

Weld Hardface and Cladding Materials Guide

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The Oerlikon Metco Difference

Every successful surface solution starts with the right material choice.

Oerlikon Metco is a world-class manufacturer and supplier of cladding and weld surfacing materials for a wide range of industrial applications, for which many must withstand the harshest of service environments. Our portfolio includes products for laser cladding, PTA, oxy-acetylene welding and arc welding processes.

Our quality commitment is evidenced by our ISO 9001 and AS 9000 quality standards and our Nadcap-approved laboratories. Our strong commitment to the environment and the safety of our coworkers and customers is validated by our ISO 14001 and OHSAS 18001 certifications. We verify our products through stringent in-process testing programs. This compliance assures that our products perform to your demanding requirements.

Our weld hardface and cladding portfolio is just one of our many material specialties. Should your needs be better suited to thermal spray, brazing, electronic fillers, pack diffusion or additive manufacturing, Oerlikon Metco is a leading supplier of these materials. Please refer to the appropriate material catalogs for more information about our products and solutions for these processes.

Contents

The Oerlikon Metco Difference	2	Spray and Fuse Powder Welding Hard Face Powders 10	
Key Information	3	Fusible Alloys with Carbide Hardphase	10
Product Availability	3	Carbide Blend Materials	10
Powder Particle Size Distributions	3	Oxy-Acetylene Welding Rod / Wire	12
Tungsten Carbide Characteristics	3	Iron-Core, Coated Rod and Wire	12
Spray and Fuse Materials	3	Nickel-Core, Coated Rod and Wire	12
Trademarks and Brands	4	Filled Rod	12
Symbols	4	Sintered Rod	13
How to Use This Guide	4	Blend Materials for Oxy-Acetylene and Arc Welding	14
Laser Cladding Powders	5	Carbide Blend Materials	14
Cobalt Base	5	Arc Welding Rod, Wire, Electrodes	16
Iron Base	5	Iron Base Wire	16
Nickel Base	5	Nickel Base Wire and Rod	16
Pre-Blended Carbide Hard Face Products	6	Dip-Coated Electrodes	17
Carbide Blend Materials	6	Sintered, Dip-Coated Electrodes	17
PTA Powders	8	Product Index	18
Fusible PTA Hardfacing Materials	8		
Carbide Blend Materials	9		

Key Information

Product Availability

The majority of the products listed in this guide are available worldwide; however, some products are only available on a regional basis. Regional products may be obtainable outside of the specified region as a special order. For further information, please refer to the appropriate material product data sheet or

contact your Oerlikon Metco account representative

In our data sheets, those items designated as Stock are warehoused and generally available for immediate shipment or for shipment within a few days. Please note that not all Oerlikon Metco

warehouses may have supplies on hand or in sufficient quantities, whereupon we will make every effort to accommodate your needs as quickly as possible. Lead time to shipment for items marked Special Order will be provided at the time of order placement. Minimum order quantities may apply.

Powder Particle Size Distributions

With few exceptions for OEM specifications, the powder materials in this guide and the associated Oerlikon Metco material data sheets reflect nominal powder particle size distributions such that the majority of the powder by weight is within the stated size range for that

product, with only a small amount being coarser or finer. In general, particle sizes that are greater than or equal to 45 µm are measured by sieve analysis (ASTM B214) and particle sizes less than 45 µm are measured by laser diffraction (Microtrac). Please refer to the data sheet for

further information. Customer specifications for that material product may reflect significantly different nominal size distributions, depending on the criteria used by the customer and the measurement methods chosen.

Tungsten Carbide Characteristics

Carbide blend materials, as well as many products in this guide that incorporate blends of tungsten carbide additives, have been manufactured using different methods to achieve specialized results in various applications:

- **CTC:** Cast and crushed tungsten carbide having a blocky shape, (W₂C-WC), 2000 to 2300 HV0.1. Alternate designations for CTC are FTC or WSC.
- **CTC-S:** Spherical cast tungsten carbide, dense, spheroidal particles

manufactured using a unique process, high density and hardness, 2700 to 3100 HV0.1. Alternate designations for CTC-S are FTC-S or WSC-S.

