

# 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, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	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

Innershield® NR®-152: rev. EN 21

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

# Innershield® NR®-152

## Materials to be welded

Steel grades/Standard      Type

### General structural steel

EN 10025 part 2      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 10025 part 3      S275, S355

EN 10025 part 4      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	Welding position		
		PA/1G	PC/2G	PG/3G (down)
1.6	PB/2F			
	Wire feed speed (cm/min.)	180	150	200
	Current (A)	205	170	220
	Voltage (V)	16.5	18.5	19.5

## Remarks/ Application advice

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

# 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, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	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

Innershield® NR®-203 NiC: rev. EN 21

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# Innershield® NR®-203 NiC

## Materials to be welded

Steel grades/Standard	Type
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### General structural steel

EN 10025 part 2	S185, S235, S275, S355
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### Ship plates

ASTM A131	Grade A, B, D, AH32 to DH36
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### Cast steel

EN 10213-2	GP240R
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### Pipe material

EN 10208-1	L210, L240, L290, L360
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EN 10208-2	L240, L290, L360
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API 5LX	X42, X46, X52
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EN 10216-1/	P235T1, P235T2, P275T1
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EN 10217-1	P275T2, P355N
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### Boiler & pressure vessel steel

EN 10028-2	P235GH, P265GH, P295GH, P355GH
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### Fine grained steel

EN 10025 part 3	S275, S355
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EN 10025 part 4	S275, S355
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## 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	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

## Remarks/ Application advice

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

# Innershield® NR®-203Ni1

## Self-shielded cored wire

### Classification

AWS A5.29/A5.29M : E71T8-Ni1  
EN ISO 17632-A : T 42 3 1Ni Y N 1

### 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



### Current type

DC -

### Approvals

ABS	BV	DNV	GL	LR	RINA	TÜV
3SA,3YSA	SA3YMH	IIYMSH10	3YSH10	3S,3YSH15	3S,3YS	+

### 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, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-(VJ) -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

Innershield® NR®-203Ni1: rev. EN 22

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# Innershield® NR®-203Ni1

## Materials to be welded

Steel grades/Standard	Type
<b>General structural steel</b>	
EN 10025 part 2	S185, S235, S275, S355
<b>Ship plates</b>	
ASTM A131	Grade A, B, D, AH32 to DH36
<b>Cast steel</b>	
EN 10213-2	GP240R
<b>Pipe material</b>	
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
<b>Boiler &amp; pressure vessel steel</b>	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
<b>Fine grained steel</b>	
EN 10025 part 3	S275, S355
EN 10025 part 4	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	Welding position						
		PA/1G	PB/2F	PC/2G	PF/3G up	PG/5G up	PG/3G 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			

## Remarks/ Application advice

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

# Innershield® NR®-211-MPE

## Self-shielded cored wire

### Classification

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

### General description

**Self shielding: easiest equipment arrangement**

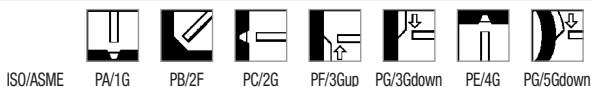
**General purpose welding**

**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



### Current type

DC -

### Approvals

BV	LR
+	AWS

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

C	Mn	Si	P	S	Al
0.21	0.65	0.25	0.010	0.003	1.3

### Mechanical properties, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J)
Required:	AWS A5.20	min. 400	480	20	not required
Typical values	AW	450	610	22	

### 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

### Remarks/ Application advice

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

Innershield® NR®-211-MPE: rev. EN

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# Innershield® NR®-211-MPE

## Materials to be welded

Steel grades/Standard	Type
<b>General structural steel</b>	
EN 10025 part 2	S185, S235, S275, S355
<b>Ship plates</b>	
ASTM A131	Grade A, B, D, AH32 to DH36
<b>Cast steel</b>	
EN 10213-2	GP240R
<b>Pipe material</b>	
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
<b>Boiler &amp; pressure vessel steel</b>	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
<b>Fine grained steel</b>	
EN 10025 part 3	S275, S355
EN 10025 part 4	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	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	230	190
	Current (A)	320	250	320	250	250
	Voltage (V)	21	18	19.5	18	18
2.4	Wire feed speed (cm/min.)	230	180	230	230	140
	Current (A)	350	275	350	250	250
	Voltage (V)	19.5	19	19.5	18	18

