-26	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.5	1.20
		1015	385	28-30	6.3	1.20
		1080	400	29-31	6.7	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PG/3G down	PE/4G
1.6	250-350A 24-32V	250-350A 24-32V	230-280A 24-30V	220-260A 22-28V	170-240A 22-28V	170-240A 22-28V

Outershield® 71E

Mild steel rutile cored wire

Classification

AWS A5.20/A5.20M : E71T-1M-JH8
EN 758 : T 46 3 P M 1 H10

General description

All position gas shielded flux cored wire for high quality welding
Excellent operator appeal due to superior welding characteristics
Full out-of-position capability with higher deposition rates
Exceptional mechanical properties (CVN > 47J at -30°C)
Superior product consistency with optimal alloy control
Excellent wire feeding

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PG/3Gdown PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H_{DM} ml/100g
M21	0.05	1.25	0.7	0.015	0.015	< 8

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) -30°C	Impact ISO-V(J) -40°C
Required: AWS A5.20			min. 400	min. 480	min. 22		min. 27
EN 758			min. 460	530-680	min. 20	min. 47	
Typical values	M21	AW	600	650	24	100	75

Packaging and available sizes

Unit type	Diameter (mm) 1.6
15 kg spool B300	X

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH36
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-25	3.1	1.20
		635	275	24-26	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.5	1.20
		1015	385	28-30	6.3	1.20
		1080	400	29-31	6.7	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PG/3G down	PE/4G
1.6	250-350A 24-32V	250-350A 24-32V	230-280A 24-30V	220-260A 22-28V	170-240A 22-28V	170-240A 22-28V

Outershield® 71E-H

Mild steel rutile cored wire

Classification

AWS A5.20 : E71T-1CJ-H4 / E71T-1MJ-H4
EN 758 : T 46 2 P C 1 H5 / T 46 3 P M 1 H5

General description

All position gas shielded flux cored wire for high quality welding
Excellent operator appeal due to superior welding characteristics
Full out-of-position capability with higher deposition rates
Exceptional mechanical properties (CVN > 47J at -30°C)
Very low hydrogen (H_{DM} < 5 ml/100g)
Superior product consistency with optimal alloy control
Excellent wire feeding
Very suitable for welding of root runs on ceramic backing
By preference use OS 71 M-H for 100 % CO_2 shielding gas

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PG/3Gdown PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Approvals

Shielding gas	ABS	BV	DB	DNV	FORCE	GL	LR	RINA	RMRS	TÜV
M21	3YSA,H5	SA3YMHH	+	IIIYMSH5	+	3YH5S	3S,3YSH15	3YS	3S,3YSH5	+
C1	3YSA,H5	SA3YMHH	+	IIIYMSH5		3HH5S	pending	2YS		

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H_{DM} ml/100g
M21	0.04	1.4	0.6	0.013	0.010	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -20°C	-30°C	-40°C
Required: AWS A5.20			min. 400	min. 480	min. 22			min. 27
EN 758			min. 460	530-680	min. 20		min. 47	
Typical values	M21	AW	570	620	25	90	65	40

Packaging and available sizes

Unit type	Diameter (mm) 1.2
5 kg plastic spool S200	X
15 kg spool B300	X
200kg Accutrak® drum	X

Outershield® 71E-H: rev. EN 22

Outershield® 71E-H

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH36
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	21-23	1.5	1.20
		700	180	22-24	2.3	1.20
		955	220	25-27	3.2	1.20
		1270	265	27-29	4.3	1.20
		1590	305	30-32	5.4	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PG/3G down	PE/4G
1.2	230-260A	230-260A	200-240A	200-240A	160-220A	160-220A
	26-32V	26-32V	25-30V	25-28V	23-26V	23-26V

Outershield® 71M-H

Mild steel rutile cored wire

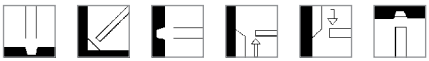
Classification

AWS A5.20/A5.20M : E71T-1CJ-H4
EN 758 : T 46 2 P C 1 H5

General description

Rutile gas shielded flux cored wire for high quality welding
Excellent operator appeal due to superior welding characteristics
Specially developed for welding with 100% CO_2; smooth arc with low spatter
Suitable for welding coated plate with use of 100% CO_2
Also suitable for welding on ceramic backing
Good mechanical properties (CVN > 47J at -20°C)
Very low hydrogen (H_{DM} < 5 ml/100g)
By preference use OS 71 E-H for Ar/CO_2 shielding gas

Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PG/3Gdown PE/4G

Current type/Shielding gas

DC +
100% CO_2 (ISO 14175: C1)
15-25 l/min

Approvals

Shielding gas	ABS	BV	CRS	DB	DNV	GL	LR	RINA	RMRS
C1	3Y,H5	SA3M,SA3YMHH	3YH5	+	III Y40H5	3Y46H5S	3S,3YSH10	3YSH5	3S,3YSH5

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H_{DM} ml/100g
C1	0.05	1.3	0.4	0.015	0.010	4

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -20°C	Impact ISO-V(J) -40°C
Required: AWS A5.20			min. 400	min. 480	min. 22		min. 27
EN 758			min. 460	530-680	min. 20	min. 47	
Typical values	C1	AW	580	620	24	80	40

Packaging and available sizes

Unit type	Diameter (mm) 1.2	1.6
5 kg plastic spool S200	X	
15 kg spool B300	X	X
15 kg spool S300		X
25kg wire reel B435		X
200kg Accutrak® drum	X	

Outershield® 71M-H: rev. EN 22

Outershield® 71M-H

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH36
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	19	445	130	21-23	1.7	1.20
		700	170	22-24	2.3	1.20
		955	220	25-27	3.3	1.20
		1270	260	27-29	4.5	1.20
		1590	290	30-32	5.6	1.20
1.6	19	320	180	21-23	2.2	1.20
		510	255	22-25	3.3	1.20
		635	300	24-26	4.2	1.20
		760	335	25-27	5.0	1.20
		890	370	27-29	5.8	1.20
		1015	395	28-30	6.5	1.20
		1080	415	29-31	7.0	1.20

Welding parameters, optimum fill passes in shielding gas 100% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PG/3G down	PE/4G	PF/3F up	PG/3Fdown
1.2	230-280A	230-280A	200-240A	200-240A	160-220A	160-220A	170-220A	170-220A
	26-32V	26-32V	25-30V	25-28V	23-26V	23-26V	26-28V	26-28V
1.6	250-380A	250-380A	230-280A	220-260A	170-240A	170-240A		
	24-32V	24-32V	24-30V	22-28V	22-28V	22-28V		

Outershield® 71C

Mild steel rutile cored wire

Classification

AWS A5.20/A5.20M : E71T-1-H8/E71T-9-H8
EN 758 : T 46 3 P C 1 H10

General description

Rutile gas shielded flux cored wire developed for CO_2 shielding gas
Good mechanical properties (CVN > 47J at -30°C)
Smooth arc action and metal transfer; easy slag removal
Suitable for welding with ceramic backing
Applications include general fabrication, shipbuilding, building or bridge erection

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PG/3Gdown PE/4G PF/5Gup

Current type/Shielding gas

DC +
100% CO_2 (ISO 14175: C1)
15-25 l/min

Approvals

Shielding gas	ABS	BV	CRS	DNV	GL	LR	PRS	RINA	RMRS	CE
C1	3YSAH10	3YSH10	3YH10S	IIIYS(H10)	3YH10S	3YSH10	3YSH10	3YSH10	+	+

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H_{DM} ml/100g
C1	0.05	1.4	0.4	0.015	0.010	6

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -18°C	-29°C	-30°C
Required: AWS A5.20			min. 400	min. 480	min. 22	min. 27 [1]	min. 27 [2]	
EN 758			min. 460	530-680	min. 20			min. 47
Typical values	C1	AW	601	650	24			80

[1]: E71T-1 requirement
[2]: E71T-9 requirement

Packaging and available sizes

Unit type	Diameter (mm) 1.2	1.4	1.6
5 kg plastic spool S200	X		
15 kg spool S300		X	X
15 kg spool B300	X	X	X
15 kg spool BS300	X		

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH36
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	125	21-23	1.5	1.21
		572	150	23-25	1.9	1.21
		699	170	24-26	2.4	1.21
		826	185	25-28	2.9	1.21
		953	210	26-28	3.3	1.21
		1080	230	27-29	3.7	1.21
		1207	245	28-30	4.2	1.21
		1524	285	30-32	5.3	1.21

Welding parameters, optimum fill passes in shielding gas 100% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PF/3F up	PE/4G
1.2	230-280A 26-32V	230-280A 26-32V	200-240A 25-30V	200-240A 25-28V	170-220A 26-28V	160-220A 23-26V

Outershield® T55-H

Mild steel basic cored wire

Classification

AWS A5.20/A5.20M : E71T-5C-JH4 / E71T-5M-JH4
EN 758 : T 42 4 B C 2 H5 / T 42 4 B M 2 H5

General description

All position gas shielded basic flux cored wire
Good weldability, also vertical up (3G)
Exceptional mechanical properties (CVN >47J at -50°C)
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Excellent wire feeding

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC -
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
CO_2 (ISO 14175: C1)
15-25 l/min

Approvals

Shielding gas	ABS	BV	DB	DNV	FORCE	GL	LR	RINA
M21	3SA,3YSA	SA3,3YMHH	+	IVYMSH5	+	4YH10S	4Y40SH15	
C1	3SA,3YSA	SA3,3YMHH	+	IVYMSH5		4YH10S	4Y40SH15	3YS

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H_{DM} ml/100g
C1	0.05	1.5	0.55	0.012	0.010	3
M21	0.06	1.5	0.6	0.012	0.010	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) -20°C	-40°C	-50°C
Required: AWS A5.20			min. 400	min. 480	min. 22		min. 27	
EN 758			min. 420	500-640	min. 20		min. 47	
Typical values	M21/C1	AW	480	570	27	130	85	60

Packaging and available sizes

Unit type	Diameter (mm) 1.0	1.2	1.6	2.4
4.5kg plastic spool S200	X	X		
15 kg spool B300		X	X	
25kg wire reel B435			X	X

Outershield® T55-H

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	510	130	25-27	1.6	1.20
		760	185	26-28	2.5	1.20
		1015	225	27-29	3.3	1.20
		1270	260	28-30	4.1	1.20
		1525	290	29-31	5.0	1.20
		1780	310	30-32	5.8	1.20
1.6	20	380	170	24-26	2.5	1.15
		510	225	25-27	3.1	1.15
		760	310	27-29	4.7	1.15
		1015	380	29-31	6.3	1.15
		1270	430	31-33	7.9	1.15

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up
1.2	215-290A	215-290A	215-250A	110-150A
	28-34V	28-34V	28-30V	17-20V
1.6	320-390A	320-390A	280-350A	130-180A
	28-34V	28-34V	28-32V	18-22V
2.4	350-550A	350-550A		
	30-34V	30-34V		

Outershield® MC700

Mild steel metal cored wire

Classification

AWS A5.18/A5.18M : E70C-6M H8
EN 758 : T 46 2 M M 2 H10

General description

All position high efficiency gas shielded metal cored wire
Excellent arc characteristics give outstanding operator appeal
Very few silicates, virtually no spatter, fast travel speed, excellent wire feeding- "robotic" quality
Superior product consistency with optimal alloy control

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25)% CO_2 (ISO 14175: M21)
15-25 l/min

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H_{DM} ml/100g
M21	0.05	1.35	0.6	0.015	0.023	6

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) -20°C	Impact ISO-V(J) -30°C
Required: AWS A5.18			min. 400	min. 480	min. 22		min. 27
EN 758			min. 460	530-680	min. 20	min. 47	
Typical values	M21	AW	475	560	24	75	45

Packaging and available sizes

Unit type	Diameter (mm) 1.2
15 kg spool B300	X

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH36
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

Calculation data

Diameter (mm)	Arc mode	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	short-arc	15	230	100	15	1.1	1.10
			320	120	16	1.4	1.10
			400	150	17	1.9	1.10
1.2	spray-arc	20	635	180	28-30	2.7	1.10
			940	275	31-34	4.8	1.10
			1420	340	35-38	6.8	1.10

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-380A	230-380A	230-300A	130-170A	140-175A
	26-36V	26-36V	26-30V	15-17V	16-17V

Outershield® MC710-H

Mild steel metal cored wire

Classification

AWS A5.18/A5.18M : E70C-6M H4
EN 758 : T 46 3 M M 2 H5 [1] / T 46 2 M M 2 H5 2)
[1] ø1.2 and 1.6 mm
2) ø2.0 and 2.4 mm

General description

All position high efficiency gas shielded metal cored wire
Excellent arc characteristics give outstanding operator appeal
Very few silicates, virtually no spatter, fast travel speed, excellent wire feeding- "robotic" quality
Superior on scaly plate, good resistance to porosity
Very good mechanical properties (CVN >47J at -30°C)
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Approvals

Shielding gas	ABS	BV	DB	DNV	FORCE	GL	LR	RINA	RMRS
M21	3SA,3YSA,H	SA3,3YMH	+	IIIYMSH5	+	3YH10S	3S,3YSH15	3YS	3S,3YSH5

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H_{DM} ml/100g
M21	0.05	1.35	0.6	0.015	0.023	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -20°C	-29°C	-30°C
Required: AWS A5.18			min. 400	min. 480	min. 22		min. 27	
EN 758 (1.2/1.6)			min. 460	530-680	min. 20			min. 47
Typical values	M21	AW	495	570	26	90		60

Packaging and available sizes

Unit type	Diameter (mm) 1.2	1.4	1.6	2.0	2.4
4.5kg plastic spool S200	X				
15 kg spool B300	X	X	X		
25kg wire reel B435		X	X	X	X
200kg Accutrak® drum	X	X	X		
270kg metal coil	X		X	X	X

Outershield® MC710-H

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH36
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

Calculation data

Diameter (mm)	Arc mode	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	short-arc	15	230	100	15	1.1	1.10
			320	120	16	1.4	1.10
			400	150	17	1.9	1.10
1.2	spray-arc	20	635	180	28-30	2.7	1.10
			940	275	31-34	4.8	1.10
			1420	340	35-38	6.8	1.10
1.4	spray-arc	25	445	170	27-29	2.5	1.10
			890	270	29-32	5.0	1.10
			1400	355	32-34	8.1	1.10
1.6	spray-arc	25	635	325	29-32	5.0	1.10
			890	400	34-37	7.0	1.10
			1145	460	36-38	9.1	1.10
2.0	spray-arc	28	320	290	25-27	3.7	1.05
			510	385	28-31	6.1	1.05
			760	510	32-35	9.3	1.05
2.4	spray-arc	30		400	28-32		
				475	28-32		
				550	30-34		