- **MTC:** Macrocrystalline tungsten carbide having a blocky shape with low decarburization during processing, results in higher wear resistance, 1700 to 2000 HV0.1.
- **CTCP:** Cemented tungsten carbide pellets are agglomerated and sintered carbide with small amounts of

a cobalt or nickel matrix and having a spheroidal shape, 1400 to 1600 HV0.1.

- **SCTC:** Sintered and crushed tungsten carbide of angular to blocky shape, 1400 to 2300 HV0.1, dependent on particle size.
- **Tetrahedral Cemented Carbide:** Very large and sharp-edged carbides for cutting applications, 1300 to 1600 HV0.1.

Spray and Fuse Materials

Please refer to Oerlikon Metco's Thermal Spray Materials Guide for information about materials that are appropriate for use as spray and fuse materials. These products can be found in the

section titled "Self-Fluxing Alloys" within that document. The associated product data sheets provide information for application of these materials via thermal spray and subsequent post-coat fusion.

For customers interested in using these materials for puddle welding hard face applications, please contact your Oerlikon Metco Sales Representative for support.

Key Information

Trademarks and Brands

The following brands in this publication are trademarks or registered trademarks of their respective owners:

Hastelloy	Haynes International, Inc.
Inconel	Huntington Alloys Corporation
Stellite	Kennametal Inc.
Ultimet	Haynes International, Inc.

The following product brands used in this guide or other media are Oerlikon Metco trademarks or registered trademarks:

■ Amdry	■ MetcoAdd	■ Sprabronze
■ ChamPro	■ MetcoClad	■ Sprasteel
■ Diamalloy	■ Metcolite	■ Thermospray
■ Durabrade	■ Metcoloy	■ WOKA
■ E-Fill	■ Metcoseal	■ WokaDur
■ HOSP	■ PlasmaDur	
■ Metco	■ Sprababbitt	

Symbols

The following Chemical Symbols are used in this guide:

Al	Aluminum	Co	Cobalt	Mn	Manganese	Ta	Tantalum
B	Boron	Cu	Copper	Nb	Niobium	Ti	Titanium
C	Carbon or Carbide	Fe	Iron	Ni	Nickel	W	Tungsten
Cr	Chromium	Mo	Molybdenum	Si	Silicon	Zn	Zinc

How to Use This Guide

Similar products in this guide are grouped together. The data sheet index number is provided for each of these product groups. The data sheet provides detailed information about each product, including customer specifications the product is approved to meet

and ordering information. Product data sheets are available from our web site at www.oerlikon.com/metco.

This guide is designed for on-screen use. To facilitate navigation, Table of Contents entries are linked to sections

within the guide and index entries are linked to material product descriptions. To navigate, simply click on any entry within the contents or indexes. Page numbers are included for printed versions.

Product Index

Product	Page	Product
MetcoClad 6	5	WOKA 50055
MetcoClad 6F	5	WOKA 50057
MetcoClad 21	5	WOKA 50057
MetcoClad 23	5	WOKA 50057
MetcoClad 316L-Si	5	WOKA 50059
MetcoClad 625	5	WOKA 50059
MetcoClad 625F	5	WOKA 50072
MetcoClad 718		
MetcoClad 8		
MetcoClad 9		

Example: Click the link for MetcoClad 21 in the Product Index ① to navigate directly to the description of MetcoClad 21 in the body ② of the guide.

Laser Cladding Powders

Cobalt Base

Chemistry	Particle Size	Product	Manufacture	Applications
Cobalt-Based Superalloys Data Sheet DSMW-0003				
Co 28Cr 4W 3Ni 3Fe 1.5Si 1C 1Mo SIMILAR TO STELLITE 6	-106 +45 µm	MetcoClad 6	Gas Atomized	- Resists seizing, galling, cavitation erosion, thermal oxidation and oxidizing acids, low frictional coefficient - For self-mating surfaces such as valve seats and components subject to cavitation - Service temperature up to 1000 °C (1830 °F)
	-53 +20 µm	MetcoClad 6F		
Co 27Cr 5.5Mo 3Ni SIMILAR TO STELLITE 21		MetcoClad 21		
Co 25Cr 5Mo 2.5W 2Ni SIMILAR TO ULTIMET	-125 +53 µm	MetcoClad 23		