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# 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



PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G

ISO/ASME

### Current type

DC -

### Approvals

ABS	BV	DNV	LR	RINA	TÜV	NKK
3SA,3YSAH15	SA3YMH	IIYMSH15	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, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J)	
					-20°C	-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

Innershield® NR®-232: rev. EN 21

# Innershield® NR®-232

## Materials to be welded

Steel grades/Standard      Type

### General structural steel

EN 10025 part 2      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 10025 part 3      S275, S355, S420

EN 10025 part 4      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	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

## Remarks/ Application advice

Designed for the semi-automatic welding of 5mm and thicker steel

Recommended for single and multi-pass 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

# 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, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	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

Innershield® NR®-233: rev. EN 21

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# Innershield® NR®-233

## Materials to be welded

Steel grades/Standard	Type
<b>General structural steel</b>	
EN 10025 part 2	S185, S235, S275, S355
<b>Ship plates</b>	
ASTM A131	Grade A, B, D, AH32 to DH36
<b>Cast steel</b>	
EN 10213-2	GP240R
<b>Pipe material</b>	
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
<b>Boiler &amp; pressure vessel steel</b>	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
<b>Fine grained steel</b>	
EN 10025 part 3	S275, S355
EN 10025 part 4	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

## Remarks/ Application advice

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

# 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



### Current type

DC -

### Approvals

BV	DNV	GL	TÜV
SA3YMH	IIYMSH15	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, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	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

Innershield® NR®-207: rev. EN 21

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# Innershield® NR®-207

## Materials to be welded

Steel grades/Standard	Type
<b>General structural steel</b>	
EN 10025 part 2	S185, S235, S275, S355
<b>Ship plates</b>	
ASTM A131	Grade A, B, D, AH32 to DH36
<b>Pipe material</b>	
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
<b>Fine grained steel</b>	
EN 10025 part 3	S275, S355
EN 10025 part 4	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	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

## Remarks/ Application advice

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

# 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, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	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

Innershield® NR®-207-H: rev. EN 21

# Innershield® NR®-207-H

## Materials to be welded

Steel grades/Standard      Type

### General structural steel

EN 10025 part 2                      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 10025 part 3                      S275, S355

EN 10025 part 4                      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	-

## Remarks/ Application advice

Where low hydrogen weld metal is required

High productivity welding

Where arctic mechanical properties are required in general construction welding

Semi-automatic pipe welding



# 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, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	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

Innershield® NR®-208-H: rev. EN 21

# Innershield® NR®-208-H

## Materials to be welded

Steel grades/Standard	Type
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### 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	-

## Remarks/ Application advice

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

# 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	IYMS

### 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, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	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

Innershield® NR®-305: rev. EN 21

# Innershield® NR®-305

## Materials to be welded

Steel grades/Standard	Type
<b>General structural steel</b>	
EN 10025 part 2	S185, S235, S275, S355
<b>Ship plates</b>	
ASTM A131	Grade A, B, D, AH32 to DH36
<b>Cast steel</b>	
EN 10213-2	GP240R
<b>Pipe material</b>	
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
<b>Boiler &amp; pressure vessel steel</b>	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
<b>Fine grained steel</b>	
EN 10025 part 3	S275, S355
EN 10025 part 4	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	
		Wire feed speed (cm/min.)	Voltage (V)	Wire feed speed (cm/min.)	Voltage (V)
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		

## Remarks/ Application advice

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.