Welding parameters, optimum fill passes in shielding gas Ar + (>5 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-380A	230-380A	230-300A	130-170A	140-175A
	26-36V	26-36V	26-30V	15-17V	16-17V
1.4	240-385A	240-385A	240-340A	160-180A	175-185A
	26-36V	26-36V	26-31V	14-15V	15-16V
1.6	280-460A	280-460A	270-300A		
	28-36V	28-36V	28-30V		
2.0	300-510A	300-510A			
	28-33V	28-33V			
2.4	400-550A	400-550A			
	32-36V	32-36V			

Outershield® MC710C-H

Mild steel metal cored wire

Classification

AWS A5.18/A5.18M : E70C-6C H4
EN 758 : T 46 3 M C 2 H5

General description

All position high efficiency CO_2 shielded metal cored wire
Excellent arc characteristics give outstanding operator appeal
Few silicates and virtually no spatter, fast travel speed, excellent wire feeding
Superior on primed or scaly plate, high resistance to porosity on primed plate
Very good mechanical properties (CVN >47J at -30°C)
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
100% CO_2 (ISO 14175: C1)
15-25 l/min

Approvals

Shielding gas	ABS	BV	DNV	GL	LRS	RINA	TÜV
C1	3YSA-H5	3YH5	III YMS	3YH5	3YH5	3YSH5	+

FCAW

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H_{DM} ml/100g
C1	0.05	1.35	0.6	0.015	0.023	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) -20°C	-29°C	-30°C
Required: AWS A5.18			min. 400	min. 480	min. 22		min. 27	
EN 758			min. 460	530-680	min. 20			min. 47
Typical values	C1	AW	490	585	27	90		70

Packaging and available sizes

Unit type	Diameter (mm) 1.2
4.5kg plastic spool S200	X
15 kg spool B300	X

Outershield MC710C-H: rev. EN 21

LINCOLN ELECTRIC

Outershield MC710C-H

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH36
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60

Calculation data

Diameter (mm)	Arc mode	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	short-arc	15	230	100	16	1.1	1.10
			320	120	16.5	1.4	1.10
			400	150	17	1.9	1.10
1.2	spray-arc	20	635	180	28-30	2.7	1.10
			940	275	31-34	4.8	1.10
			1420	340	35-38	6.8	1.10

Welding parameters, optimum fill passes in shielding gas 100% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-380A 26-36V	230-380A 26-36V	230-300A 26-30V	100-170A 16-17V	140-175A 16-17V

Outershield® MC715-H

Mild steel metal cored wire

Classification

AWS A5.18/A5.18M : E70C-6M H4
EN 758 : T 46 4 M M 2 H5

General description

Metal cored gas shielded wire for all positions
Few silicates and virtually no spatter, fast travel speed, excellent wire feeding
Excellent arc characteristics give outstanding operator appeal
Excellent mechanical properties (CNV >47J at -40°C)
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Depending on application good alternative for basic flux cored wires

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Approvals

Shielding gas	ABS	BV	DB	DNV	GL	LR	RINA
M21	4Y40SA,HH	SA3,3YMHH	+	IV Y40H5	4Y40H5S	4Y40SH5	4YSH5

FCAW

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H_{DM} ml/100g
M21	0.04	1.5	0.4	0.012	0.020	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -29°C	-30°C	-40°C	-50°C
Required: AWS A5.18			min. 400	min. 480	min. 22	min. 27			
EN 758			min. 460	530-680	min. 20			min. 47	
Typical values	M21	AW	480	540	27		120	110	80

Packaging and available sizes

Unit type	Diameter (mm) 1.2	1.4	1.6
4.5kg plastic spool S200	X		
15 kg spool B300	X	X	X
25kg wire reel B435			X
200kg Accutrak® drum	X	X	X

Outershield® MC715-H: rev. EN 22

Outershield® MC715-H

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

Calculation data

Diameter (mm)	Arc mode	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	short-arc	15	230	100	15	1.1	1.10
			320	120	16	1.4	1.10
			400	150	17	1.9	1.10
1.2	spray-arc	20	635	180	28-30	2.7	1.10
			940	275	31-34	4.8	1.10
			1420	340	35-38	6.8	1.10
1.4	short-arc	15	205	105	14.5	1.2	1.10
			255	125	15.0	1.5	1.10
			280	135	15.5	1.6	1.10
1.4	spray-arc	25	445	170	27-29	2.5	1.10
			890	270	29-32	5.0	1.10
			1400	355	32-34	8.1	1.10
1.6	short-arc	18	180	145	15	1.5	1.10
			205	160	16	1.7	1.10
			230	170	18	1.9	1.10
1.6	spray-arc	25	380	235	25-26	2.9	1.10
			635	325	29-32	5.0	1.10
			890	400	34-37	7.0	1.10
			1145	460	36-38	9.1	1.10

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-380A	230-380A	230-300A	130-170A	140-175A
	26-36V	26-36V	26-30V	15-17V	16-17V
1.4	240-385A	240-385A	240-340A	160-180A	175-185A
	26-36V	26-36V	26-31V	14-15V	15-16V
1.6	280-460A	280-460A	270-300A		
	28-36V	28-36V	28-30V		

Outershield® MC460VD-H

◀ Back

Mild steel metal cored wire

Classification

AWS A5.18/A5.18M : E70C-6M H4
EN 758 : T 46 2 M M 1 H5

General description

Metal cored wire for welding with high efficiency
Especially for vertical down welding in thin plate
Excellent arc characteristics give outstanding operator appeal
No slag, only some silicate islands, very good wire feeding
High resistance to porosity on primed plate
Superior product consistency with optimal alloy control
Very low hydrogen (H_{DM} <5 ml/100g)

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PG/3Gdown PE/4G

Current type/Shielding gas

DC- for all welding positions
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Approvals

Shielding gas	ABS	BV	DNV	GL	LR
M21	3YSA,H5	SA3YMHHH	IIIYMSH5	3YH5S	3S,3YSH5

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H_{DM} ml/100g
M21	0.05	1.25	0.6	0.015	0.015	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) -20°C	Impact ISO-V(J) -29°C
Required: AWS A5.18			min. 400	min. 480	min. 22		min. 27
EN 758			min. 460	530-680	min. 20	min. 47	
Typical values	M21	AW	510	600	25	90	60

Packaging and available sizes

Unit type	Diameter (mm) 1.2
4.5kg plastic spool S200	X
15 kg spool B300	X

Outershield® MC460VD-H: rev. EN 22

FCAW

Outershield® MC460VD-H

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	635	180	28-30	2.7	1.10
		940	275	31-34	4.8	1.10
		1420	340	35-38	6.8	1.10

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PB/2F	PG/3F down	PG/3G down	PE/4F
1.2	250 - 300A 26-30V	250 - 300A 26-30V	200-220A 21-24V	200-220A 23-25V

Outershield® MC420N-H

Metal cored wire for applications that need to be normalized

Classification

A5.28/A5.28M : E70C-GM H4
EN 758 : T 38 Z Z M M 2 H5

Note: the above mentioned classifications are an indication of the weld metal properties in the as welded condition. However, the Outershield MC420N-H is designed to be used only in the normalized condition. As neither AWS nor EN has included weld metal properties in the normalized condition, the wire cannot be classified for the condition it is designed for.

General description

All position high efficiency mix gas shielded metal cored wire
Excellent arc characteristics, few silicates and virtually no spatter, excellent wire feeding
High resistance to porosity
Designed to withstand normalizing treatment (4h 900°C)
Mechanical properties after normalizing meet base material requirements
Very low hydrogen (H_{DM} <5 ml/100g)
Only to be used in normalized condition!

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	H_{DM} ml/100g
M21	0.03	0.6	0.3	0.017	0.023	2.9	<5

FCAW

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -50°C
Typical values N = 900°C/4h	M21	N	353	493	32	57

Packaging and available sizes

Unit type	Diameter (mm) 1.2	1.6
15 kg spool B300	X	X
200kg Accutrak® drum		X

Outershield MC420N-H: rev. EN 23

LINCOLN ELECTRIC

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH36
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
EN 10028-3	P275N, P355N
Fine grained steel	
EN 10113-2	S275N, S275NL, S355N, S355NL

The wire is only applicable for materials that will be normalized after welding
In principle only applicable for materials that will be normalized after welding

Calculation data

Diameter (mm)	Arc mode	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	spray-arc	20	445	130	20-22	1.6	1.20
			700	180	23-25	2.5	1.20
			950	220	25-27	3.4	1.20
			1270	265	27-29	4.5	1.20
			1590	305	30-32	5.9	1.20

FCAW

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-380A	230-380A	230-300A	130-170A	140-175A
	26-36V	26-36V	26-30V	15-17V	16-17V

Outershield® 81Ni1-H

Low temperature rutile cored wire

Classification

AWS A5.29/A5.29M : E81T1-Ni1M-JH4 [1)]
EN 758 : T 50 5 1Ni P M 2 H5 2)
[1)] all diameters
2) only diameter 1.2 mm

General description

All position gas shielded 1% Ni flux cored wire, offshore and similar applications
Superior weldability, low spatter, good bead appearance
Outstanding operator appeal
Exceptional mechanical properties (CVN >47J at -50°C)
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Excellent wire feeding

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Approvals

Shielding gas	BV	DNV	FORCE	GL	LR	RINA
M21	SA3,3YMHH	IVYMSH5	+	4YH10S	4Y40SH5	4YSH5

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	H_{DM} ml/100g
M21	0.05	1.4	0.2	0.013	0.010	0.95	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -40°C	Impact ISO-V(J) -50°C
Required: AWS A5.29			min. 470	550-690	min. 19	min. 27	
EN 758			min. 500	560-720	min. 18		min. 47
Typical values	M21	AW	530	600	24	90	60

Packaging and available sizes

Unit type	Diameter (mm) 1.2	1.4	1.6	2.0
4.5kg plastic spool S200	X			
15 kg spool B300	X	X	X	
15 kg spool BS300			X	X
25kg wire reel B435			X	

Outershield® 81Ni1-H: rev. EN 23

FCAW

Outershield® 81Ni1-H

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275, S355, S420, S460

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-24	3.1	1.20
		635	275	24-25	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.6	1.20
		1015	385	28-30	6.4	1.20
		1080	400	30-31	6.8	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-280A	230-280A	200-240A	200-240A	160-220A
	26-32V	26-32V	25-32V	25-28V	23-28V
1.6	250-350A	250-350A	230-280A	220-260A	170-240A
	24-32V	24-32V	24-32V	24-28V	22-28V

Outershield® 81Ni1-HSR

Low temperature rutile cored wire

Classification

AWS A5.29/A5.29M : E81T1-Ni1M-JH4
EN 758 : T 50 5 1Ni P M 2 H5 T

General description

All position gas shielded 1% Ni flux cored wire, offshore and similar applications
Specific design for stress relieved applications, guaranteed impact properties after PWHT
Superior weldability, low spatter, good bead appearance
Outstanding operator appeal
Exceptional mechanical properties (CVN >47J at -50°C)
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Excellent wire feeding

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Approvals

Shielding gas	BV	DNV	GL	LR
M21	4YSDH5	IVYMSH5	4YH5S	4YSH5

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	H_{DM} ml/100g
M21	0.06	1.4	0.3	0.013	0.010	0.95	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -40°C	Impact ISO-V(J) -50°C
Required: AWS A5.29			min. 470	550-690	min. 19	min. 27	
EN 758			min. 500	560-720	min. 18		min. 47
Typical values	M21	AW	570	620	24	120	100
	M21	SR	550	600	24	120	100

SR 1h/600°C, 3G up - V45°

Packaging and available sizes

Unit type	Diameter (mm) 1.2
4.5kg plastic spool S200	X
15 kg spool B300	X

Outershield® 81Ni1-HSR

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, C, D, AH32 to DH36
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60, X65
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275, S355, S420, S460

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-24	3.1	1.20
		635	275	24-25	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.6	1.20
		1015	385	28-30	6.4	1.20
		1080	400	30-31	6.8	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-280A	230-280A	200-240A	200-240A	160-220A
	26-32V	26-32V	25-32V	25-28V	23-28V
1.6	250-350A	250-350A	230-280A	220-260A	170-240A
	24-32V	24-32V	24-32V	24-28V	22-28V

Outershield® 81K2-H

Low temperature rutile cored wire

Classification

AWS A5.29/A5.29M : E81T1-K2M-JH4 [1)]
EN 758 : T 50 6 1.5Ni P M 2 H5 2)
[1)] all diameters
2) only diameter 1.2 mm

General description

All position gas shielded 1.5% Ni, Ti and B alloyed flux cored wire
Used in off-shore and similar applications
Superior weldability, low spatter, good bead appearance
Outstanding operator appeal
Exceptional mechanical properties (CVN >80J at -60°C)
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Excellent wire feeding

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Approvals

Shielding gas	DNV	LR	RINA	RMRS
M21	IVY46MSH5	4Y40SH5	4YS	4Y50SH5

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	H_{DM} ml/100g
M21	0.04	1.4	0.2	0.012	0.010	1.4	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -40°C	-50°C	-60°C
Required: A5.29			min. 470	550-690	min.19	min. 27		
EN 758			min. 500	560-720	min.18			min. 47
Typical values	M21	AW	590	630	23	130	100	80

Packaging and available sizes

Unit type	Diameter (mm) 1.2	1.6	2.0
4.5kg plastic spool S200	X		
14 kg spool S300	X		
15 kg spool B300	X		
25kg wire reel B435		X	X
200kg Accutrak® drum	X		

Outershield® 81K2-H: rev. EN 21

FCAW

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60, X65
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275, S355, S420, S460

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-24	3.1	1.20
		635	275	24-25	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.6	1.20
		1015	385	28-30	6.4	1.20
		1080	400	30-31	6.8	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-280A	230-280A	200-240A	200-240A	160-220A
	26-32V	26-32V	25-32V	25-28V	23-30V
1.6	250-350A	250-350A	230-280A	220-260A	170-240A
	24-32V	24-32V	24-32V	24-28V	22-28V