Laser Cladding Powders

Cobalt Base

Chemistry	Particle Size	Product	Manufacture	Applications
Cobalt-Based Superalloys			Data Sheet DSMW-0003	
Co 28Cr 4W 3Ni 3Fe 1.5Si 1C 1Mo SIMILAR TO STELLITE 6	-106 +45 µm	MetcoClad 6	Gas Atomized	- Resists seizing, galling, cavitation erosion, thermal oxidation and oxidizing acids, low frictional coefficient - For self-mating surfaces such as valve seats and components subject to cavitation - Service temperature up to 1000 °C (1830 °F)
	-53 +20 µm	MetcoClad 6F		
Co 27Cr 5.5Mo 3Ni 0.25C SIMILAR TO STELLITE 21	-125 +45 µm	MetcoClad 21		
Co 25Cr 5Mo 2.5W 2Ni SIMILAR TO ULTIMET	-125 +53 µm	MetcoClad 23		- Resists heat, cavitation, galling and corrosion - For compressor blades, piston rings, components with metal-to-metal sliding wear - Service temperature up to 1000 °C (1830 °F) - Resists high-stress abrasion, wear and corrosion - Recommended for hydraulic piston rods - Service up to 600 °C (1112 °F)

Iron Base

Chemistry	Particle Size	Product	Manufacture	Applications
Austenitic Stainless Steel			Data Sheet DSMW-0017	
Fe 12Ni 17Cr 2.5Mo 2.3Si 1Mn 0.03C SIMILAR TO AISI 316L / UNS S31603	-106 +44 µm	MetcoClad 316L-Si	Gas Atomized	- Resists pitting and crevice corrosion, chlorine environments; good impact resistance - For use on heavy equipment, food equipment, medical implants, hydraulic pumps and turbines, printing machinery, shafts in marine environments, and repair of steel parts - Service up to 900 °C (1650 °F)

Nickel Base

Chemistry	Particle Size	Product	Manufacture	Applications
Nickel-Based Superalloys			Data Sheet DSMW-0002	
Ni 15Cr 16Mo 5Fe 4W SIMILAR TO HASTELLOY C-276	-106 +45 µm	MetcoClad C-276	Gas Atomized	- Resists acidic, chlorinated and seawater media - For digesters, flue gas desulfurization equipment, evaporators, heat exchangers, filters, mixers and other processing equipment exposed to corrosive media
Ni 21.5Cr 8.5Mo 3.5Nb 3Fe SIMILAR TO HASTELLOY 625	-90 +45 µm	MetcoClad 625		- Resists seawater, oxidation, hydrogen sulfide and elevated sulfur environments; stable against intercrystalline, pitting and crevice corrosion - High strength deposits can be used in high stress environments - For flue gas and desulfurization equipment, offshore platform flare stacks, tar-sand and oil-shale recovery equipment - Service up to 1000 °C (1830 °F)
	-53 +20 µm	MetcoClad 625F		
Ni 19Cr 18Fe 3Mo 0.5Al 5Nb 1Ti 0.05C SIMILAR TO INCONEL 718	-90 +44 µm	MetcoClad 718		- Resists oxidation, creep and stress rupture at elevated temperatures - For repair of superalloy components including gas turbine and high speed air frame parts - Service up to 700 °C (1290. °F)

Laser Cladding Powders

Pre-Blended Carbide Hard Face Products

Chemistry	Particle Size	Product	Manufacture	Applications
Spherical Cast Tungsten Carbide / Self-Fluxing Blend			Data Sheet DSMW-0014	
WC 40(NiCrBSi)	-106 +45 µm	MetcoClad 52052	Gas Atomized Blend	▪ Carbide hardness: 2700 – 3100 HV0.1 (CTC-S) ▪ Matrix macrohardness: ▪ MetcoClad 52052: 37 – 44 HRC ▪ MetcoClad 53003: 50 – 55 HRC ▪ High hardness with good impact resistance ▪ MetcoClad 52052: Resists slurry erosion ▪ MetcoClad 53003: High abrasion resistance ▪ For downhole tools, slurry pump impellers, conveyors screws for plastic and ceramic manufacture, agricultural shearing blades ▪ Service up to 500 °C (930 °F)
WC 40(Ni 3.15B 3Si)	-106 +45 µm	MetcoClad 53003		
Cast Tungsten Carbide / Self-Fluxing Blend			Data Sheet DSMW-0025	
WC 40(Ni 12Cr 2.8Fe 2.4B 4Si 0.65C)	-125 +45 µm	WOKA 56006	Blended	▪ Carbide hardness: 2000 – 2300 (CTC) ▪ Matrix hardness: 50 – 55 HRC ▪ Good abrasive wear resistance in combination with corrosion and impact resistance ▪ For tailing pipeline elbows, chippers, agricultural equipment, mining equipment, petrochemical equipment, bulk material processing equipment ▪ Service up to 500 °C (930 °F)