# 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, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	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

Innershield® NR®-311: rev. EN 21

# Innershield® NR®-311

## Materials to be welded

Steel grades/Standard	Type
<b>General structural steel</b>	
EN 10025 part 2	S185, S235, S275, S355
<b>Ship plates</b>	
ASTM A131	Grade A, B, D, AH32 to DH36
<b>Cast steel</b>	
EN 10213-2	GP240R
<b>Pipe material</b>	
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
<b>Boiler &amp; pressure vessel steel</b>	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
<b>Fine grained steel</b>	
EN 10025 part 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	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	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

## Remarks/ Application advice

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

# 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	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, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	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

Innershield® NR®-400: rev. EN 23

# Innershield® NR®-400

## Materials to be welded

Steel grades/Standard      Type

### General structural steel

EN 10025 part 2                      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 10025 part 3                      S275, S355

EN 10025 part 4                      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	Welding position			
		PA/1G	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

## Remarks/ Application advice

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



# Innershield® NR®-450-H

## Self-shielded cored wire

### Classification

AWS A5.29/A5.29M : E71T8-Ni2 <sup>1)</sup>  
<sup>1)</sup> also meets: E81T8-Ni2

### General description

Self shielding: easiest equipment  
Higher strength level, yield strength up to 450 N/mm<sup>2</sup>  
Excellent impact toughness at -40°C  
CTOD tested, offshore constructions

### Welding positions



### 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, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -29°C	-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

Innershield® NR®-450-H: rev. EN 22

# Innershield® NR®-450-H

## Materials to be welded

Steel grades/Standard	Type
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### General structural steel

EN 10025 part 2	S185, S235, S275, S355
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### Ship plates

ASTM A131	Grade A, B, D, AH32 to EH36
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### Cast steel

EN 10213-2	GP240R
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### Pipe material

EN 10208-1	L210, L240, L290, L360, L415, L445
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EN 10208-2	L240, L290, L360
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API 5LX	X42, X46, X52, X60
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EN 10216-1/	P235T1, P235T2, P275T1
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EN 10217-1	P275T2, P355N
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### Boiler & pressure vessel steel

EN 10028-2	P235GH, P265GH, P295GH, P355GH
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### Fine grained steel

EN 10025 part 3	S275, S355, S420
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EN 10025 part 4	S275, S355, S420
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## 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

## Remarks/ Application advice

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

# 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/mm<sup>2</sup>

Excellent impact toughness at -40°C

CTOD tested, offshore constructions

### Welding positions



PA/1G



PB/2F



PC/2G



PF/3Gup



PE/4G



PF/5Gup

ISO/ASME

### 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, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J)	
					-18°C	-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

Innershield® NR®-550-H: rev. EN 22

# Innershield® NR®-550-H

## Materials to be welded

Steel grades/Standard	Type
<b>General structural steel</b>	
EN 10025 part 2	S185, S235, S275, S355
<b>Ship plates</b>	
ASTM A131	Grade A, B, D, AH32 t/m EH36
<b>Cast steel</b>	
EN 10213-2	GP240R
<b>Pipe material</b>	
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
<b>Boiler &amp; pressure vessel steel</b>	
EN 10028-2	P235GH, P265GH, P295GH, P355GH
<b>Fine grained steel</b>	
EN 10025 part 3	S275, S355, S420
EN 10025 part 4	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

## Remarks/ Application advice

- 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

# Innershield® NS®-3ME

## Self-shielded cored wire

### Classification

AWS A5.20/A5.20M : E70T-4  
EN ISO 17632-A : T 46 Z V N 3

### General description

NS-3ME 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	0.25	0.006	0.006	1.40

### Mechanical properties, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J)
Required:	AWS A5.20	460	530-670	22	not required
Typical values	AW	470	640	27	

### 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

Innershield® NS®-3ME: rev. EN 21

# Innershield® NS®-3ME

## Materials to be welded

Steel grades/Standard	Type
<b>General structural steel</b>	
EN 10025	S185, S235, S275, S355
<b>Ship plates</b>	
ASTM A131	Grade A, B, D, AH32 to DH36
<b>Cast steel</b>	
EN 10213-2	GP240R
<b>Pipe material</b>	
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
<b>Fine grained steel</b>	
EN 10025 part 3	S275, S355, S420
EN 10025 part 4	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	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)	Welding position	PA/1G		PB/2F	
		PA/1G	PB/2F	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

## Remarks/ Application advice

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

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## 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.