Outershield® 81K2-HSR

Low temperature rutile cored wire

Classification

AWS A5.29 : E81T1-K2M-JH4
EN 758 : T 50 6 1.5Ni P M 2 H5 T

General description

All position gas shielded 1.5% Ni alloyed flux cored wire for offshore and similar applications
Specific design for stress relieved applications, guaranteed impact properties after PWHT
Superior weldability, low spatter, good bead appearance and outstanding operators appeal
Exceptional mechanical properties (CVN >80J at -60°C)
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Excellent wire feeding

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	H_{DM} ml/100g
M21	0.06	1.3	0.3	0.012	0.010	1.4	3

FCAW

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) -40°C	-50°C	-60°C
Required: A5.29			min. 470	550-690	min.19	min. 27		
EN 758			min. 500	560-720	min.18			min. 47
Typical values	M21	AW	590	630	23	140	100	80
	M21	SR	570	620	24			85

SR 1h/600°C, 3G up - V45°

Packaging and available sizes

Unit type	Diameter (mm) 1.2
15 kg spool B300	X

Outershield® 81K2-HSR

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60, X65
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275, S355, S420, S460

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-280A 26-32V	230-280A 26-32V	200-240A 25-32V	200-240A 25-28V	160-220A 23-28V

Outershield® 500CT-H

Weather resistant rutile cored wire

Classification

AWS A5.29/A5.29M : E81T1-GM-H4
EN 758 : T 50 5 Z P M 2 H5

General description

All position gas shielded 0.8% Ni and 0.4% Cu flux cored wire, for welding weather resistant steel (CorTen)
For welding in all positions
Superior weldability, low spatter, good bead appearance
Outstanding operator appeal
Exceptional mechanical properties (CVN >47J at -50°C)
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Excellent wire feeding

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

FCAW

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	Cu	H_{DM} ml/100g
M21	0.04	1.3	0.2	0.014	0.010	0.84	0.39	<5

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) -50°C
Required: AWS A5.29			min. 470	550-690	min. 19	not required
EN 758			min. 500	560-720	min. 18	min. 47
Typical values	M21	AW	580	610	23	80

Packaging and available sizes

Unit type	Diameter (mm) 1.2
4.5kg plastic spool S200	X
15 kg spool B300	X

Materials to be welded

Steel grades/Code	Type
Weather resisting steels	
EN 10155	S235 J0W
	S235 J2W
	S355 J0W
	S355 J2W
	S355 K2G1W

Weather resistant steels like Cor-Ten®, Patinax®-F, Patinax®-37 and similar Ni- and Cu-alloyed steels

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20

FCAW

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-280A	230-280A	200-240A	200-240A	160-220A
	26-32V	26-32V	25-32V	25-28V	23-28V

Outershield® 91Ni1-HSR

Low temperature rutile cored wire

Classification

AWS A5.29 : E91T1-GM-H4
ISO 18276-A : T 55 4 1NiMo P M 2 H5

General description

All position gas shielded 1% Ni and 0.4%Mo alloyed flux cored wire for offshore, pipeline and similar applications
Superior weldability, low spatter, good bead appearance and outstanding operators appeal
Exceptional mechanical properties
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Excellent wire feeding
Specific design to withstand high heat input procedures

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PF/5Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	Mo	H_{DM} ml/100g
M21	0.06	1.4	0.3	0.013	0.010	0.95	0.4	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -20°C	-40°C	-50°C
Required: AWS A5.29			min. 540	620-760	min. 17	min. 27		
ISO 18276-A			min. 550	640-820	min. 18		min. 47	
Typical values	M21	AW	695	740	21			65

Packaging and available sizes

Unit type	Diameter (mm) 1.2
4.5kg plastic spool S200	X
15 kg spool B300	X

FCAW

Outershield® 91Ni1-HSR

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, C, D, AH32 to DH36
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60, X65, X70, X80
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH, P420GH, P460GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275, S355, S420, S460, S500

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-280A 26-32V	230-280A 26-32V	200-240A 25-32V	200-240A 25-28V	160-220A 23-28V

Outershield® 91K2-HSR

Low temperature rutile cored wire

Classification

AWS A5.29 : E91T1-GM-H4
ISO 18276-A : T 55 4 1,5NiMo P M 2 H5

General description

All position gas shielded 1.5% Ni and 0.4%Mo alloyed flux cored wire for offshore, pipeline and similar applications
Superior weldability, low spatter, good bead appearance and outstanding operators appeal
Exceptional mechanical properties
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Excellent wire feeding
Specific design to withstand high heat input procedures

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PF/5Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	Mo	H_{DM} ml/100g
M21	0.06	1.4	0.3	0.013	0.010	1.4	0.4	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -20°C	-40°C	-50°C
Required: AWS A5.29			min. 540	620-760	min. 17	min. 27		
ISO 18276-A			min. 550	640-820	min. 18		min. 47	
Typical values	M21	AW	695	740	21			75

Packaging and available sizes

Unit type	Diameter (mm) 1.2
4.5kg plastic spool S200	X
15 kg spool B300	X

Outershield® 91K2-HSR

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	
EN 10213-2	G P 240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
API 5LX	X42, X46, X52, X60, X65, X70, X80
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH, P420GH, P460GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275, S355, S420, S460, S500

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-280A 26-32V	230-280A 26-32V	200-240A 25-32V	200-240A 25-28V	160-220A 23-28V

Outershield® 550-H

High strength rutile cored wire

Classification

AWS A5.29/A5.29M : E101T1-K3M-JH4
ISO 18276-A : T 55 4 Z P M 1 H5

General description

All position gas shielded rutile flux cored wire, for high strength steel grades for welding pipes and plates
Outstanding operator appeal
Excellent mechanical properties (CVN >50J at -40°C)
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Good wire feeding

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PG/3Gdown PE/4G PF/5Gup PG/5Gdown

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	Mo	H_{DM} ml/100g
M21	0.04	1.4	0.2	0.012	0.010	2.0	0.3	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) -40°C
Required: AWS A5.29			min. 610	690-800	min.16	min. 27
ISO 18276-A			min. 550	640-820	min.18	min. 47
Typical values	M21	AW	700	730	19	60

Packaging and available sizes

Unit type	Diameter (mm) 1.2
4.5kg plastic spool S200	X
15 kg spool B300	X

Materials to be welded

Steel grades/Code	Type
Pipe material	
API 5LX	X52, X60, X60, X65, X70, X80
Fine grained steel	
EN 10137-2	S500 - S550

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-280A 26-32V	230-280A 26-32V	200-240A 25-32V	200-240A 25-28V	160-220A 23-30V

Outershield® 690-H

High strength rutile cored wire

Classification

AWS A5.29/A5.29M : E111T1-K3M-JH4
ISO 18276-A : T 69 4 Z P M 2 H5

General description

All position gas shielded rutile flux cored wire, for high strength steel grades like grade S690
Outstanding operator appeal
Excellent mechanical properties (CVN >50J at -40°C)
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Good wire feeding

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Approvals

Shielding gas	ABS
M21	AWS

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	Mo	H_{DM} ml/100g
M21	0.06	1.5	0.2	0.015	0.010	2.0	0.5	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -18°C	-29°C	-40°C	-46°C
Required: A5.29			min. 680	760-900	min.15		min. 27		
ISO 18276-A			min. 690	770-940	min.17			min. 47	
Typical values	M21	AW	800	830	17	80		60	50

Packaging and available sizes

Unit type	Diameter (mm) 1.2	1.6
4.5kg plastic spool S200	X	
14 kg spool S300	X	
15 kg spool B300	X	X
15 kg spool BS300	X	X

Materials to be welded

Steel grades/Code	Type
Fine grained steel	
EN 10137-2	S500-S690

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-24	3.1	1.20
		635	275	24-25	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.6	1.20
		1015	385	28-30	6.4	1.20
		1080	400	30-31	6.8	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-280A	230-280A	200-240A	200-240A	160-220A
	26-32V	26-32V	25-32V	25-28V	23-30V
1.6	250-350A	250-350A	230-280A	220-260A	170-240A
	24-29V	24-29V	24-28V	24-26V	22-26V

Outershield® 690-HSR

High strength rutile cored wire

Classification

AWS A5.29/A5.29M : E111T1-K3M-JH4
ISO 18276-A : T 69 4 Z P M 2 H5 T

General description

All position gas shielded rutile flux cored wire, for high strength steel grades like grade S690
Specific design for stress relieved applications
Outstanding operator appeal
Excellent mechanical properties (CVN >50J at -40°C)
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Good wire feeding

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	Mo	H_{DM} ml/100g
M21	0.06	1.5	0.2	0.015	0.010	2.0	0.5	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -29°C	-30°C	-40°C
Required: AWS A5.29			min. 680	760-900	min.15	min.27		
ISO 18276-A			min. 690	770-970	min.17			min.47
Typical values	M21	AW	740	790	19		75	70
	M21	SR	720	770	20		60	

SR: 1h/580°C, 3G up - V60°

Packaging and available sizes

Unit type	Diameter (mm) 1.2	1.6
4.5kg plastic spool S200	X	
15 kg spool B300	X	X

Materials to be welded

Steel grades/Code	Type
Fine grained steel	
EN 10137-2	S500-S690

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-24	3.1	1.20
		635	275	24-25	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.6	1.20
		1015	385	28-30	6.4	1.20
		1080	400	30-31	6.8	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-280A	230-280A	200-240A	200-240A	160-220A
	26-32V	26-32V	25-32V	25-28V	23-30V
1.6	250-350A	250-350A	230-280A	220-260A	170-240A
	24-29V	24-29V	24-28V	24-26V	22-26V

Outershield® 12-H

Creep resistant rutile cored wire

Classification

AWS A5.29/A5.29M : E 81T1-A1M-H4
EN 12071 : T MoL P M 2 H5

General description

All position mix gas shielded 0.5% Mo-alloyed rutile cored wire
Superior weldability, low spatter, good bead appearance
Outstanding operator appeal
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Excellent wire feeding

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Approvals

TÜV
+

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Mo	H_{DM} ml/100g
M21	0.065	0.8	0.2	0.014	0.010	0.46	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) +20°C	Impact ISO-V(J) -20°C
Required: AWS A5.29		SR[1)]	min. 470	550-690	min. 19	not required	
EN 12071		SR[2)]	min. 355	min. 510	min.22	47	
Typical values	M21	SR[3)]	540	600	26	160	79

Stress relieving: SR[1)] = 620 ± 15°C/1h, SR[2)] = 570-620°C/1h, SR[3)] = 1h/620°C

Packaging and available sizes

Unit type	Diameter (mm) 1.2
15 kg spool B300	X

Outershield 12-H: rev. EN 22

Materials to be welded

Steel grades/Code	Type
Creep resistant steels	
EN 10028-2	P295 G H, P355 G H, 16 Mo 3
EN 10222-2	17 Mo 3, 14 Mo 6
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275, S355, S420

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-280A 26-32V	230-280A 26-32V	200-240A 25-32V	200-240A 25-28V	160-220A 23-28V

Remarks/ Application advice

Recommended tempering heat treatment range: 570-630°C
Time depends on material thickness

Outershield® 19-H

Creep resistant rutile cored wire

Classification

AWS A5.29/A5.29M : E 81T1-B2M-H4
EN 12071 : T CrMo1 P M 2 H5

General description

All position mix gas shielded 1.25% Cr 0.5% Mo-alloyed rutile cored wire
Superior weldability, low spatter, good bead appearance
Outstanding operator appeal
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Excellent wire feeding

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Approvals

TÜV
+

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Cr	Mo	H_{DM} ml/100g
M21	0.06	0.74	0.24	0.013	0.010	1.24	0.52	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) +20°C	Impact ISO-V(J) -20°C
Required: AWS A5.29		SR[1)]	min. 470	550-690	min. 19	not required	
EN 12071		SR[2)]	min. 355	min. 510	min.20	47	
Typical values	M21	SR[3)]	545	636	22	163	76

Stress relieving: SR[1)] = 690 ± 15°C/1h, SR[2)] = 660-700°C/1h, SR[3)] = 1h/690°C

Packaging and available sizes

Unit type	Diameter (mm) 1.2
15 kg spool B300	X

FCAW

Materials to be welded

Steel grades/Code	Type
Creep resistant steels	
EN 10028-2	13 CrMo 4-5
EN 10083-1	25 CrMo 4
EN 10222-2	14 CrMo 4-5
Tool steel	
DIN 17210	16 MnCr 5

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-280A 26-32V	230-280A 26-32V	200-240A 25-32V	200-240A 25-28V	160-220A 23-28V

Remarks/ Application advice

Recommended preheat temperature: 200 - 250°C
Recommended tempering heat treatment range: 660-700°C
Time depends on material thickness

Outershield® 20-H

Creep resistant rutile cored wire

Classification

AWS A5.29/A5.29M : E 91T1-B3M-H4
EN 12071 : T CrMo2 P M 2 H5

General description

All position mix gas shielded 2.25% Cr 1% Mo-alloyed rutile cored wire
Superior weldability, low spatter, good bead appearance
Outstanding operator appeal
Very low hydrogen (H_{DM} <5 ml/100g)
Superior product consistency with optimal alloy control
Excellent wire feeding

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>15-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Approvals

TÜV
+

Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Cr	Mo	H_{DM} ml/100g
M21	0.06	0.75	0.21	0.013	0.008	2.23	1.09	3

Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) +20°C	Impact ISO-V(J) -20°C
Required: AWS A5.29		SR[1)]	min. 540	620-760	min. 17	not required	
EN 12071		SR[2)]	min. 400	min. 500	min. 18	47	
Typical values	M21	SR[3)]	568	679	20	161	61

Stress relieving: SR[1)] = 690 ± 15°C/1h, SR[2)] = 690-750°C/1h, SR[3)] = 1h/690°C

Packaging and available sizes

Unit type	Diameter (mm) 1.2
15 kg spool B300	X

Outershield 20-H: rev. EN 22

Materials to be welded

Steel grades/Code	Type
Creep and hydrogen resistant steels	
EN 10028-2	10 CrMo 9-10
EN 10222-2	12 CrMo 9-10

Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weldmetal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20

Welding parameters, optimum fill passes in shielding gas Ar + (>15 - 25)% CO_2

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	230-280A 26-32V	230-280A 26-32V	200-240A 25-32V	200-240A 25-28V	160-220A 23-28V

Remarks/ Application advice

Recommended preheat temperature: 200 - 250°C
Recommended tempering heat treatment range: 690-750°C
Time depends on material thickness