Carbide Blend Materials

Chemistry	Particle Size	Product	Manufacture	Applications
Spherical Cast Tungsten Carbide (CTC-S)			Data Sheet DSMW-0015	
WC	-106 +45 μm	MetcoClad 52001	Gas Atomized	▪ Carbide hardness: 2700 – 3100 HV0.1 (CTC-S) ▪ Spherical cast tungsten carbide for blending with self-fluxing matrix material ▪ Resists slurry erosion; high hardness ▪ For downhole tools, slurry pump impellers, conveyors screws for plastic manufacture ▪ Service up to 500 °C (930 °F)
Spherical Cast Two-Phase Tungsten Carbide (CTC-S)			Data Sheet DSMW-0028	
WC-W ₂ C	-150 +63 μm	WOKA 50057	Fused, Crushed & Plasma Densified	▪ Carbide hardness: 2700 – 3100 HV0.1 (CTC-S) ▪ Spherical tungsten carbide for blending with self-fluxing matrix material ▪ High hardness, excellent abrasion resistance with good impact resistance ▪ For a wide range of applications for construction, earth moving, tunneling, heavy equipment, agricultural, oil and gas drilling, recycling and mining equipment ▪ Service up to 500 °C (930 °F)
	-125 +45 μm	WOKA 50059		
	-106 +45 μm	WOKA 50054		
	-90 +45 μm	WOKA 50055		
	-53 +20 μm	WOKA 50051		
Fused and Crushed Two-Phase Tungsten Carbide (CTC)			Data Sheet DSMW-0029	
WC-W ₂ C	-150 +63 μm	WOKA 50007	Fused & Crushed	▪ Carbide hardness: 2000 – 2300 HV0.1 (CTC) ▪ Irregular tungsten carbide for blending with self-fluxing matrix material ▪ High hardness, excellent abrasion resistance with fair impact resistance ▪ For a wide range of applications for construction, tunneling, heavy equipment, agricultural, oil and gas drilling, biomass, wood processing, recycling and mining equipment ▪ Service up to 500 °C (930 °F)
	-125 +45 μm	WOKA 50009		
	-90 +45 μm	WOKA 50005		
	-53 +20 μm	WOKA 50001		

Laser Cladding Powders

Carbide Blend Materials

CONTINUED

Chemistry	Particle Size	Product	Manufacture	Applications
Monocrystalline Tungsten Carbide (MTC)			Data Sheet DSMW-0030	
WC	-180 +75 µm	WOKA 50120	Carburized & Crushed	▪ Carbide hardness: 1700 – 2000 HV0.1 (MTC) ▪ Blocky tungsten carbide for blending with self-fluxing matrix material ▪ Hard and abrasion-resistant with moderate impact resistance ▪ For a wide range of applications for construction, tunneling, heavy equipment, agricultural, oil and gas drilling, biomass, wood processing, and mining equipment ▪ Service up to 500 °C (930 °F)
	-180 +63 µm	WOKA 50115		
	-150 +63 µm	WOKA 50107		
	-90 +45 µm	WOKA 50105		
Tungsten Carbide Cemented Sinter Pellets (CTCP)			Data Sheet DSMW-0026	
WC 6Co	-150 +63 µm	WOKA 50207	Agglomerated, Sintered & Densified	▪ Carbide hardness: 1400 – 1600 HV0.1 (CTCP) ▪ Spherical tungsten carbide-cobalt for blending with self-fluxing matrix material ▪ Excellent combination impact and abrasion resistance ▪ For plowshares, cultivator blades, wood processing knives, drillstring stabilizers and tool joints, heavy equipment chains and bearings ▪ Service up to 500 °C (930 °F)
	-125 +75 µm	WOKA 50505		
Cemented Tungsten Carbide Cobalt Hard Metal Grit (SCTC)			Data Sheet DSMW-0031	
WC 6Co	-212 +150 µm	WOKA 50174	Sintered & Crushed	▪ Carbide hardness: 2000 – 2300 HV0.1 (SCTC) ▪ Sintered and crushed tungsten carbide-cobalt for blending with self-fluxing matrix material ▪ Excellent abrasion resistance; very good impact resistance ▪ For construction equipment and agricultural wear plates, tunnelling machinery, harvester blades, mining classification screens and crushers, heavy equipment mixer blades ▪ Service up to 600 °C (1100 °F)
	-90 +53 µm	WOKA 50168		
	-90 +45 µm	WOKA 50155		