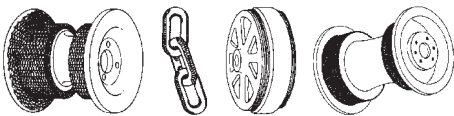
Typical applications include:

#### 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



### Mechanical properties, typical, all weld metal

#### Typical hardness values

Layer 1	21-30 HRC (230-290HB)
Layer 2	26-32 HRC (260-300HB)
Layer 3	28-34 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

Lincore® 33: rev. EN 21

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Additional information

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

Preheat and postweld heat treatment is not generally necessary on C/Mn steels, however, preheat up to 260°C may be necessary on high carbon steels or large complex or restrained components.

The deposited weld metal can be machined to exact dimensions using high speed or carbide cutting tools.

There is no limit to the deposit build-up with this electrode.

## Welding positions



ISO/ASME PA/1G

## Current type

DC +

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

C	Mn	Si	Cr	Al
0.15	2.0	0.7	2.0	1.6

## 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<sup>®</sup> 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.

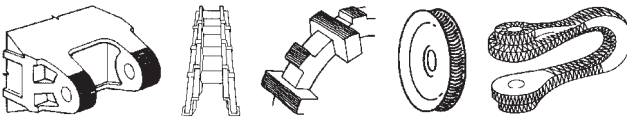
### Application

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 bainite 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



### Mechanical properties, typical, 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

Lincore® 40-O: rev. EN 21

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## 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.

Lincore 40-O deposits normally have good resistance to cross-checking. Special precautions, however, should be taken with any buildup or hardfacing product on applications that are inherently crack sensitive. These applications include the facing of high carbon or alloy steels, previously faced parts and highly stressed parts. The facing of heavy cylinders, massive parts and parts having complex shapes are all examples of applications producing high internal stresses that may result in delayed cracking.

These applications may require one or more of the following:

1. Higher preheat temperature (150-260°C).
2. Higher interpass temperatures.
3. Controlled slow cooling between passes and/or layers

Interpass temperatures in the range of 150-200°C will not significantly affect the hardness of weld deposits produced by Lincore 40-O.

The weld deposited, can be machined with carbide tools or can be finished by grinding.

## 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

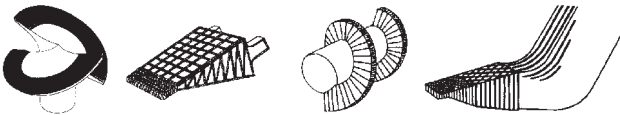
Lincore 50-O is a self shielded, open arc, flux cored tubular electrode that produces a primary austenite and austenite-carbide eutectic weld deposit. The arc characteristics are excellent producing minimal spatter and good slag removal. Although, Lincore 50 is primarily designed for the open arc operation, 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, scraper blades and cultivator sweeps
- Truck chain and gears
- Dragline buckets, links and chains



### Mechanical properties, typical, 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

Lincore® 50: rev. EN 21

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## 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 irregularities such as cracks and deep gouges can be repaired locally using Wearshield BU30 or Wearshield 15CrMn prior to hardfacing with Lincore 50.

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 carbon carbon steels a preheat of 200°C is usually sufficient, but is dependent on material thickness and chemistry.

The weld metal is not machinable by conventional methods although the deposit can be shaped by grinding. Lincore 50 cannot be cut by the oxy-fuel processes. Plasma arc and air-carbon arc processes can be used to both cut an gouge the weld deposit. Preheat temperatures similar to those for welding may be necessary to prevent cracking along the cut edge.

Lincore 50 may also be used in corrosive, cavitation and erosion situations such as the chemical, paper mill, food processing industry, glass manufacturing, power generation and tool manufacturing.

