

Repair & Maintenance

DATA SHEET

E-51

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650 HARDFACING

Alloy type

Martensitic alloy for hardfacing producing a deposit of nominally 650HV hardness.

Materials to be welded

These consumables are not used for joining they are used for surfacing/hardfacing applications. They can be used for hardfacing many materials including structural steel (BS 4360), wear resisting steel, high strength cast steel (BS 3100 & BS 1504), and Hadfield 13%Mn steel.

Applications

These consumables give a hardfacing deposit with a hardness in the range 53-59 HRC dependent upon parent material dilution and the number of layers.

It is particularly suitable for resistance to abrasion but will withstand a reasonable amount of impact damage and battering.

Typical applications are **bulldozer blades, excavator teeth, crusher jaws, buckets, scrapers and swing hammers** in conditions of severe abrasion from soil, sand and crushed minerals, coupled with the risk of impact from large rocks and compacted materials.

Microstructure

In the as-deposited condition the microstructure consists of martensite with some carbides.

Welding guidelines

Preheat is not normally required but 100-200°C may be required with thick and/or complex sections particularly with low alloy base materials or where there is a risk of hydrogen-induced cracking.

For substantial build-ups on plain carbon or CMn steels 350 types (data sheet E-50) should be used as a buffer layer to reduce the risk of cracking or spalling.

Additional information

The combination of a 307 type (data sheet E-21) buffer with two or more layers of 650 has proved to be particularly successful for excavation and crushing equipment in cement plants in areas where the high stress abrasion resistance of 13%Mn steel is inadequate.

Related alloy groups

The 350 surfacing consumables (data sheet E-50) are used for less abrasion resistant applications where better impact resistance is required. The chromium carbide types (data sheet E-55) are used for more severe abrasion applications.

Products available

Process	Product	Specification
MMA	Methard 650	(BS EN EFe2)
	Methard 650R	(BS EN EFe2)
FCW	Hardcore 650	BS EN TFe2

General Data for all MMA Electrodes

Storage	<p>3 hermetically sealed ring-pull metal tins per carton, with unlimited shelf life. Direct use from tin is satisfactory. For electrodes that have been exposed: Redry 100 – 150°C/1-2h to restore to as-packed condition. Maximum 150° C, 3 cycles, 10h total. Storage: Recommended ambient storage conditions for opened tins (using plastic lid): < 60% RH, > 18°C.</p>																				
Fume data	<p>Fume composition, wt % typical:</p> <table border="1"> <thead> <tr> <th>Fe</th> <th>Mn</th> <th>Cr</th> <th>Mo</th> <th>V</th> <th>F</th> <th>OES (mg/m³)</th> </tr> </thead> <tbody> <tr> <td>20</td> <td>6</td> <td>2.5</td> <td>0.1</td> <td>0.5</td> <td>18</td> <td>2</td> </tr> </tbody> </table>							Fe	Mn	Cr	Mo	V	F	OES (mg/m ³)	20	6	2.5	0.1	0.5	18	2
Fe	Mn	Cr	Mo	V	F	OES (mg/m ³)															
20	6	2.5	0.1	0.5	18	2															

METHARD 650

MMA hardfacing electrode producing a nominal 650HV hardness deposit

Product description	Rutile metal powder flux on a low carbon core wire. Recovery is about 120% with respect to core wire, 65% with respect to whole electrode.						
Specifications	DIN 8555 BS EN 14700	E6-UM-60-GP (E Fe2 nearest)					
ASME IX Qualification	QW432 F-No --						
Composition (weld metal wt %)		C	Mn	Si	Cr	Mo	V
	typical	0.7	0.6	0.4	8	0.6	0.5
All-weld mechanical properties	Typical hardness as-welded on mild steel base plate:						
		1 layer			3 layers		
	Vickers HV	600-700			700-760		
	Rockwell HRC	55-60			60-63		
	Preheat and dilution will affect hardness in the first two layers but will have little effect in subsequent layers.						
Operating parameters	DC +ve or AC (OCV: 45V min)						
	ø mm	3.2	4.0	5.0			
	min A	80	100	140			
	max A	140	180	240			
Packaging data	ø mm	3.2	4.0	5.0			
	length mm	450	450	450			
	kg/carton	18.6	18.6	19.5			
	pieces/carton	387	246	171			

METHARD 650R

High recovery MMA hardfacing electrode of nominal 650HV hardness

Product description	Rutile high recovery metal powder flux made on pure low carbon core wire. Recovery is about 160% with respect to core wire, 65% with respect to whole electrode.						
Specifications	DIN 8555 BS EN 14700	E6-UM-60-GP (E Fe2 nearest)					
ASME IX Qualification	QW432 F-No --						
Composition (weld metal wt %)		C	Mn	Si	Cr	Mo	V
	typical	0.4	0.3	0.8	8	1	0.6
All-weld mechanical properties	Typical hardness as-welded on mild steel base plate:						
		1 layer		3 layers		1 layer on high carbon steel	
	Vickers HV	560-600		620-680		580-640	
	Rockwell HRC	53-55		56-59		54-57	
	Preheat and dilution will affect hardness in the first two layers but will have little effect in subsequent layers.						
	The weld metal will retain its hardness up to about 450°C but then softens markedly at temperatures in the range 550-700°C.						

METHARD 650R (continued)

Operating parameters	DC +ve or AC (OCV: 45V min)									
	ø mm	2.5	3.2	4.0	5.0					
	min A	70	80	100	140					
	max A	110	140	180	240					
Packaging data	ø mm	2.5	3.2	4.0	5.0					
	length mm	320	380	380	450					
	kg/carton	12.0	13.8	13.2	15.0					
	pieces/carton	606	255	162	102					

HARDCORE 650

Self-shielded flux cored wire of nominal 650 hardness

Product description	Self-shield flux cored wire for surfacing applications in the flat and HV positions. The tubular wire has a lime-fluorspar flux fill which eliminates the need for an external shielding gas. Metal recovery about 90% with respect to wire.							
Specifications	DIN 8555	MF2-GF-55-GP						
	BS EN 14700	T Fe2						
ASME IX Qualification	QW432 F-No --							
Composition (weld metal wt %)		C	Mn	Si	Cr	Mo	Al	
	typical	0.8	2	0.8	2.5	0.2	1.7	
All-weld mechanical properties	Typical all-weld metal hardness:							
	Vickers	HV	600-700					
	Rockwell	HRC	55-60					
	Brinell	HB	620-680					
	Typical single layer hardness on mild steel = 45 HRC.							
Operating parameters	No shielding gas is required.							
	Current: DC+ve ranges as below:							
	ø mm	amp-volt range				stickout		
	1.2	150-250A, 20-26V				40-50mm		
1.6	200-300A, 24-30V				40-50mm			
Packaging data	Spools in cardboard carton: 13kg Where possible, preferred storage conditions are 60% RH max, 18°C min.							
Fume data	Fume composition (wt %)							
		Fe	Mn	Ni	Cr	Cu	F	OES (mg/m ³)
		18	7	<0.5	1.5	<0.5	12	5