Innershield® NR®-152

Self-shielded cored wire

Classification

AWS A5.20/A5.20M : E71T-14

General description

Self shielded: easiest equipment arrangement
Welding galvanized steel
Single pass automatic and semi-automatic
Recommended for sheets from 1.2 to 5.0mm

Welding positions

ISO/ASME PA/1G PC/2G PG/3Gdown PG/5Gdown

Current type

DC -

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al	Ti	N
0.30	0.99	0.24	0.013	0.007	1.63	0.003	0.051

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation %	Impact ISO-V(J)
Required:	AWS A5.20		not required	480	not required	not required
Typical values		AW		525*		

* Flat tensile test specimen

Packaging and available sizes

Unit type	Diameter (mm) 1.6
22.68 kg coil 50C	X

Suggestions for use

Spot welds on 0.75mm to 1.5mm thick material
These procedures include automatic processes where excellent striking is required
Galvanized or zinc coated steel may be welded with Innershield NR-152 at travel speeds of 75 to 100 cm/min. The joint design must permit the zinc oxide vapor to diffuse through the molten puddle or to the atmosphere

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 t/m DH36
Cast steel	
EN 10213-2	GP240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240, L290, L360
API 5LX	X42, X46, X52
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355
EN 10113-3	S275, S355

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
1.6	13	75	90	13	0.55	1.11
		125	150	15	0.9	1.11
		280	250	19	2.0	1.11

Welding parameters, optimum fill passes

Diameter (mm)		Welding position PA/1G PB/2F	PC/2G	PG/3G (down)
1.6	Wire feed speed (cm/min.)	180	150	200
	Current (A)	205	170	220
	Voltage (V)	16.5	18.5	19.5

Innershield® NR®-203 NiC

Self-shielded cored wire

Classification

AWS A5.29/A5.29M : E61T8-K6

General description

Self shielded: easiest equipment arrangement
All position welding
Easy to weld in vertical up position
All passes
Good impact and CTOD toughness

Welding positions

ISO/ASME	PA/1G	PB/2F	PC/2G	PF/3Gup	PG/3Gdown	PF/5Gup	PG/5Gdown

Current type

DC -

Approvals

ABS	DNV	LR
3SA	IIIMSH15	3SH15

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Cr	Al	V	Mo
0.06	0.83	0.05	0.004	0.003	0.57	0.08	0.73	<0.1	<0.1

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation %	Impact ISO-V(J) -29°C
Required:	AWS A5.29		min. 340	410-550	22	27
Typical values		AW	400	490	29	95

Packaging and available sizes

Unit type	Diameter (mm) 2.0
6.35 kg coil 14C	X
22.68 kg coil 50C	X

Suggestions for use

For mild and higher strength steel not exceeding the yield strength range
Roundabout groove welds, especially for large diameter heavy tubular constructions
General plate fabrication, including bridge construction, hull plate and stiffener welding on ships and barges, offshore

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	
EN 10213-2	GP240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240, L290, L360
API 5LX	X42, X46, X52
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355
EN 10113-3	S275, S355

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	19	125	145	16	1.10	1.32
		230	235	20	1.95	1.32
		280	275	21	2.40	1.32

Welding parameters, optimum fill passes

Diameter (mm)		Welding position PA/1G PB/2F	PC/2G	PF/3G up PF/5G up	PG/5G down PG/5G down	PE/4G
2.0	Wire feed speed (cm/min.)	280	230	200	200	200
	Current (A)	275	235	215	215	215
	Voltage (V)	21	20	19	18	19

Innershield® NR®-203Ni1

Self-shielded cored wire

Classification

AWS A5.29/A5.29M : E71T8-Ni1
EN 758 : T 42 3 1Ni YN1

General description

Self shielded: easiest equipment arrangement
All position welding
Easy to weld in vertical up position
All passes
Good impact and CTOD toughness

Welding positions

ISO/ASME	PA/1G	PB/2F	PC/2G	PF/3Gup	PG/3Gdown	PE/4G	PF/5Gup	PG/5Gdown

Current type

DC -

Approvals

ABS	BV	DNV	FORCE	GL	LR	RINA	TÜV
3SA,3YSA	SA3YMHH	IIIYMSH10	+	3YSH10	3S,3YSH15	3S,3YS	+

FCAW

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Al
0.08	1.1	0.27	0.008	0.003	0.9	0.85

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation %	Impact ISO-V(J) -29°C
Required:	AWS A5.29		min. 400	480-620	20	27
Typical values		AW	465	540	26	115

Packaging and available sizes

Unit type	Diameter (mm) 2.0	2.4
6.35 kg coil 14C	X	
22.68 kg coil 50C	X	X

Suggestions for use

For mild and higher strength steel, not exceeding the yield strength range of the electrode weld deposit
General plate fabrication, including bridge construction, hull plate and stiffener welding on ships and barges, offshore
For semi- and full automatic welding

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	
EN 10213-2	GP240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240, L290, L360
API 5LX	X42, X46, X52
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355
EN 10113-3	S275, S355

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	19	125	145	16	1.10	1.30
		230	235	20	1.95	1.30
		355	310	23	3.15	1.30
2.4	19	125	215	18	1.60	1.20
		240	315	21	3.25	1.20
		330	385	24	4.30	1.20

Welding parameters, optimum fill passes

Diameter (mm)		Welding position PA/1G	PB/2F	PC/2G	PF/3G up	PF/5G up	PG/3G down PG/5G down	PE/4G
2.0	Wire feed speed (cm/min.)	280	330	230	200	200	200	180
	Current (A)	255	300	235	215	215	215	195
	Voltage (V)	21	22	20	19	19	18	19
2.4	Wire feed speed (cm/min.)	280	280	215	180			
	Current (A)	345	345	290	250			
	Voltage (V)	22	22	19.5	19			

Innershield® NR®-211-MP

Self-shielded cored wire

Classification

AWS A5.20/A5.20M : E71T-11

General description

Self shielding: easiest equipment arrangement
General purpose welding
Easy handling and welding versatility
Recommended for sheets from 2.5 to 12mm
With electrode diameter 0.9mm: excellent for sheets from 1.2mm

Welding positions

ISO/ASME	PA/1G	PB/2F	PC/2G	PF/3Gup	PG/3Gdown	PE/4G	PG/5Gdown

Current type

DC -

Approvals

BV	FORCE	LR
+	+	AWS

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.21	0.60	0.18	0.008	0.007	1.50

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation %	Impact ISO-V(J)
Required:	AWS A5.20		min. 400	480	20	not required
Typical values		AW	450	580	23	

Packaging and available sizes

Unit type	Diameter (mm)			
	0.9	1.2	1.7	2.0
6.35 kg coil 14C	X	X		
6.35 kg coil 14C			X	X
11,34 kg coil 22RR	X	X		
22.68 kg coil 50C			X	X

Suggestions for use

Fabricating and repair of machinery parts, truck bodies, saddles, tanks, hoppers, etc.
Racks, scaffolding, light angle structurals, joints, small roundabouts, etc.
Short assembly welds on brackets, dips, etc.
Galvanized steel

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	
EN 10213-2	GP240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240, L290, L360
API 5LX	X42, X46, X52
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355
EN 10113-3	S275, S355

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
0.9	10	125	30	14	0.3	1.22
		230	90	16	0.6	1.22
		280	120	16.5	0.8	1.22
1.1	14	180	120	15	0.5	1.22
		280	160	17	1.0	1.22
		330	170	18	1.2	1.22
1.7	19	100	120	15	0.8	1.22
		190	190	18	1.5	1.22
		440	320	23	3.5	1.22
2.0	19	130	180	16	1.4	1.09
		190	250	18	2.2	1.09
		380	350	22	4.3	1.09
2.4	19	130	235	16	2.0	1.10
		140	250	18	2.3	1.10
		250	370	20	4.2	1.10

Welding parameters, optimum fill passes

Diameter (mm)		Welding position PA/1G PB/2F	PC/2G	PF/3G up	PG/3G down PG/5G down	PE/4G
0.9	Wire feed speed (cm/min.)	180	180	150	230	230
	Current (A)	65	65	50	85	85
	Voltage (V)	15	15	14.5	16	16
1.1	Wire feed speed (cm/min.)	230	230	200	280	280
	Current (A)	140	140	130	160	160
	Voltage (V)	16	16	16	17	17
1.7	Wire feed speed (cm/min.)	440	250	190	300	300
	Current (A)	320	230	190	280	280
	Voltage (V)	23	19.5	18	21	21
2.0	Wire feed speed (cm/min.)	330	190		230	190
	Current (A)	320	250		320	250
	Voltage (V)	21	18		19.5	18
2.4	Wire feed speed (cm/min.)	230	180		230	140
	Current (A)	350	275		350	250
	Voltage (V)	19.5	19		19.5	18

Innershield® NR®-232

Self-shielded cored wire

Classification

AWS A5.20/A5.20M : E71T-8

General description

Self shielded: easiest equipment arrangement
Deposit rate up to 3 kg/h, out of position
Excellent low temperature impact toughness
Ideal for fillet welding and filling
For single and multi-pass welds
Size diam. 1.7mm suitable for contaminated or primed plate

Welding positions

ISO/ASME	PA/1G	PB/2F	PC/2G	PF/3Gup	PE/4G

Current type

DC -

Approvals

ABS	BV	DNV	LR	RINA	TÜV	NKK
3SA,3YSAH15	SA3YMH	IIIYMSH15	3S,3YSH15	3YS	+	KSW53NH10

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.18	0.65	0.27	0.006	0.004	0.55

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation %	Impact ISO-V(J) -20°C	Impact ISO-V(J) -29°C
Required:	AWS A5.20		min. 400	480	22		27
Typical values		AW	490	590	26	65	35

Packaging and available sizes

Unit type	Diameter (mm) 1.7	1.8	2.0
6.12 kg coil 14C	X	X	X
22.68 kg coil 50C	X	X	X

FCAW

Suggestions for use

Designed for the semi-automatic welding of 5mm and thicker steel
Recommended for single and multi-pas welds
Size diam. 1.7mm, is recommended for welds where it is necessary to produce wider passes (weave technique) and for welding plate with contaminations such as oil, rust, paint or primer
Size diam. 1.8mm is recommended to obtain the fastest travel speed on single pass fillet weld
Size diam. 2.0mm is recommended for overhead position

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to DH36.
Cast steel	
EN 10213-2	GP240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240, L290, L360, L415
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure Vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275, S355, S420

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
1.7	12-25	280	170	19	1.7	1.33
		430	250	21	2.7	1.33
		810	400	26	5.1	1.33
1.8	12-25	200	130	17	1.5	1.22
		430	250	21	2.9	1.22
		730	350	24	5.0	1.22
2.0	12-25	150	130	16	1.3	1.22
		330	250	21	2.8	1.22
		550	350	25	4.6	1.22

Welding parameters, optimum fill passes

Diameter (mm)		Welding position PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.7	Wire feed speed (cm/min.)	635	495		380	380
	Current (A)	310	275		225	225
	Voltage (V)	23	23		19.5	19.5
1.8	Wire feed speed (cm/min.)	635	510	430	390	430
	Current (A)	355	290	255	240	255
	Voltage (V)	11	21	21	20	21
2.0	Wire feed speed (cm/min.)	460	380		330	380
	Current (A)	315	285		250	285
	Voltage (V)	23	22		21	22

Innershield® NR®-233

Self-shielded cored wire

Classification

AWS A5.20/A5.20M E71T-8

General description

Self shielded: easiest equipment arrangement
Due to new production technology and formulation: welder friendly wire with wide range of parameter settings
Forgiving arc, with increased penetration gives better quality welds with great bead appearance
High deposition rate, even in out of position welding
Good impact values
NR-233 has been developed to minimize gas marking, even after the electrode has been exposed to the atmosphere

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G PF/5Gup

Current type

DC -

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.16	0.65	0.21	0.010	0.003	0.60

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation %	Impact ISO-V(J) -29°C
Required:	AWS A5.20		min. 400	480	22	27
Typical values		AW	440	570	26	40

Packaging and available sizes

Unit type	Diameter (mm) 1.6	1.8
5,7kg plastic spool	X	
11,3 kg plastic spool Foil Bag	X	X

FCAW

Innershield® NR®-233

Suggestions for use

Vertical up fillet and grove welds
Overhead fillet and groove welds
Seismic structural steel erection
General structural steel erection
Ship and barge fabrication

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	
EN 10213-2	GP240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240, L290, L360
API 5LX	X42, X46, X52
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355
EN 10113-3	S275, S355

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
1.6	13-32	380	220	17-19	1.9	1.26
		510	245	19-21	2.5	1.31
		640	270	21-23	3.0	1.35
		760	295	23-25	3.5	1.35
		890	315	25-27	4.3	1.31
1.8	19-25	250	185	17-18	1.6	1.25
		380	250	18-19	2.5	1.24
		510	295	20-21	3.2	1.25
		640	330	22-23	4.0	1.26
		760	355	23-24	4.8	1.26

Innershield NR®-204-H

Self-shielded cored wire

Classification

AWS A5.20/A5.20M : E71T-GS

General description

Self shielded: easiest equipment arrangement
NR 204 recommended for vertical down root pass pipe welding
NR 207 recommended for filling in vertical down position pipe welding
High quality construction welding in all positions
Good impact and CTOD toughness
Low hydrogen weld metal (H_{DM} 5-7ml/100g)

Welding positions

ISO/ASME PA/1G PC/2G PG/3Gdown PG/5Gdown

Current type

DC -

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.15	0.75	0.20	0.008	0.013	0.65

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation %	Impact ISO-V(J)
Required:	AWS A5.20		not required	min. 480	not required	not required
Typical values		AW		510*	24	

* Flat tensile test specimen

Packaging and available sizes

Unit type	Diameter (mm) 1.7
6.35 kg coil 14C	X

Innershield NR®-204-H

Suggestions for use

Where low hydrogen weld metal is required
High productivity welding
Where arctic mechanical properties are required in general construction welding
Semi-automatic pipe welding
Drag angle 30°, electrical stick out 15-20mm

Materials to be welded

Steel grades/Code	Type
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240, L290, L360
API 5LX	X42, X46, X52
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)
1.7	19	200	170	13.5	1.8
		240	185	14.5	2.1
		280	210	15.6	2.4

Welding parameters, optimum fill passes

Diameter (mm)		Welding position PA/1G	PC/2G	PG/3G down PG/5G down
1.7	Wire feed speed (cm/min.)	280	230	230
	Current (A)	240	220	220
	Voltage (V)	21	19	19