## 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<sup>®</sup> ABR and Wearshield<sup>®</sup> 44 are the nearest.

## Hardfacing cored wire

### Classification

DIN 8555 : MF2-GF-55-GP

### General description

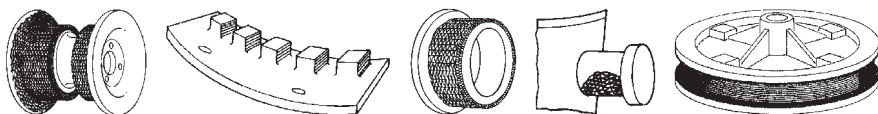
Lincore 55 is a self shielded, open arc, flux cored tubular electrode designed to provide a hardfacing overlay on new or old steel components. Although, Lincore 55 is primarily designed for the open arc operation, it may be used under a neutral flux for conditions requiring spatter elimination and removal 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
- Scraper blades
- Transfer tables
- Cable sheaves



### Mechanical properties, typical, 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

Lincore® 55: rev. EN 21

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## 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.

A preheat of up to 250°C is necessary to prevent cracking in situations of high restraint and/or heavy thicknesses. Interpass temperatures between 150 - 300°C do not adversely effect deposit hardness.

The deposit thickness is usually limited to 2 layers on high carbon or alloy steels and/or situations of high restraint and heavy sections due to the risk of cracking. Higher preheat and interpass temperatures coupled with slow cooling will minimise the risk of cracking.

The deposited weld metal is not machinable by conventional methods although the deposit can be shaped by grinding.

The deposit can be softened by annealing at 875°C for one hour and slow cooling (air cool 22- 43HRc, furnace cool 15-17HRc). The hardness can be restored by heating at 875°C followed by water quenching (50-59HRc). The component should then be tempered at 150-200°C for one hour (54-59HRc) to retain some toughness.

## 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<sup>®</sup> MM and Wearshield<sup>®</sup> MI(ε).

## Hardfacing cored wire

### Classification

DIN 8555 : MF10-GF-60-CG

### General description

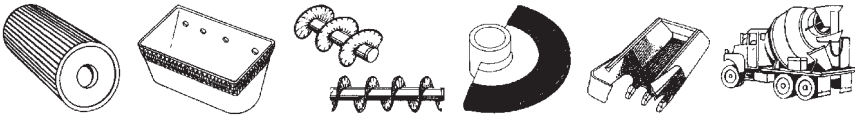
Lincore 60-O is a self shielded, open arc, flux cored tubular electrode that produces a primary carbide weld deposit. Although , designed primarily for the open arc process it can be used with a neutral flux to improve the weld shape, minimise fume and remove arc glare.

### 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 sleeves
- Bucket and shovel lips
- Brick & coke machinery
- Cement mill parts



### Mechanical properties, typical, 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

Lincore® 60-O: rev. EN 21

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Additional information

When welding with Lincore 60-0 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 cracking.

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 cracking.

The weld metal is not machinable or forgeable and it readily check cracks. The deposit thickness is usually limited to 2 layers, as excessive build-up will result in chipping and fragmentation.

For applications requiring build-ups in excess of 2 layers, buttering layers of Lincore 33, Wearshield BU30 or RepTec 126 Alternatively, a preheat of 650°C can be used to eliminate the formation of check cracks.

## 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

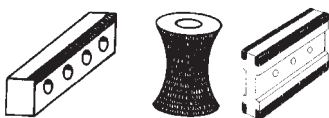
Lincore T&D is a self shielded, open arc, flux cored tubular electrode that produces a H12 type airhardening tool steel deposit. The arc characteristics are excellent producing minimal spatter and good slag removal. Although, Lincore T&D is primarily designed for the open arc operation, it may be used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

Lincore® T&D: rev. EN 21

## 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 hardness and toughness.

The deposited weld metal is not machinable by conventional methods although the deposit can be shaped by grinding.