PTA Powders

Fusible PTA Hardfacing Materials

Chemistry	Particle Size	Product	Manufacture	Applications
Spherical Cast and Cast Tungsten Carbide / Self-Fluxing Blend			Data Sheet DSMW-0013	
WC 40(Ni 3.15B 3Si)	-106 +45 μm	PlasmaDur 51937	Blended	▪ Carbide hardness: 2000 – 3100 HV0.1 (CTC / CTC-S) ▪ Matrix macrohardness: 58 – 62 HRC ▪ Excellent abrasion resistance; fair impact resistance ▪ For oil exploration and downhole equipment ▪ Service up to 500 °C (930 °F)
Cast Tungsten Carbide / Nickel-Based Self-Fluxing Blend			Data Sheet DSMW-0019	
WC 40(Ni 3.15B 3Si)	-180 +63 μm	PlasmaDur 51022	Blended	▪ Carbide hardness: 2000 – 2300 HV0.1 (CTC) ▪ Matrix macrohardness : ▪ PlasmaDur 51021, PlasmaDur 51022, PlasmaDur 51027, PlasmaDur 51202: 48 – 54 HRC ▪ PlasmaDur 51222: 57 – 63 HRC ▪ Very good abrasion resistance; good impact resistance; avoid impact for PlasmaDur 51222 ▪ PlasmaDur 51021, PlasmaDur 51202, PlasmaDur 51207: Chromium-free ▪ PlasmaDur 51202, PlasmaDur 51222: Beter corrosion resistane ▪ For oil sand and lignite mining equipment, downhole oil exploration tooling, excava- tor buckets, extruder screws for plastic manufacturing ▪ Service up to 500 °C (930 °F)
	-150 +63 μm	PlasmaDur 51027		
	-150 +53 μm	PlasmaDur 51021		
WC 40(Ni 11Cr 2.25B 3.4Si 2.8Fe 0.45C)	-180 +63 μm	PlasmaDur 51202		
WC 40(Ni 15Cr 3.25B 4.4Si 3.5Fe 0.65C)	-180 +63 μm	PlasmaDur 51222		
Cast Tungsten Carbide / Nickel-Chromium Self-Fluxing Blend			Data Sheet DSMW-0025	
WC 40(Ni 12Cr 2.8Fe 2.4B 4Si 0.65C)	-125 +45 μm	WOKA 56006	Blended	▪ Carbide hardness: 2000 – 2300 HV0.1 (CTC) ▪ Matrix hardness: 50 – 55 HRC ▪ Good abrasive wear resistance in combination with corrosion and impact resistance ▪ For tailing pipeline elbows, chippers, agri- cultural equiment, mining equipment, petro- chemical equipment, bulk material processing equipment ▪ Service up to 500 °C (930 °F)
Monocrystalline Tungsten Carbide / Self-Fluxing Blend			Data Sheet DSMW-0001	
WC 35(Ni 7Cr 1.3B 4Si)	-180 +63 μm	PlasmaDur 51302	Blended	▪ Carbide hardness: 1700 – 2000 HV0.1 (MTC) ▪ Matrix macrohardness: ▪ PlasmaDur 51122: 48 – 54 HRC ▪ PlasmaDur 51132: 57 – 63 HRC ▪ PlasmaDur 51142: 37 – 44 HRC ▪ PlasmaDur 51302: 29 – 35 HRC ▪ PlasmaDur 51322: 28 – 34 HRC ▪ PlasmaDur 51302 / PlasmaDur 51322: Higher impact, lower abrasion resistance ▪ PlasmaDur 51122: good abrasion resistance; fair impact resistance ▪ PlasmaDur 51132: high hardness and abrasion resistance; avoid impact ▪ PlasmaDur 51142: good abrasion and impact resistance ▪ For mining, petrochemical and earth-moving equipment, food and chemical processing de- canter screws ▪ Service up to 500 °C (930 °F)
WC 40(Ni 11Cr 2.25B 3.75Si)		PlasmaDur 51122		
WC 40(Ni 15Cr 2.25B 4.5Si)		PlasmaDur 51132		
WC 40(Ni 7.5Cr 1.65B 3.5Si)		PlasmaDur 51142		
WC 40(Ni 5.75Cr 1B 4Si)		PlasmaDur 51322		