Innershield® NR®-207

Self-shielded cored wire

Classification

AWS A5.29/A5.29M : E71T8-K6

General description

Self shielded: easiest equipment arrangement
Vertical down filling semi-automatic pipe welding
High quality construction welding in all positions
Good impact and CTOD toughness

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PG/3Gdown PE/4G PG/5Gdown

Current type

DC -

Approvals

BV	DNV	GL	TÜV
SA3YMH	IIIYMSH15	3YH15S	+

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Al
0.07	0.9	0.20	0.005	0.003	0.85	1.0

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation %	Impact ISO-V(J) -29°C
Required:	AWS A5.29		min. 400	480-620	20	27
Typical values		AW	420	535	25	110

Packaging and available sizes

Unit type	Diameter (mm) 1.7	2.0
6.35 kg coil 14C	X	X
22.68 kg coil 50C		X

Suggestions for use

High productivity welding
Where arctic mechanical properties are required in general construction welding
Semi-automatic pipe welding

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to DH36
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240, L290, L360, L415
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Fine grained steel	
EN 10113-2	S275, S355
EN 10113-3	S275, S355

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	19	180	175	17.5	1.4	1.27
		230	220	18.5	1.7	1.27
		250	260	19.5	2.5	1.27

Welding parameters, optimum fill passes

Diameter (mm)		Welding position PA/1G PB/2F	PC/2G	PG/3G down PG/5G down	PE/4G
2.0	Wire feed speed (cm/min.)	280	230	230	190
	Current (A)	240	220	220	185
	Voltage (V)	21	19	19	19

FCAW

Innershield® NR®-207-H

Self-shielded cored wire

Classification

AWS A5.29/A5.29M : E71T8-K6

General description

Self shielded: easiest equipment arrangement
Vertical down semi-automatic pipe welding
High quality construction welding in all positions
Good impact and CTOD toughness
Low hydrogen weld metal H

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PG/3Gdown PE/4G PG/5Gdown

Current type

DC -

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Al
0.07	0.9	0.20	0.005	0.003	0.85	1.0

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation %	Impact ISO-V(J) -29°C
Required:	AWS A5.29		min. 400	480-620	20	27
Typical values		AW	420	535	25	110

Packaging and available sizes

Unit type	Diameter (mm) 1.7
6.35 kg coil 14C	X

Suggestions for use

Where low hydrogen weld metal is required
High productivity welding
Where arctic mechanical properties are required in general construction welding
Semi-automatic pipe welding

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to DH36.
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240, L290, L360, L415
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Fine grained steel	
EN 10113-2	S275, S355
EN 10113-3	S275, S355

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
1.7	19	230	205	17.5	1.5	-
		270	220	18.5	1.8	-
		300	245	19.5	2.0	-

Innershield® NR®-208-H

Self-shielded cored wire

Classification

AWS A5.29/A5.29M : E91T8-G

General description

Self shielded: easiest equipment arrangement
Semi-automatic fill and cap pass welding of X-80 pipe steel in vertical down position
Excellent low temperature toughness
Low hydrogen content (H_{DM} < 8 ml/100g)

Welding positions

ISO/ASME PG/5Gdown

Current type

DC -

Approvals

TÜV
+

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al	Ni
0.05	1.65	0.25	0.007	<0.003	0.85	0.8

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation %	Impact ISO-V(J) -30°C
Required:	AWS A5.29		min. 540	620-760	17	
Typical values		AW (1G)	585	650	26	115

Packaging and available sizes

Unit type	Diameter (mm) 1.7	2.0
6.35 kg coil 14C	X	X

FCAW

Suggestions for use

Preheat and interpass temperature depending on steel quality
For root pass welding of X-60 to X-80 the Innershield NR-204-H electrode is recommended

Materials to be welded

Steel grades/Code	Type
Pipe material	
API5LX	X60, X70
EN 10208-2	L 415, L445, L480, L550

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
1.7	19	150	145	15.5	1.0	-
		205	180	17.5	1.3	-
		270	215	18.5	1.8	-
		370	255	20.5	2.4	-

Innershield® NR®-305

Self-shielded cored wire

Classification

AWS A5.20/A5.20M : E70T-6

General description

NR-305 is a self-shielded flux cored wire
Not intended for out-of-position welding, but can be used on 15° max. downhill and 5° max. uphill applications
High deposit rates and fast travel speed
Easy handling
Recommended for maximum productivity, downhand welding

Welding positions

ISO/ASME PA/1G PB/2F

Current type

DC +

Approvals

ABS	BV	DNV
2SA,2YSA	SA2YMH	IIYMS

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.09	0.9	0.20	0.007	0.008	0.80

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation %	Impact ISO-V(J) -29°C
Required:	AWS A5.20		min. 400	480	22	27
Typical values		AW	470	550	25	40

Packaging and available sizes

Unit type	Diameter (mm)		
	1.7	2.0	2.4
22.68 kg coil 50C	X	X	X

Suggestions for use

Typical applications include bridge, ship, barge or offshore drilling rig construction and machinery, structural and general fabrication. NR-305 can be used for single and multiple pass fillet and lap welds and for deep groove butt welds in the flat position.

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	
EN 10213-2	GP240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240, L290, L360, L415
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355
EN 10113-3	S275, S355

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
1.7	12-25	510	275	24	3.75	1.22
		635	325	25	4.60	1.22
		890	390	27	6.35	1.22
2.0	19-25	510	360	22.5	4.50	1.22
		635	410	25	5.90	1.22
		1140	545	32.5	11.10	1.22
2.4	38-65	405	330	21	5.00	1.23
		610	425	24	7.55	1.23
		1015	525	33	12.70	1.23

Welding parameters, optimum fill passes

Diameter (mm)		Welding position PA/1G	PB/2F
1.7	Wire feed speed (cm/min.)	635	635
	Voltage (V)	25	25
2.0	Wire feed speed (cm/min.)	890	635
	Voltage (V)	25	24
2.4	Wire feed speed (cm/min.)	710	610
	Voltage (V)	27	24

Innershield® NR®-311

Self-shielded cored wire

Classification

AWS A5.20/A5.20M : E70T-7

General description

Self shielded: easiest equipment arrangement
Good penetration, as in column butt welds and narrow gap welds
Fast travel speed
High deposition rates

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PG/3Gdown

Current type

DC -

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.27	0.40	0.08	0.007	0.005	1.5

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation %	Impact ISO-V(J)
Required:	AWS A5.20		min. 400	480	22	not required
Typical values		AW	430	590	24	

Packaging and available sizes

Unit type	Diameter (mm) 2.0	2.4
6.35 kg coil 14C	X	
22.68 kg coil 50C		X

Suggestions for use

Horizontal butt welds such as column structural connections
Fillet and lap welds in the flat horizontal and downhill positions
Deep groove welds. The penetration and extremely easy slag removal permit using a narrow gap and small bevel angle to minimize the total amount of weld metal needed to fill the joint

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	
EN 10213-2	GP240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240, L290, L360, L415
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	32	255	190	21	2.2	1.28
		405	275	25	3.6	1.28
		760	4100	28	7.1	1.28

Welding parameters, optimum fill passes

Diameter (mm)		Welding position PA/1G	PB/2F	PC/2G	PG/3G down
2.0	Wire feed speed (cm/min.)	610	510	410	380
	Current (A)	355	320	280	260
	Voltage (V)	26	26	25	25

Innershield® NR®-400

Self-shielded cored wire

Classification

AWS A5.29/A5.29M : E71T8-K6

General description

Self shielding: easiest equipment arrangement
Higher strength level, overmatching StE 355
Excellent impact toughness at -40°C
CTOD tested, offshore constructions
All positions, all passes

Welding positions

ISO/ASME	PA/1G	PB/2F	PC/2G	PF/3Gup	PE/4G	PF/5Gup

Current type

DC -

Approvals

BV	FORCE	LR	TÜV
SA3YMHH	+	3S,3YSH15	+

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Cr	Al
0.06	0.74	0.17	0.004	0.002	0.75	0.13	0.74

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation %	Impact ISO-V(J) -60°C
Required:	AWS A5.29		min. 400	480-620	20	27
Typical values		AW	435	525	26	100

Packaging and available sizes

Unit type	Diameter (mm) 2.0
6.35 kg coil 14C	X
22.68 kg coil 50C	X

Suggestions for use

Off-shore oil equipment, piping, storage tanks
General plate fabrication including bridge construction on ships and barges
Circumferential groove welds for heavy wall, large diameter tubular construction

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to DH36.
Cast steel	
EN 10213-2	GP240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240, L290, L360
API 5LX	X42, X46, X52
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355
EN 10113-3	S275, S355

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	19	150	150	16.5	1.20	1.37
		230	225	19.5	1.85	1.37
		280	265	20.5	2.35	1.37

Welding parameters, optimum fill passes

Diameter (mm)		Welding position PA/1G PB/2F	PC/2G	PF/3G(up) PF/5G(up)	PE/4G
2.0	Wire feed speed (cm/min.)	280	230	200	200
	Current (A)	265	225	190	190
	Voltage (V)	20	19	18	18

Innershield® NR®-450-H

Self-shielded cored wire

Classification

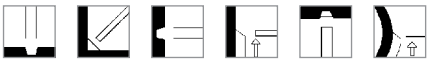
AWS A5.29/A5.29M : E71T8-Ni2 [1)]

[1)] also meets: E81T8-Ni2

General description

Self shielding: easiest equipment
Higher strength level, yield strength up to 450 N/mm²
Excellent impact toughness at -40°C
CTOD tested, offshore constructions

Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G PF/5Gup

Current type

DC -

Approvals

ABS	GL	LR
3SA,3YSAH10	3YSH10	3S,3YSH10

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Al
0.07	0.26	0.06	0.004	0.002	2.44	0.88

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation %	Impact ISO-V(J) -29°C	Impact ISO-V(J) -40°C
Required:	AWS A5.29		min. 400	480-620	20	27	
Typical values		AW	500	570	28	88	84

Packaging and available sizes

Unit type	Diameter (mm) 2.0
6.35 kg coil 14C	X

FCAW

Suggestions for use

Off-shore oil equipment, piping, storage tanks
General plate fabrication including bridge construction on ships and barges
Circumferential groove welds for heavy wall, large diameter tubular construction

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to EH36
Cast steel	
EN 10213-2	GP240R
Pipe material	
EN 10208-1	L210, L240, L290, L360, L415, L445
EN 10208-2	L240, L290, L360
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275, S355, S420

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	19	150	140	16.5	1.18	1.44
		230	200	19.5	1.90	1.51
		280	225	20.5	2.35	1.33

Innershield® NR®-550-H

Self-shielded cored wire

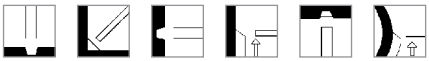
Classification

AWS A5.29/A5.29M : E81T8-Ni2 H8

General description

Self shielding: easiest equipment
Higher strength level, yield strength up to 450 N/mm²
Excellent impact toughness at -40°C
CTOD tested, offshore constructions

Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G PF/5Gup

Current type

DC -

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Al
0.05	1.14	0.07	0.010	0.003	2.35	0.7

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation %	Impact ISO-V(J) -18°C	Impact ISO-V(J) -29°C
Required:	AWS A5.29		min. 400	480-620	20		27
Typical values		AW	490	585	25	113	100

Packaging and available sizes

Unit type	Diameter (mm) 2.0
6.35 kg coil 14C	X

FCAW

Suggestions for use

Off-shore oil equipment, piping, storage tanks
General plate fabrication including bridge construction on ships and barges
Circumferential groove welds for heavy wall, large diameter tubular construction

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 t/m EH36
Cast steel	
EN 10213-2	GP240R
Pipe material	
EN 10208-1	L210, L240, L290, L360, L415, L445
EN 10208-2	L240, L290, L360
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275, S355, S420

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	19	150	140	16.5	1.18	1.44
		230	200	19.5	1.90	1.51
		280	225	20.5	2.35	1.33

Innershield® NS®-3M

Self-shielded cored wire

Classification

AWS A5.20/A5.20M : E70T-4
EN 758 : T 42 Z V N 3

General description

NS-3M is a self shielded wire for high deposition rate flat and horizontal welding where impact properties are not required
Recommended for heavy sections or crack-sensitive applications
Can be used for rail joint welding

Welding positions

ISO/ASME PA/1G PB/2F

Current type

DC +

Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.23	0.45	0.26	0.006	0.006	1.40

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation %	Impact ISO-V(J)
Required:	AWS A5.20		min. 400	480	22	not required
Typical values		AW	450	570	26	

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	
EN 10213-2	GP240R
Pipe material	
EN 10208-1	L210, L240, L290, L360
EN 10208-2	L240, L290, L360, L415
API 5LX	X42, X46, X52, X60
EN 10216-1/	P235T1, P235T2, P275T1
EN 10217-1	P275T2, P355N
Fine grained steel	
EN 10113-2	S275, S355, S420
EN 10113-3	S275, S355, S420

Packaging and available sizes

Unit type	Diameter (mm) 2.0	2.4	3.0
6.35 kg coil 14C	X		
12,5 kg coil 25RR	X		
22.68 kg coil 50C	X	X	X

Suggestions for use

Multi-pass fillet and lap welds
Single passes 4.5 to 9mm fillet and lap welds (1F)
Crack resistant fillets on higher strength steels where required joint strength can be obtained by using the proper fillet size
Joint welding of rail steel profiles with placed copperbacking

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	50	500	250	29	5.0	1.18
		635	290	30	6.3	1.18
		760	320	31	7.6	1.18
2.4	70	280	250	28	3.8	1.16
		580	400	31	8.1	1.16
		700	450	32	10.0	1.16
3.0	70	380	400	28	7.7	1.23
		450	450	29	9.0	1.23
		570	550	31	12.0	1.23
2.0	95	530	450	35	11.3	1.23
		900	600	38	17.9	1.23

Welding parameters, optimum fill passes

Diameter (mm)	Wire feed speed/ Current/ Voltage	Welding position PA/1G	PB/2F
2.0	Wire feed speed (cm/min.)	635	635
	Current (A)	290	290
	Voltage (V)	30	30
2.4	Wire feed speed (cm/min.)	580	580
	Current (A)	400	400
	Voltage (V)	31	31
3.0*	Wire feed speed (cm/min.)	440	440
	Current (A)	445	445
	Voltage (V)	29	29
3.0**	Wire feed speed (cm/min.)	760	
	Current (A)	550	
	Voltage (V)	37	

* Stick-out 70mm
** Stick-out 95mm

FCAW

Innershield® NR®-431

Self-shielded cored wire

Classification

AWS A5.26/26M : EG72T-1

General description

NR-431 is an Innershield consumable used for electrogas welding (EGW).
Vertishield is the Lincoln Electric name for its vertical-up, self-shielded, single pass electrogas arc welding process.
This process does not use an external shielding gas.
Vertishield welds are made by two methods: the consumable guide and the moving shoe process.

