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metco

Product Data Sheet

Work Hardening, Austenitic Matrix Hardfacing Alloy Strengthened with Fine Vanadium-Chromium Carbides

Powder Products: Metco 1040A, Metco 1040B
Wire Products: Metco 8250

Patent pending

1 Introduction

Metco™ 1040x series products and Metco 8250 have been developed using the Scoperta™ Computational Design Process as a manganese steel compatible hardfacing overlay with a high carbide fraction for wear resistance. In many mining processes where manganese steel is used, the steel is gouged or wears away before it has a chance to work harden.

Metco 1040A and Metco 8250 are welded as a hardfacing overlay that protects manganese steel substrates from extreme abrasion. As welded, it is in a hardened state (HRC 45), yet work hardens quickly to even higher hardness levels (≥ HRC 63), thereby preventing gouging and wear.

Metco 1040B is designed for HVOF that produces dense, hard, wear-resistant coatings for dimensional restoration and boiler coating work.

1.1 Typical Welded Uses and Applications

Metco 1040A and Metco 8250 are suggested for use in any manganese steel application where improved abrasion resistance is required. The revolutionary improvement in abrasion and impact for an as-welded manganese steel overlay will lead to longer lifespans for manganese steel plates in the mining industry.

Specific applications include:

- Crawler shoes
- Crush hammers
- Bucket blades
- Stone chutes
- Shovel bucket bushings
- Other manganese steel mining applications

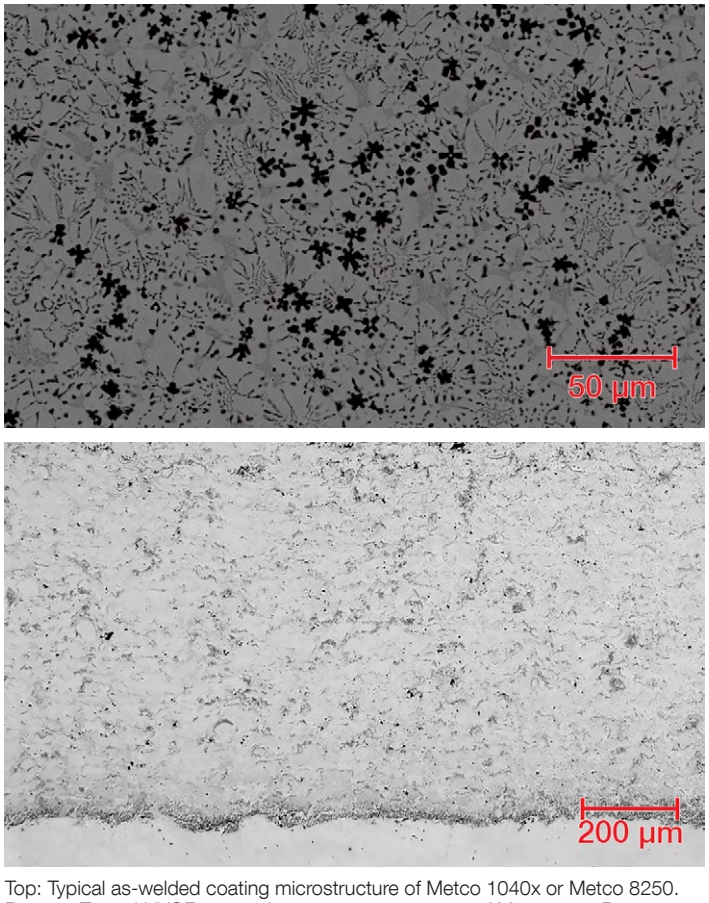
1.2 Typical HVOF User and Applications

- Shaft repair
- Hydraulic cylinders
- Pulverized Coal and CFB Boilers
- Gear Boxes

Quick Facts

Classification	Alloy, iron-based
Chemistry	Proprietary austenitic alloy
Manufacture	Composite wire or gas atomized powder
Abrasion Resistance	
welded surfaces	0.16 to 0.36 g lost (ASTM G65A)
HVOF sprayed	≈ 0.18 g lost (ASTM G65B)
Impact Resistance [a]	> 10 000 impacts @ 20 J without failure
Overlay Hardness	
as welded	42 to 50 HRC
work hardened [a]	63 to 65 HRC
HVOF sprayed	86 to 87 HR15N
Hard Phase	30 % to 45 %
Purpose	Impact and abrasion resistance
Processes	GMAW, GTAW, Laser Cladding, EHLA, PTA, HVOF-GF

[a] As tested for welded surfaces



Top: Typical as-welded coating microstructure of Metco 1040x or Metco 8250.
Bottom: Typical HVOF-sprayed coating microstructure of Metco 1040B.