Annealing at 850°C for several hours and slow cooling will reduce the hardness to approximately 30HRc. This deposit can be readily machined. Rehardening is achieved by heating to about 1200°C for several hours to dissolve all carbides and homogenise the steel, followed by air cooling and tempering.

Lincore T&D cannot be cut by the oxy-fuel processes. Plasma arc and air-carbon arc processes can be used to both cut and gouge the weld deposit. Preheat temperatures similar to those for welding may be necessary to prevent cracking along the cut edge.

## 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

## Hardfacing cored wire

### Classification

DIN 8555 : MF7-GF-250-KP

### General description

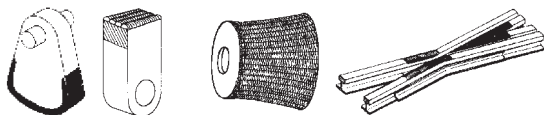
Lincore 15CrMn is a self shielded, open arc, flux cored tubular electrode that exhibits excellent arc characteristics, clean slag detachability, and low spatter levels. Although, Lincore 15CrMn is primarily designed for the open arc operation, it may be used under neutral flux for conditions requiring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

Lincore® 15CrMn: rev. EN 21

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## 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.

Narrow stringer beads are preferred to avoid excessive heat build up in the base material. High heat input welds and interpass temperatures above 260°C causes manganese carbide precipitation resulting in embrittlement.

There is no definite limitation to the number of passes that may be deposited, however, it is good practise to peen each pass immediately after welding to minimise internal stresses and possible distortion and cracking.

Lincore 15CrMn deposits work harden rapidly making them difficult to machine. For best results carbide or ceramic cutting tools and rigid tooling should be used. Grinding can also be successfully employed.

For applications involving severe impact and abrasion, a build-up of Lincore 15CrMn coupled with a single pass of Wearshield 60 or Lincore 60-O should be employed.

The Lincore 15CrMn deposit can not be cut using the oxy-fuel process due to the high chromium content, however, plasma arc and air carbon arc processes are appropriate.

## 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

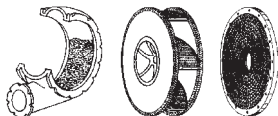
Lincore 420 is a self shielded, open arc, flux cored tubular electrode that produces a martensitic deposit similar to AISI 420 stainless steel. The arc characteristics are excellent producing minimal spatter and good slag removal.

### 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



### Mechanical properties, typical, 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

Lincore® 420: rev. EN 21

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## 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.

Areas that contain irregularities such as cracks and deep gouges can be repaired locally using Wearshield<sup>®</sup> BU30 or Wearshield<sup>®</sup> 15CrMn prior to hardfacing with Lincore 420.

Preheat would be needed if the welding is done over either highly restrained material or martensitic stainless base metal.

A preheat and interpass temperature in the range of 200-300°C can be used depending on the nature of the material to be welded.

Under conditions of low dilution, the microstructure is similar to that of AISI 420 martensitic stainless steel. This structure provides good abrasion resistance under conditions of severe corrosion and high impact. At higher dilutions, when overlaid on mild steel or low alloy steel, the weld metal microstructure will retain its martensitic stainless structure. But the reduced chromium level might adversely affect the corrosion resistance of the deposit.

## 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 + ferritic

## 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<sup>®</sup> 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

### Mechanical properties, typical, 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

Lincore® M: rev. EN 21

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## 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.

Narrow stringer beads are preferred to avoid excessive heat build up in the base material. High heat input welds and interpass temperatures above 260°C causes manganese carbide precipitation resulting in embrittlement.

There is no definite limitation to the number of passes that may be deposited, however, it is good practise to peen each pass immediately after welding to minimise internal stresses and possible distortion and cracking.

Lincore M deposits work harden rapidly making them difficult to machine. For best results carbide or ceramic cutting tools and rigid tooling should be used. Grinding can also be successfully employed.

First layers on mild and low alloy steel can be welded with RepTec 126, Lincore M can be used to complete the build up.

## 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 + ferritic

## 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

Complementary products include Wearshield<sup>®</sup> Mangjet (e)



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