Welding positions

ISO/ASME PF/3Gup

Current type

DC +

Chemical composition (w%), typical, all weld metal

Chemistries of the welds will change with different heats of steel.

Mechanical properties, all weld metal

		Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation %	Impact ISO-V(J) -27°C
Required:	AWS A5.26/26M	AW	min. 345	483-655	22	20

Packaging and available sizes

Unit type	Diameter (mm) 2.4
22.68 kg coil 50C	X

FCAW

Suggestions for use

The moving shoe (dam) welding can be used with either a gapped V-groove or square butt plate.
Material from 9.5 to 100 mm plate thickness and unlimited length can be welded.
The consumable quide process is intended tot weld joints less than three feet long.
Copper retaining dams extend the full length of the joint.

Materials to be welded

Steel grades/Code	Type
General structural steel	
EN 10025	S185, S235, S275, S355
Ship plates	
ASTM A131	Grade A, B, D, AH32 to DH36

Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)
2.4	38	635	390-430	34	9
		760	435-465	36	11
		890	480-520	37	13
		1020	530-570	39	15

Cor-A-Rosta 304L

Stainless steel rutile cored wire

Classification

AWS A5.22 : E308LT0-1/-4
ISO 17663 : T 19 9 L R C/M 3

General description

Gas shielded flux cored stainless steel wire electrode for downhand welding
Stable arc, low spatter and good slag removal
Excellent wire feeding and operator appeal
Bright appearance of weld metal

Welding positions

ISO/ASME PA/1G PB/2F PC/2G

Current type/Shielding gas

DC +
Ar+ (>5-25%) CO_2 (ISO 14175: M21)
100% CO_2 (ISO 14175: C1)
15-25 l/min

Approvals

Shielding gas	DNV	GL	LR	TÜV
M21	308LMS	4550S		+
C1	308LMS		304L	+

Chemical composition (w%) and Ferrite Number (FN), Typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	FN
M21/C1	0.03	1.3	0.6	20	10	8

Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) +20°C	Impact ISO-V(J) -110°C
Required: AWS A5.22			not required	min. 520	min. 35		
ISO 17663			min. 320	min. 510	min. 30		
Typical values	M21/C1	AW	400	555	42	75	40

Packaging and available sizes

Unit type	Diameter (mm) 1.2	1.6
5 kg plastic spool S200	X	
15 kg spool S300	X	X

FCAW

Cor-A-Rosta 304L: rev. EN 22

Materials to be welded

Steel grades	EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon (C <0.03%)					
	X2 CrNi 19 11		1.4306	(TP)304L	S30403
				CF-3	J92500
	X2 CrNiN 18 10		1.4311	(TP)304LN	S30453
				302,304	S30400
Medium carbon (C >0.03%)					
	X4 CrNi 18 10		1.4301	(TP)304	S30409
		GX5 CrNi 19 10	1.4308	CF 8	J92600
Ti-, Nb stabilized					
	X6 CrNiTi 18 10		1.4541	(TP)321	S32100
				(TP)321H	S32109
	X6 CrNiNb 18 10		1.4550	(TP)347	S34700
				(TP)347H	S34709
		GX5 CrNiNb 19 10	1.4552	CF-8C	J92710

Welding parameters, optimum fill passes in shielding gas M21/C1

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G
1.2	100-250A	100-250A	100-200A
1.6	140-300A	140-300A	140-200A

Remarks/ Application advice

Use for positional welding: Cor-A-Rosta P304L

Cor-A-Rosta P304L

Stainless steel rutile cored wire

Classification

AWS A5.22 : E308LT1-1/-4
ISO 17663 : T 19 9 L P C/M 2

General description

Gas shielded flux cored stainless steel wire electrode for positional welding
Stable arc, low spatter and good slag removal
Excellent wire feeding and operator appeal
Bright appearance of weld metal

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>5-25%) CO_2 (ISO 14175: M21)
100% CO_2 (ISO 14175: C1)
15-25 l/min

Approvals

Shielding gas	GL	TÜV
M21	4550S	pending
C1		pending

Chemical composition (w%) and Ferrite Number (FN), Typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	FN
M21/C1	0.03	1.3	0.6	19.5	10	8

Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) +20°C	Impact ISO-V(J) -110°C
Required: AWS A5.22			not required	min. 520	min. 35		
ISO 17663			min. 320	min. 510	min. 30		
Typical values	M21/C1	AW	390	560	42	75	40

Packaging and available sizes

Unit type	Diameter (mm) 1.2
15 kg spool S300	X

FCAW

Cor-A-Rosta P304L

Materials to be welded

Steel grades	EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon (C <0.03%)					
	X2 CrNi 19 11		1.4306	(TP)304L	S30403
				CF-3	J92500
	X2 CrNiN 18 10		1.4311	(TP)304LN	S30453
				302,304	S30400
Medium carbon (C >0.03%)					
	X4 CrNi 18 10		1.4301	(TP)304	S30409
		GX5 CrNi 19 10	1.4308	CF 8	J92600
Ti-, Nb stabilized					
	X6 CrNiTi 18 10		1.4541	(TP)321	S32100
				(TP)321H	S32109
	X6 CrNiNb 18 10		1.4550	(TP)347	S34700
				(TP)347H	S34709
		GX5 CrNiNb 19 10	1.4552	CF-8C	J92710

Welding parameters, optimum fill passes in shielding gas M21/C1

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up
1.2	100-250A	100-250A	100-200A	100-180A

Remarks/ Application advice

Use for downhand welding: Cor-A-Rosta 304L

Cor-A-Rosta 347

Stainless steel rutile cored wire

Classification

AWS A5.22 : E347T0-4
ISO 17663 : T 19 9 Nb R M 3

General description

Rutile gas shielded stainless steel wire electrode for downhand welding
For Ti or Nb stabilized 304 or equivalent steels
Excellent resistance in oxidizing environments such as nitric acid
High resistance to intergranular corrosion
Easy slag release and smooth bead appearance

Welding positions

ISO/ASME PA/1G PB/2F PC/2G

Current type/Shielding gas

DC +
Ar+ (>5-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Chemical composition (w%) and Ferrite Number (FN), Typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Nb	FN
M21	0.03	1.2	0.45	19.0	10.5	0.5	8

FCAW

Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.22			not required	min. 520	min. 30	
ISO 17663			min. 350	min. 550	min. 25	
Typical values	M21	AW	440	610	41	85

Packaging and available sizes

Unit type	Diameter (mm) 1.2
15 kg spool S300	X

Cor-A-Rosta 347: rev. EN 22

Materials to be welded

Steel grades	EN 10088-1/-2	EN 10213-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Ti-, Nb stabilized					
	X6 CrNiTi 18 10		1.4541	(TP)321	S32100
				(TP)321H	S32109
	X6 CrNiNb 18 10		1.4550	(TP)347	S34700
				(TP)347H	S34709
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710
Non stabilized					
				302	
	X4CrNi 18-10		1.4301	(TP)304	S30400
	X2CrNi 19-11		1.4306	(TP)304L	S30403
		GX5 CrNi 19-10	1.4308	CF-8	J92600
			1.4312		
				(TP)304H	S30409

Welding parameters, optimum fill passes in shielding gas M21

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G
1.2	100-250A	100-250A	100-200A

Cor-A-Rosta 316L

Stainless steel rutile cored wire

Classification

AWS A5.22 : E316LT0-1/ -4
ISO 17663 : T 19 12 3 L R C/M 3

General description

Gas shielded flux cored stainless steel wire electrode for downhand welding
Stable arc, low spatter and good slag removal
Excellent wire feeding and operator appeal
Bright appearance of weld metal

Welding positions

ISO/ASME PA/1G PB/2F PC/2G

Current type/Shielding gas

DC +
Ar+ (>5-25%) CO_2 (ISO 14175: M21)
100% CO_2 (ISO 14175: C1)
15-25 l/min

Approvals

Shielding gas	BV	DNV	GL	LR	TÜV
M21	316L	316LMS	pending	316L	+
C1	316L	316LMS		316L	+

Chemical composition (w%) and Ferrite Number (FN), Typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Mo	FN
M21/C1	0.03	1.4	0.6	19.0	12.0	2.7	9

Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) +20°C	Impact ISO-V(J) -110°C
Required: AWS A5.22			not required	min. 485	min. 30		
ISO 17663			min. 320	min. 510	min. 25		
Typical values	M21/C1	AW	440	570	39	70	35

Packaging and available sizes

Unit type	Diameter (mm) 1.2	1.6
15 kg spool S300	X	X

Materials to be welded

Steel grades	EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon (C <0.03%)					
	X2 CrNiMo 17-12-2		1.4404	(TP)316L	S31603
				CF-3M	J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
Medium carbon (C >0.03%)					
	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
		GX5 CrNiMo 19-11	1.4408	CF 8M	J92900
Ti-, Nb stabilized					
	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710

Welding parameters, optimum fill passes in shielding gas M21/C1

Diameter (mm)	Welding positions PA/1G	PB/2F
1.2	100-250A	100-250A
1.6	140-300A	140-300A

Remarks/ Application advice

Use for positional welding: Cor-A-Rosta P316L

Cor-A-Rosta P316L

Stainless steel rutile cored wire

Classification

AWS A5.22 : E316LT1-1/-4
ISO 17663 : T 19 12 3 L P C/M 2

General description

Gas shielded flux cored stainless steel wire electrode for positional welding
Stable arc, low spatter and good slag removal
Excellent wire feeding and operator appeal
Bright appearance of weld metal

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>5-25%) CO_2 (ISO 14175: M21)
100% CO_2 (ISO 14175: C1)
15-25 l/min

Approvals

Shielding gas	ABS	DNV	GL	LR	TÜV
M21	pending	316LMS	4571S	316L	pending
C1		316LMS			pending

Chemical composition (w%) and Ferrite Number (FN), Typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Mo	FN
M21/C1	0.03	1.3	0.6	19.0	12.0	2.8	8

Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) +20°C	Impact ISO-V(J) -110°C
Required: AWS A5.22			not required	min. 485	min. 30		
ISO 17663			min. 320	min. 510	min. 25		
Typical values	M21/C1	AW	440	570	39	70	35

Packaging and available sizes

Unit type	Diameter (mm) 1.2
5 kg plastic spool S200	X
15 kg spool S300	X

FCAW

Cor-A-Rosta P316L: rev. EN 22

Cor-A-Rosta P316L

Materials to be welded

Steel grades	EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon (C <0.03%)					
	X2 CrNiMo 17-12-2		1.4404	(TP)316L	S31603
				CF-3M	J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
Medium carbon (C >0.03%)					
	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
Ti-, Nb stabilized					
	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710

Welding parameters, optimum fill passes in shielding gas M21/C1

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up
1.2	100-250A	100-250A	100-200A	100-200A

FCAW

Remarks/ Application advice

Use for downhand welding: Cor-A-Rosta 316L

Cor-A-Rosta 309L

Stainless steel rutile cored wire

Classification

AWS A5.22 : E309LT0-1/-4
ISO 17663 : T 23 12 L R C/M 3

General description

Gas shielded flux cored high CrNi alloyed wire electrode for downhand welding
For welding stainless to mild steel and buffer layers in clad steel
Excellent weldability and self releasing slag
High resistance to embrittlement

Welding positions

ISO/ASME PA/1G PB/2F PC/2G

Current type/Shielding gas

DC +
Ar+ (>5-25%) CO_2 (ISO 14175: M21)
100% CO_2 (ISO 14175: C1)
15-25 l/min

Approvals

Shielding gas	BV	DNV	GL	LR	TÜV
M21	309L	309LMS	4332S	SS/CMn	pending
C1	309L	309LMS		SS/CMn	pending

Chemical composition (w%) and Ferrite Number (FN), Typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	FN
M21/C1	0.03	1.4	0.6	24	12.5	15

Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) +20°C	Impact ISO-V(J) -20°C
Required: AWS A5.22			not required	min. 520	min. 30		
ISO 17663			min. 320	min. 510	min. 25		
Typical values	M21/C1	AW	450	570	36	45	40

Packaging and available sizes

Unit type	Diameter (mm) 1.2	1.6
5 kg plastic spool S200	X	
15 kg spool S300	X	X

FCAW

Materials to be welded

Steel grades	EN 10088-11-2	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Corrosion resistant cladsteels				
	X2 CrNiN 18-10	1.4311	(TP)304LN	S30453
	X2 CrNi 19-11	1.4306	(TP)304L	S30403
			CF-3	J92500
	X4 CrNi 18-10	1.4301	(TP)304	S30400

Dissimilar metals (mild and low alloyed steel to CrNi or CrNiMo stainless steel)
Build-up welding on mild and low alloyed steel

Welding parameters, optimum fill passes in shielding gas M21/C1

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G
1.2	100-250A	100-250A	100-200A
1.6	140-300A	140-300A	140-200A

FCAW

Remarks/ Application advice

Use for positional welding: Cor-A-Rosta P309L

Cor-A-Rosta P309L

Stainless steel rutile cored wire

Classification

AWS A5.22 : E309LT1-1/-4
ISO 17663 : T 23 12 L P C/M 2

General description

Gas shielded flux cored high CrNi alloyed wire electrode for positional welding
For welding stainless to mild steel and buffer layers in clad steel
Excellent weldability and self releasing slag
High resistance to embrittlement

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>5-25%) CO_2 (ISO 14175: M21)
100% CO_2 (ISO 14175: C1)
15-25 l/min

Approvals

Shielding gas	ABS	DNV	GL	LR	TÜV
M21	pending	309L	4332S	SS/CMn	+
C1		309LMS			pending

Chemical composition (w%) and Ferrite Number (FN), Typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	FN
M21/C1	0.03	1.2	0.6	23.3	12.6	15

Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) +20°C	Impact ISO-V(J) -20°C
Required: AWS A5.22			not required	min. 520	min. 30		
ISO 17663			min. 320	min. 510	min. 25		
Typical values	M21/C1	AW	440	565	37	60	55