2 Material Information

2.1 Properties and Characteristics

Product	Nominal Chemistry	Product Form	Size	Recommended Process	Previously Sold As
Metco 1040A	Proprietary	Powder	-150 +53 µm	PTA, Laser Cladding	Vecalloy 800
Metco 1040B			-53 +20 µm	Laser Cladding, EHLA, HVOF-GF	
Metco 8250		Composite Wire	1.2 mm (0.047 in)	GMAW, GTAW	
			1.6 mm (0.063 in; 1/16 in)	GMAW	

2.2 Key Selection Criteria for Welded Alloys

- **Wear and Impact Performance:** With a low mass loss as measured using ASTM G65A, overlays of these materials exhibit superior wear performance compared to traditional manganese steels.

  The wear performance of the overlay will increase the lifetime of the product while providing the ductility to enable work hardening of the manganese steel substrate.

- **Work Hardening:** Due to the high manganese content and the austenitic matrix, overlays will typically work harden up to 63 to 65 HRC under impact, providing greater wear resistance the longer the overlay is in service..

- **Crack Resistance:** These products employ finely dispersed carbides that prevent the propagation of cracks through the coating when welded on Mn steel. Not only does the crack resistance lead to superior impact resistance, but it also prevents cracks from forming during the welding process.

  Since no cracks form during the welding process, Metco 1040x series materials or Metco 8250 can be welded as a double-layer overlay without fear of underbead or lateral cracking.

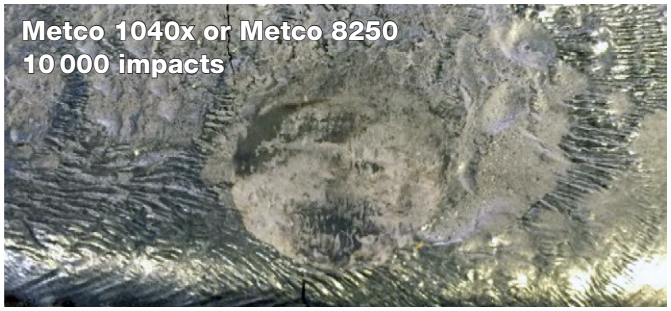
2.3 Related Products

- When welding using GMAW, Metco 8250 combines high impact resistance with excellent abrasion resistance. For higher abrasion resistance, consider Metco 8224. Although Metco 8224 is applied as a hard overlay, it does not offer the work hardening characteristics of Metco 8250. If better gouging resistance is needed, combined with resistance to high-stress abrasion, consider Metco 8226.

- When applying coatings via PTA or Laser Cladding where improved abrasion resistance is required, consider Metco 1030A or Metco 1030B; however, Metco 1040A provides superior impact resistance compared to Metco 1030A.

- In addition, Oerlikon Metco produces a wide range of other products designed for mining applications. Products are available in wire and powder form appropriate for application using thermal spray, PTA, laser cladding and other welding processes. Please contact your Oerlikon Metco Account Manager for more information.

- Metco 8294 is a wire for electric arc wire spray that can be used as a substitute for Metco 1040B.



Preventing Deformation: Overlays of Metco 1040x series and Metco 8250 materials do not deform as drastically as cast manganese steel does. Metco 1040x series and Metco 8250 protect manganese steel substrates from deformation in high-stress environments.

3 Key Coating Information

3.1 Using Metco 1040X Powder

3.1.1 Laser Cladding Parameters

Shielding gas	Argon
Power	4 kW
Powder feed	35 g/min (4.6 lb/h)
Expected hardness (approx.)	51 to 52 HRC (as-sprayed)
Expected hardness	45 to 47 HRC (work hardened)
Expected ASTM G65A (approx)	0.16 g mass loss

These parameters where developed using a Coherent 4000L. Please note that these parameters serve as a starting point. Optimum parameters can vary significantly with different laser equipment. Laser welds can be deposited with multiple layers to achieve the desired total thickness.

3.1.2 Plasma Transferred Arc (PTA) Parameters

Powder size	-150 +53 µm
Voltage	28 V
Amperage	180 A
Expected thickness (approx.)	3 mm (0.12 in)
Expected hardness (approx.)	46 to 47 HRC
Expected ASTM G65A (approx)	0.16 g mass loss

Please note that these parameters serve as a starting point parameters and can vary significantly with different PTA equipment. PTA welds can be deposited with multiple layers to achieve the desired total thickness.

3.1.3 Gas-Fuel HVOF Coating Results (hydrogen fuel)

Powder size	-53 +20 µm
Abrasion resistance	0.18 g loss (ASTM G65B)
Metal-to-metal wear resistance	0.34 mm^3 (ASTM G77)
Microhardness	610 to 637 HV300
Macrohardness	86 to 87 HR15N
Surface roughness (as-sprayed)	7.0 to 7.3 µm (275 to 285 µin)
Porosity	1 to 1.9 vol. %
Oxides	5.2 to 5.6 vol. %
Deposit efficiency	≈ 74 %
Bond strength	41.0 to 45.7 MPa (5950 to 6625 psi)

Please note that these results where achieved using a DiamondJet 2600 spray gun and hydrogen fuel gas. Results can vary significantly with different HVOF equipment and parameters. For specific parameters, please contact Oerlikon Metco.