Packaging and available sizes

Unit type	Diameter (mm) 1.2
5 kg plastic spool S200	X
15 kg spool S300	X

FCAW

Materials to be welded

Steel grades	EN 10088-11-2	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Corrosion resistant cladsteels				
	X2 CrNiN 18-10	1.4311	(TP)304LN	S30453
	X2 CrNi 19-11	1.4306	(TP)304L	S30403
			CF-3	J92500
	X4 CrNi 18-10	1.4301	(TP)304	S30400

Dissimilar metals (mild and low alloyed steel to CrNi or CrNiMo stainless steel)
Build-up welding on mild and low alloyed steel

Welding parameters, optimum fill passes in shielding gas M21/C1

Diameter (mm)	Welding positions			
	PA/1G	PB/2F	PC/2G	PF/3G up
1.2	100-250A	100-250A	100-200A	100-200A

FCAW

Remarks/ Application advice

Use for downhand welding: Cor-A-Rosta 309L

Cor-A-Rosta 309MoL

Stainless steel rutile cored wire

Classification

AWS A5.22 : E309LMoT0-1/-4
ISO 17663 : T 23 12 2 L R C/M 3

General description

Gas shielded flux cored high CrNiMo alloyed wire electrode for downhand welding
High Corrosion resistant deposit
Specially developed for welding stainless steel to mild steel and buffer layers in cladding
Maximum plate thickness in butt welds ~ 12 mm
Suitable for repair welding in dissimilar joints and steels difficult to weld

Welding positions

ISO/ASME PA/1G PB/2F PC/2G

Current type/Shielding gas

DC +
Ar+ (>5-25%) CO_2 (ISO 14175: M21)
100% CO_2 (ISO 14175: C1)
15-25 l/min

Approvals

Shielding gas	BV	DNV	LR	TÜV
M21		309MoLMS		+
C1	UP	309MoLMS	SS/CMn	+

FCAW

Chemical composition (w%) and Ferrite Number (FN), Typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Mo	FN
M21/C1	0.03	1.3	0.6	23.0	12.8	2.3	20

Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.22			not required	min. 520	min. 25	
ISO 17663			min. 350	min. 550	min. 25	
Typical values	M21/C1	AW	545	695	29	50

Packaging and available sizes

Unit type	Diameter (mm) 1.2	1.6
15 kg spool S300	X	X

Cor-A-Rosta 309MoL: rev. EN 22

Cor-A-Rosta 309MoL

Materials to be welded

Steel grades	EN 10088-11-2	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Corrosion resistant cladsteels				
	X2 CrNiMo 17-12-2	1.4404	(TP)316L	S31603
			CF-3M	J92800
	X2 CrNiMo 18-14-3	1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2	1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3	1.4429		
	X4 CrNiMo 17-13-3	1.4436		
	X6 CrNiMoTi 17-12-2	1.4571	316Ti	S31635
	X10 CrNiMoTi 17-3	1.4573	316Ti	S31635
	X6 CrNiMoNb 17-12-2	1.4580	316Cb	S31640

Welding dissimilar metals: mild steel or low alloyed steel to stainless CrNi or CrNiMo-steel up to max. thickness of 12 mm.
Build-up welding on mild and low alloyed steel

Welding parameters, optimum fill passes in shielding gas M21/C1

Diameter (mm)	Welding positions		
	PA/1G	PB/2F	PC/2G
1.2	100-250A	100-250A	100-200A

Remarks/ Application advice

Use for positional welding Cor-A-Rosta P309MoL

Cor-A-Rosta P309MoL

Stainless steel rutile cored wire

Classification

AWS A5.22 : E309LMoT1-1/-4
ISO 17663 : T 23 12 2 L P C/M 2

General description

Gas shielded flux cored high CrNi alloyed wire electrode for positional welding
High corrosion resistant deposit
Specially developed for welding stainless steel to mild steel and buffer layers in cladding
Maximum plate thickness in butt welds ~ 12 mm
Suitable for repair welding in dissimilar joints and steels difficult to weld

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>5-25%) CO_2 (ISO 14175: M21)
100% CO_2 (ISO 14175: C1)
15-25 l/min

Approvals

Shielding gas	BV	DNV	LR
M21	309LMo	309MoLMS	SS/CMn

Chemical composition (w%) and Ferrite Number (FN), Typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Mo	FN
M21/C1	0.03	0.8	0.6	22.7	12.5	2.3	20

Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm^2)	Tensile strength (N/mm^2)	Elongation (%)	Impact ISO-V(J) -20°C
Required: AWS A5.22			not required	min. 520	min. 25	
ISO 17663			min. 350	min. 550	min. 25	
Typical values	M21/C1	AW	525	675	34	45

Packaging and available sizes

Unit type	Diameter (mm) 1.2
15 kg spool S300	X

FCAW

Cor-A-Rosta P309MoL

Materials to be welded

Steel grades	EN 10088-11-2	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Corrosion resistant cladsteels				
	X2 CrNiMo 17-12-2	1.4404	(TP)316L	S31603
			CF-3M	J92800
	X2 CrNiMo 18-14-3	1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2	1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3	1.4429		
	X4 CrNiMo 17-13-3	1.4436		
	X6 CrNiMoTi 17-12-2	1.4571	316Ti	S31635
	X10 CrNiMoTi 17-3	1.4573	316Ti	S31635
	X6 CrNiMoNb 17-12-2	1.4580	316Cb	S31640

Welding dissimilar metals: mild steel or low alloyed steel to stainless CrNi or CrNiMo-steel up to max. thickness of 12 mm.
Build-up welding on mild and low alloyed steel

Welding parameters, optimum fill passes in shielding gas M21/C1

Diameter (mm)	Welding positions			
	PA/1G	PB/2F	PC/2G	PF/3G up
1.2	100-250A	100-250A	100-200A	100-200A

Remarks/ Application advice

Use for downhand welding Cor-A-Rosta 309MoL

Cor-A-Rosta 4462

Stainless steel rutile cored wire

Classification

AWS A5.22 : E2209T0-4
ISO 17663 : T 22 9 3 N L R M 3

General description

Gas shielded flux cored wire electrode for duplex stainless steel welding in downhand position
Excellent weldability
Applicable up to a service temperature of 280°C
High resistance to general corrosion, pitting and stress corrosion conditions
High yield strength > 500 N/mm²

Welding positions

ISO/ASME PA/1G PB/2F PC/2G

Current type/Shielding gas

Ar+ (>5-25%) CO_2 (ISO 14175: M21)
15-25 l/min

Approvals

Shielding gas	DNV	TÜV
M21	+	+

Chemical composition (w%) and Ferrite Number (FN), Typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Mo	N	FN
M21	0.03	1.2	0.6	23.0	9.3	3.1	0.13	40

Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -20°C	Impact ISO-V(J) -50°C
Required: AWS A5.22			not required	min. 690	min. 20		
ISO 17663			min. 450	min. 550	min. 20		
Typical values	M21	AW	635	805	29	38	30

Packaging and available sizes

Unit type	Diameter (mm) 1.2
15 kg spool S300	X

FCAW

Back

Materials to be welded

Steel grades	EN 10088-11-2	W.Nr.	ASTM / ACI A240	UNS
Duplex stainless steels				
	X2 CrNiMoN 22 -5-3	1.4462		S31803
		1.4417		S31500
	X3 CrNiMoN 27-5-2	1.4460		S31200
	X2 CrNiN 23-4	1.4362		S32304

Dissimilar joints such as un- and low alloyed steel to duplex stainless steel

Welding parameters, optimum fill passes in shielding gas M21

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G
1.2	100-250A	100-250A	100-200A

Remarks/ Application advice

Use for positional welding Cor-A-Rosta P4462

Cor-A-Rosta P4462

Stainless steel rutile cored wire

Classification

AWS A5.22 : E2209T1-4
ISO 17663 : T 22 9 3 N L P C/M 2

General description

Gas shielded flux cored wire electrode for positional welding of duplex stainless steel
Excellent weldability
Applicable up to a service temperature of 280°C
High resistance to general corrosion, pitting and stress corrosion conditions
High yield strength > 500 N/mm²
M21 shielding gas is recommended

Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3Gup PE/4G

Current type/Shielding gas

DC +
Ar+ (>5-25%) CO_2 (ISO 14175: M21/C1)
15-25 l/min

Approvals

Shielding gas	DNV
M21	+

FCAW

Chemical composition (w%) and Ferrite Number (FN), Typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Mo	N	FN
M21	0.03	1.2	0.6	23.0	9.2	3.1	0.13	40

Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J) -20°C	-50°C	-75°C
Required: AWS A5.22			not required	min. 690	min. 20			
ISO 17663			min. 450	min. 550	min. 20			
Typical values	M21	AW	640	790	29	60	55	30

Packaging and available sizes

Unit type	Diameter (mm) 1.2
15 kg spool S300	X

Materials to be welded

Steel grades	EN 10088-11-2	W.Nr.	ASTM / ACI A240	UNS
Duplex stainless steels				
	X2 CrNiMoN 22 -5-3	1.4462		S31803
		1.4417		S31500
	X3 CrNiMoN 27-5-2	1.4460		S31200
	X2 CrNiN 23-4	1.4362		S32304

Dissimilar joints such as un- and low alloyed steel to duplex stainless steel

Welding parameters, optimum fill passes in shielding gas M21/C1

Diameter (mm)	Welding positions PA/1G	PB/2F	PC/2G	PF/3G up
1.2	100-250A	100-250A	100-200A	130-180A

FCAW

Remarks/ Application advice

Use for downhand welding Cor-A-Rosta 4462

Hardfacing cored wire

Classification

DIN 8555 : MF1-GF-350-GPS
EN 14700 : T Fe 1

General description

Lincore 33 is a self shielded, open arc, flux cored tubular electrode designed primarily for the build-up of steel parts or as a buttering layer prior to hardfacing. Arc characteristics are excellent producing a soft low penetration arc (ideal for build-up) that exhibits low spatter levels and excellent slag removal. Although, Lincore 33 is primarily designed for the open arc operation, it may be used under a neutral flux for conditions requiring spatter elimination and removal of arc glare

Application

Lincore 33 produces a crack-free wear resistant deposit with a hardness range of 25-35 HRc depending on material dilution and number of layers. Designed primarily as a final overlay on steel parts which need to be machined or as a build-up layer of other hardfacing materials. It is particularly suitable of conditions of moderate abrasion and friction, coupled with resistance to impact such as APLs involving rolling, sliding and metal to metal wear.

Typical applications include:

Buildup:
Shovel and bucket lips
Pump impellers and housings
Dredge and shovel bucket teeth
Mill and crushing hammers

HARDFACING:
Crane and mine car wheels
Tractor rolls, idlers, links and sprockets
Cable drums
Shafts
Roller guides

FCAW

Mechanical properties, all weld metal

	Typical hardness values
Layer 1	21-30 HRc (230-290HB)
Layer 2	26-32 HRc (260-300HB)
Layer 3	25-35 HRc (250-330HB)

Welded on Mild Steel Plate (12mm)

Packaging and available sizes

Unit type	Diameter (mm)			
	1.1	1.6	2.0	2.8
6.35 kg coil 14C			X	
10 kg coil 22RR	X	X	X	
22.68 kg coil 50C			X	X

Additional information

All work-hardened base material should be removed prior to applying Lincore 33 to prevent embrittlement and cracking.

Welding positions

ISO/ASME PA/1G

Current type

DC +

Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Al
0.14	2.2	0.55	1.3	1.8

Structure

In the as welded condition the microstructure consists mainly of a mixture of ferrite and bainite

Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (A)	Arc Voltage (volts)	Deposition Rate (kg/h)	Efficiency (%)
1.1	5.1 to 12.7	80-150	25-31	1.5-3.9	80-85
1.6	3.8 to 8.9	125-225	26-32	2.1-5.0	79-84
2.0	3.2 to 6.4	200-325	23-29	3.1-6.1	87-86

Complementary products

Complementary products include Wearshield® BU30

Hardfacing cored wire

Classification

DIN 8555 : MF1-GF-400-GPS

General description

Lincore 40-O is a self shielded, open arc, flux cored tubular electrode that produces a martensitic deposit. The arc characteristics are excellent producing minimal spatter and good slag removal. Although, Lincore 40-O is primarily designed for the open arc operation, it may be used with a neutral flux for conditions requiring spatter elimination and removal of arc glare.

Application

This electrode provides an overlay hardfacing deposit on carbon and low alloy steels that resists rolling, sliding and metal-to-metal wear under heavy impact conditions. The deposit has a hardness of about 40 HRc which fills in the rather large hardness gap between the ferritic barnite buildup deposit of Lincore 33 and the martensitic deposit from Lincore 55 designed for metal-to-metal wear. Although the electrode is designed to provide a hardfacing deposit by itself, it could be used as a build-up electrode to provide a base on which harder deposits could be overlaid.

Typical applications include:

Bucket links
Bucket bases
Guide rolls
Tractor rollers
Actuating cams
Steel shafts
Crane wheels
Mine car wheels

FCAW

Mechanical properties, all weld metal

	Typical hardness values
Layer 1	ca. 36 HRc (340HB)
Layer 2	ca. 41 HRc (380HB)

Packaging and available sizes

Unit type	Diameter (mm)	
	2.0	2.8
10 kg coil 22RR	X	
22.68 kg coil 50C		X

Additional information

The area to be hardfaced should be clean and free of rust, scale, oil, grease or dirt of any kind. Any previous hardfacing deposit that has been embrittled by severe work hardening should also be removed. Irregularities such as cracks, low spots etc. should be properly repaired before hardfacing. Cold parts should be preheated to at least 40°C. Larger parts, and those made of higher alloy or higher carbon steel, should be preheated to the 100-150°C range.

Welding positions

ISO/ASME PA/1G

Current type

DC +

Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Mo	Al
0.2	1.5	0.7	3.5	0.4	1.8

Structure

Martensitic

Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (A)	Arc Voltage (volts)	Deposition Rate (kg/h)	Efficiency (%)
2.0	3.2 to 6.4	200-325	23-29	3.1-6.1	87-86

Complementary products

Complementary products include Wearshield® MM40

Hardfacing cored wire

Classification

DIN 8555 : MF6-GF-50-GP

General description

Lincore 50-O is a self shielded, open arc, flux cored tubular electrode that produces a primary austenite and austenite-carbide eutectic weld deposit. The arc characteristics are excellent producing minimal spatter and good slag removal. Although, Lincore 50 is primarily designed for the open arc operation, it may be used with a neutral flux for conditions requiring spatter elimination and removal of arc glare. The as welded deposit usually check cracks.