3.2 Using Metco 8250 Wire

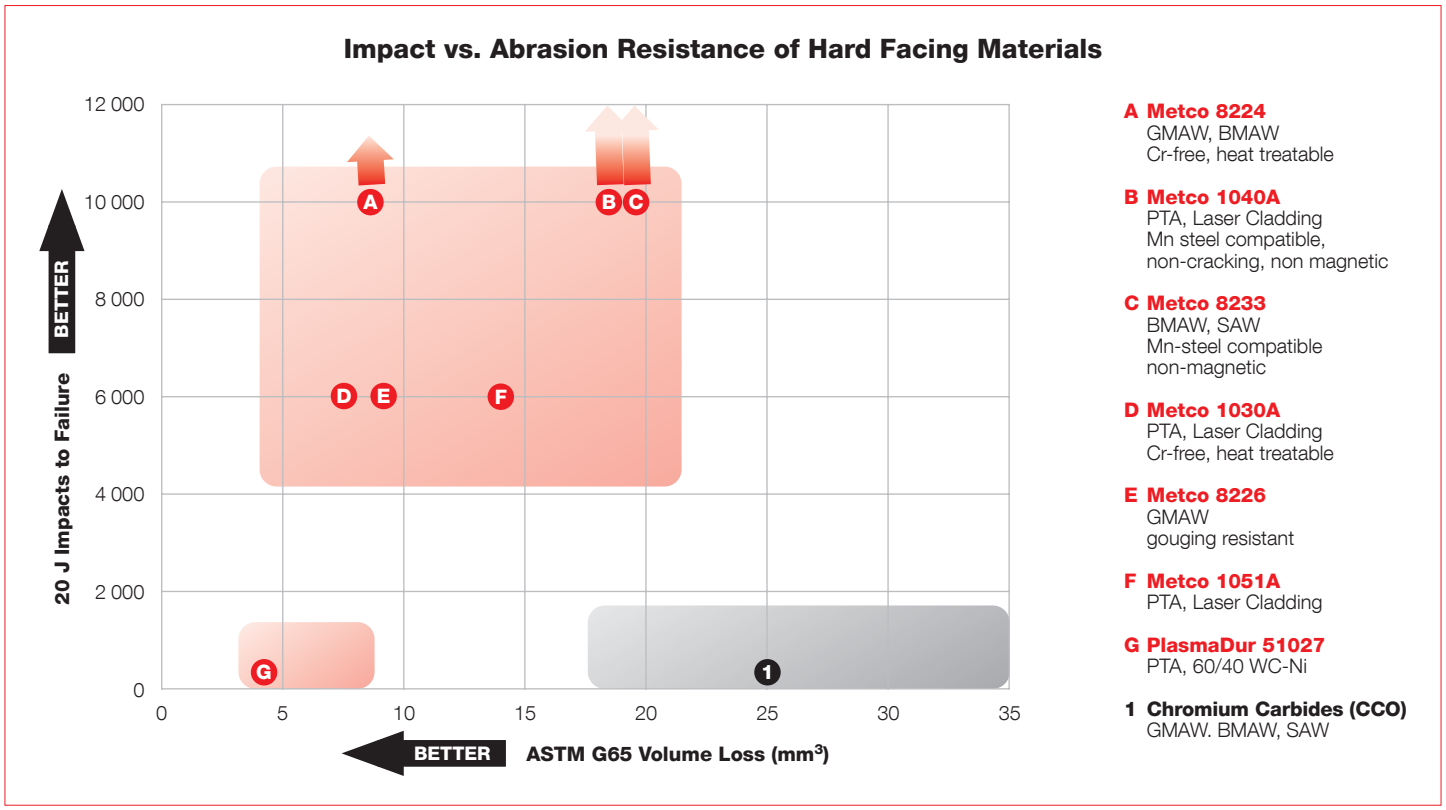
3.2.1 GMAW Welding Parameters

Wire Diameter	1.6 mm (0.063 in)
Current	DCEP
Desired weld thickness	6 to 8 mm (0.24 to 0.31 in)
Voltage	28 to 36 V
Amperage	250 to 280 A
Shielding gas	100% Ar or 98% Ar / 2% O_2
Stickout	25 to 32 mm (1 to 1.25 in)
Preheat	None
Torch drag angle	5° to 15°
Travel speed	50 to 125 mm/min (2 to 5 in/min)
Expected hardness	45 to 47 HRC
Expected ASTM G65	0.36 g mass loss

Wire Diameter	1.2 mm (0.047 in)
Current	DCEP
Desired weld thickness	3 to 4 mm (0.12 to 0.16 in)
Voltage	26 to 30 V
Amperage	150 to 200 A
Shielding gas	100% Ar or 98% Ar / 2% O_2
Stickout	25 to 32 mm (1 to 1.25 in)
Preheat	None
Torch drag angle	5° to 15°
Travel speed	50 to 100 mm/min (2 to 4 in/min)
Expected hardness	42 to 45 HRC
Expected ASTM G65	0.36 g mass loss

3.3 Coating Development

For specific coating application requirements, the services of Oerlikon Metco's Coating Solution Centers are available. Please contact your Oerlikon Metco Account Manager for more information.



4 Commercial Information

4.1 Ordering Information and Availability

Product	Order No.	Form	Size	Package Size	Availability	Distribution
Metco 1040A	1097802	Powder	-150 +53 µm	10 lb (4.5 kg)	Stock	Global
Metco 1040B	1300144	Powder	-53 +20 µm	10 lb (4.5 kg)	Stock	Global
Metco 8250	1503063	Wire	1.2 mm (0.047 in)	12.5 kg (27.5 lb)	Stock	Global
	1300404		1.6 mm (0.063 in; 1/16 in)	25 lb (11 kg) spool	Stock	Global

4.2 Handling Recommendations

- Store in the original container in a dry location
- For powders, tumble contents prior to use to prevent segregation
- Open containers of powder should be stored in a drying oven to prevent moisture pickup

4.3 Safety Recommendations

See the SDS (Safety Data Sheet) in the localized version applicable to the country where the material will be used. SDS are available from the Oerlikon web site at www.oerlikon.com/metco (Resources – Safety Data Sheets).

Product	SDS Index No.
Metco 1040A	50-2211
Metco 1040B	50-2211
Metco 8250	50-2205

The Oerlikon Metco Difference:

Metco 1040x and Metco 8250 were developed using our patented and proprietary **Scoperta™** high throughput computational metallurgical process to evaluate millions of candidate alloy compositions. Potential candidates are then experimentally evaluated using an advanced screening process where both properties and alloy microstructure are measured.

The combined **Scoperta** computational and experimental approach allows Oerlikon Metco to rapidly design the final material with a much better accuracy than conventional empirically-based methodologies.

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