Application

Lincore 50 produces an abrasion and impact resistant deposit with a hardness range of 34-56HRc depending on base metal chemistry, material dilution and number of layers. The combination of abrasion and impact resistance coupled with hot forging properties makes Lincore 50 particularly suitable for APLs involving transportation of abrasive media under heavy variable loading.

Typical applications include:

Dipper and dredge cutter teeth
Rock crusher hammers and mill hammers
Rock crushers and crusher mantles
Screw flights
Coal mining cutters
Conveyor buckets and rolls
Plough shares, scrapper blades and cultivator sweeps
Truck chain and gears
Dragline buckets, links and chains

Mechanical properties, all weld metal

	Typical hardness values
Layer 1	34-41 HRc (320-380HB)
Layer 2	44-53 HRc (415-530HB)
Layer 3	48-56 HRc (460-584HB)

Welded on Mild Steel Plate (12mm)

Packaging and available sizes

Unit type	Diameter (mm)			
	1.1	1.6	2.0	2.8
10 kg coil 22RR			X	
11,34 kg coil 22RR	X	X		
22.68 kg coil 50C	X	X	X	X

Additional information

All work-hardened base material and previously deposited hardfacing material should be removed prior to applying a new deposit, since such areas are prone to embrittlement and possible cracking. Areas that contain irregularaties such as cracks and deep gouges can be repaired locally using Wearshield BU30 or Wearshield 15CrMn prior to hardfacing with Lincore 50.

Welding positions

ISO/ASME PA/1G

Current type

DC +

Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Mo	Al
2.2	1.2	1.0	11.0	0.5	0.6

Structure

In the as welded condition the microstructure consists mainly of primary austenite with an austenite-carbide eutectic

Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (A)	Arc Voltage (volts)	Deposition Rate (kg/h)
1.1	5.1 to 15.2	120 - 250	20 - 28	1.9 - 5.8
1.6	3.8 to 8.9	175 - 365	23 - 33	2.7 - 7.9
2.0	3.2 to 6.4	210 - 380	27 - 23	3.4 - 6.8
2.8	2.0 to 3.3	315 - 450	26 - 29	3.9 - 6.4

Complementary products

There is no direct equivalent to Lincore 50 although Wearshield® ABR and Wearshield® 44 are the nearest.

Hardfacing cored wire

Classification

DIN 8555 : MF2-GF-55-GP

General description

Lincore 55 is a self shielded, open arc, flux cored tubular electrode designed to provide a hardfacing overlay on new or old steel components. Although, Lincore 55 is primarily designed for the open arc operation, it may be used under a neutral flux for conditions requiring spatter elimination and removal of arc glare. A long stickout for maximum efficiency and minimum penetration.

Application

Lincore 55 produces a martensitic and some retained austenite deposit with a hardness range of 50-59HRc. This microstructure makes Lincore 55 particularly suitable for APLs involving sliding, rolling and metal to metal wear, coupled with resistance to mild abrasion. Typical APLs include:

Typical applications include:

Crane and mine car wheels
Sprockets and gear teeth
Skip guides
Dredger buckets
Scrapper blades
Transfer tables
Cable sheaves

Mechanical properties, all weld metal

	Typical hardness values
Layer 1	50 - 59 HRc
Layer 2	50 - 59 HRc

Welded on Mild Steel Plate (12mm)

Packaging and available sizes

Unit type	Diameter (mm)		
	1.1	1.6	2.0
6.35 kg coil 14C			X
10 kg coil 22RR			X
11,34 kg coil 22RR	X		
22.68 kg coil 50C			X

Additional information

All work-hardened base material and previously deposited material should be removed prior to applying a new deposit, since such areas are prone to embrittlement and possible cracking.

Welding positions

ISO/ASME PA/1G

Current type

DC +

Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Mo	Al
0.45	1.4	0.55	5.3	0.8	1.4

Structure

In the as welded condition the microstructure consists mainly of martensite with some retained austenite

Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (A)	Arc Voltage (volts)	Deposition Rate (kg/h)	Efficiency (%)
1.1	5.1 to 12.7	85 - 165	25 - 31	1.6 - 4.3	80 - 85
1.6	3.8 to 8.9	125 - 245	26 - 32	2.2 - 5.5	79 - 84
2.0	3.2 to 6.4	190 - 330	24 - 30	3.2 - 6.2	87 - 86

Complementary products

Complementary products include Wearshield® MM and Wearshield® MI(e).

Hardfacing cored wire

Classification

DIN 8555 : MF10-GF-60-CG

General description

Lincore 60-O is a self shielded, open arc, flux cored tubular electrode that produces a primary carbide weld deposit. Although , designed primarily for the open arc process it can be used with a neutral flux to improve the weld shape, minimise fume and remove arc glare.

Application

Lincore 60-O produces an primary carbide weld deposit with a hardness range of 55-60HRc. The primary carbide microstructure makes Lincore 60-O ideally suitable for APLs of severe abrasion. Typical APLs include:

Typical applications include:

Crusher rolls, plates and jaws
Conveyor screws and sleaves
Bucket and shovel lips
Brick & coke machinery
Cement mill parts

FCAW

Mechanical properties, all weld metal

	Typical hardness values
Layer 1	55 - 60 HRc
Layer 2	58 - 60 HRc

Welded on Mild Steel Plate (12mm)

Packaging and available sizes

Unit type	Diameter (mm)		
	1.1	1.6	2.0
10 kg coil 22RR			X
11,34 kg coil 22RR	X	X	
22.68 kg coil 50C			X

Additional information

When welding with Lincore 60-O stringer beads should be employed. Weaving is not advised since wide weaves generally increase the check crack spacing which can result in deposit spalling. Preheat is not necessary when surfacing austenitic substrates such as stainless steels and manganese steels, although the interpass temperature should be limited to about 260°C for manganese steels. For low alloy and high carbon steels a preheat of 200°C is necessary to prevent heat affected zone

Welding positions

ISO/ASME PA/1G

Current type

DC +

Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Al
4.2	1.6	1.3	25.4	0.6

Structure

In the as welded condition the microstructure consists of primary carbides in an austenite - carbide eutectic matrix

Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (A)	Arc Voltage (volts)	Deposition Rate (kg/h)
1.1	5.1 to 12.7	125 - 210	21 - 27	1.9 - 4.7
1.6	5.1 to 11.4	240 - 350	28 - 33	3.4 - 7.5
2.0	6.4 to 3.2	250 - 400	25 - 32	3.4 - 6.9

Complementary products

Complementary products include Wearshield® 60

Hardfacing cored wire

Classification

DIN 8555 : MF4-GF-60-S

General description

Lincore T&D is a self shielded, open arc, flux cored tubular electrode that produces a H12 type airhardening tool steel deposit. The arc characteristics are excellent producing minimal spatter and good slag removal. Although, Lincore T&D is primarily designed for the open arc operation, it may be used with a neutral flux for conditions requiring spatter elimination and removal of arc glare.

Application

Lincore T&D produces a crack-free wear resistant tool steel deposit with a hardness range of 48- 55HRc. The hardness can be further increased to between 55-65HRc after tempering. It is particularly suitable for APLs involving severe metal to metal wear coupled with elevated temperatures (up to 540°C). Ideally suited to the build up of worn steel dies, cutting tools or the APL of wear resistant surfaces to carbon and low alloy steels.

Typical applications include:

Punch and forging dies
Shear blades
Trimmers
Cutting tools

Mechanical properties, all weld metal

	Typical hardness values
As welded	48 - 55 HRc
Tempered at 540°C	55 - 65 HRc

Welded on Mild Steel Plate (12mm)

Packaging and available sizes

Unit type	Diameter (mm)	
	1.6	2.8
10 kg coil 22RR	X	
22.68 kg coil 50C		X

Additional information

A preheat and interpass temperature of 325°C, or higher (up to 540°C), are necessary to avoid cracking. It is important to ensure that an adequate “soak” is achieved prior to the welding operation. After welding, the component should be covered and slow cooled down to room temperature. Once cooled, the weldment should be post weld heat treated to temper the martensite and toughen the deposit. Tempering at 540°C normally produces the optimum combination of

Welding positions

ISO/ASME PA/1G

Current type

DC +

Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Mo	W	Al
0.65	1.5	0.8	7.0	1.4	1.6	1.8

Structure

In the as welded condition the microstructure consists mainly of martensite with some carbides. After tempering the microstructure consists of tempered martensite with secondary carbides

Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (A)	Arc Voltage (volts)	Deposition Rate (kg/h)
1.6	3.8 to 8.9	170 - 300	22 - 26	2.4 - 5.4
2.8	2.5 to 5.1	340 - 500	26 - 30	4.7 - 9.1

Complementary products

Complementary products include Wearshield® T&D

Lincore® 15CrMn

Hardfacing cored wire

Classification

DIN 8555 : MF7-GF-250-KP

General description

Lincore 15CrMn is a self shielded, open arc, flux cored tubular electrode that exhibits excellent arc characteristics, clean slag detachability, and low spatter levels. Although, Lincore 15CrMn is primarily designed for the open arc operation, it may be used under neutral flux for conditions requiring spatter elimination and removal of arc glare.

Application

Lincore 15CrMn produces a premium austenitic chromium-manganese deposit. The term premium is used because the weld metal has sufficient alloy content te produce a single pass austenitic deposit on ordinary carbon steel. The deposit rapidly work hardens under impact making it particularly suitable for APLs of high impact and gouging coupled with moderate abrasion. In addition to surfacing, the high crack resistance of this alloy design makes Lincore 15CrMn an ideal electrode for joining manganese steel to itself or carbon steels with minimal the risk of centerline cracking. Joining by the SAW process, however, is not recommended.

Typical applications include:

Railroad frogs
Track ends
Crusher hammers and screens
Earth moving equipment
Rebuilding of austenitic manganese plates and components
Construction equipment

Mechanical properties, all weld metal

	Typical hardness values
As deposited	18 - 22 HRc (210-235 HB)
Work Hardened	40 - 50 HRc (375-490HB)

Packaging and available sizes

Unit type	Diameter (mm)	
	2.0	2.8
6.35 kg coil 14C	X	
10 kg coil 22RR	X	
22.68 kg coil 50C	X	X

Additional information

All work-hardened base material and previously deposited material should be removed prior to applying a new deposit, since such areas are prone to embrittlement and possible cracking. No preheat is required on austenitic manganese steels although a preheat of between 150-200°C may be necessary on carbon and low steels to prevent heat affected zone cracking.

Welding positions

ISO/ASME PA/1G

Current type

DC +

Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr
0.4	15.0	0.25	16.0

Structure

In the as welded condition, the microstructure consists of a soft chromium manganese alloy austenite which rapidly work hardens under impact loading

Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (A)	Arc Voltage (volts)	Deposition Rate (kg/h)
2.0	3.2 to 8.9	210 - 380	26 - 32	3.3 - 9.7
2.8	1.9 to 4.4	250 - 380	26 - 30	2.5 - 7.5

Complementary products

Complementary products include Wearshield® 15CrMn

Hardfacing cored wire

Classification

DIN 8555 : MF6-GF-55-CGR

General description

Lincore 420 is a self shielded, open arc, flux cored tubular electrode that produces a martensitic deposit similar to AISI 420 stainless steel. The arc characteristics are excellent producing minimal spatter and good slag removal.

Application

Lincore 420 is martensitic stainless hardfacing electrode designed to provide overlay deposits that resists metal wear under corrosion.

Typical applications include:

Sand pumps
Dredging equipment
Fans
Valve seats in steam and liquid pipes

FCAW

Mechanical properties, all weld metal

	Typical hardness values
Layer 1	52 HRc
Layer 2	51 HRc
Layer 3	53 HRc

Welded on Mild Steel Plate (12mm)

Packaging and available sizes

Unit type	Diameter (mm)			
	1.6	2.4	3.2	4.0
14 kg spool S300	X			
22.68 kg coil 50C		X	X	
272.2 kg speed-feed® drum			X	X

Additional information

All work-hardened base material and previously deposited material should be removed prior to applying a new deposit, since such areas are prone to embrittlement and possible cracking.

Welding positions

ISO/ASME PA/1G

Current type

DC +

Chemical composition (w%), typical, all weld metal

ø1.6 mm	C	Mn	Si	Cr	ø2.0 mm	C	Mn	Si	Cr
	0.5	1.7	0.9	11		0.5	1.4	0.7	11

Structure

Martensitic + ferretic

Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (A)	Arc Voltage (volts)	Deposition Rate (kg/h)
1.1	5.1 to 15.2	120 - 250	20 - 28	1.9 - 5.8
1.6	3.8 to 8.9	175 - 365	23 - 33	2.7 - 7.9
2.0	3.2 to 6.4	210 - 380	27 - 23	3.4 - 6.8

Complementary products

Complementary products include Wearshield® 420

Hardfacing cored wire

Classification

DIN 8555 : MF6-GF-45-KP

General description

Lincore M is a selfshielded, open arc, flux cored tubular electrode
Deposition of austenitic manganese steel with 14% manganese

Application

Lincore M is designed for rebuilding and hardfacing of manganese steel, carbon steel and low alloy steel parts
Typical APLs include: Rail crossovers, frogs and switchpoints

Typical applications include:

Rail crossovers, frogs and switches
Dipper teeth and lips
Crusher hammers
Crushers screens and grizzlies
Chain hooks
Dredge parts, pump shells
Parts for safes and vaults
Manganese bucket fronts
Crusher rolls
Dragline pins and links
Rolling mill parts
Drive sprockets
Shovel tracks

FCAW

Mechanical properties, all weld metal

	Typical hardness values
As deposited	18-28 Rc
Work Hardened	30-48 Rc

Packaging and available sizes

Unit type	Diameter (mm) 2.0
10 kg coil 22RR	X

Additional information

All work-hardened base material and previously deposited material should be removed prior to applying a new deposit, since such areas are prone to embrittlement and possible cracking.

Welding positions

ISO/ASME PA/1G

Current type

DC +

Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni
0.6	13.0	0.4	4.9	0.5

Structure

Martensitic + ferretic

Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (A)	Arc Voltage (volts)	Deposition Rate (kg/h)
2.0	3.2 to 6.4	240 - 360	24 - 29	2.9 - 6.2

Complementary products

Complementray products include Wearshield® Mangjet (e)