PTA Powders

Carbide Blend Materials

Chemistry	Particle Size	Product	Manufacture	Applications
Spherical Cast Two-Phase Tungsten Carbide (CTC-S)			Data Sheet DSMW-0028	
WC-W ₂ C	-150 +63 μm	WOKA 50057	Fused, Crushed, Plasma Densified	- Carbide hardness: 2700 – 3100 HV0.1 (CTC-S) - Spherical tungsten carbide-cobalt for blending with self-fluxing matrix material - High hardness, excellent abrasion resistance with good impact resistance - For a wide range of applications for construction, earth moving, tunneling, heavy equipment, agricultural, oil and gas drilling, recycling and mining equipment - Service up to 500 °C (930 °F)
	-125 +45 μm	WOKA 50059		
	-106 +45 μm	WOKA 50054		
Fused and Crushed Two-Phase Tungsten Carbide (CTC)			Data Sheet DSMW-0029	
WC-W ₂ C	-212 +150 μm	WOKA 50024	Fused & Crushed	- Carbide hardness: 2000 – 2300 HV0.1 (CTC) - Irregular tungsten carbide for blending with self-fluxing matrix material - High hardness, excellent abrasion resistance with fair impact resistance - For a wide range of applications for construction, tunneling, heavy equipment, agricultural, oil and gas drilling, biomass, wood processing, recycling and mining equipment - Service up to 500 °C (930 °F)
	-150 +63 μm	WOKA 50007		
	-125 +45 μm	WOKA 50009		
	-90 +45 μm	WOKA 50005		
Monocrystalline Tungsten Carbide (MTC)			Data Sheet DSMW-0030	
WC	-180 +75 μm	WOKA 50120	Carburized & Crushed	- Carbide hardness: 1700 – 2000 HV0.1 (MTC) - Blocky tungsten carbide for blending with self-fluxing matrix material - Minimal dissolution during processing - Hard and abrasion-resistant with moderate impact resistance - For a wide range of applications for construction, tunneling, heavy equipment, agricultural, oil and gas drilling, biomass, wood processing, and mining equipment - Service up to 500 °C (930 °F)
	-180 +63 μm	WOKA 50115		
	-150 +63 μm	WOKA 50107		
Tungsten Carbide Cemented Sinter Pellets (CTCP)			Data Sheet DSMW-0026	
WC 6Co	-125 +75 μm	WOKA 50505	Agglomerated, Sintered & Densified	- Carbide hardness: 1400 – 1600 HV0.1 (CTCP) - Spherical tungsten carbide-cobalt for blending with self-fluxing matrix material - Excellent combination impact and abrasion resistance - WC 6Co: best impact resistance - WC 6Ni: better corrosion resistance - For plowshares, cultivator blades, wood processing knives, drillstring stabilizers and tool joints, heavy equipment chains and bearings - Service up to 500 °C (930 °F)
	-150 +63 μm	WOKA 50207		
	-180 +75 μm	WOKA 50504		
	-250 +125 μm	WOKA 50512		
WC 6Ni	-250 +125 μm	WOKA 50532		
	-180 +106 μm	WOKA 50538		
Cemented Tungsten Carbide Cobalt Hard Metal Grit (SCTC)			Data Sheet DSMW-0031	
WC 6Co	-212 +150 μm	WOKA 50174	Sintered & Crushed	- Carbide hardness: 2000 – 2300 HV0.1 (SCTC) - Sintered and crushed tungsten carbide-cobalt for blending with self-fluxing matrix material - Excellent abrasion resistance; very good impact resistance - For construction equipment and agricultural wear plates, tunnelling machinery, harvester blades, mining classification screens and crushers, heavy equipment mixer blades - Service up to 600 °C (1100 °F)
	-90 +53 μm	WOKA 50168		
	-90 +45 μm	WOKA 50155		

Spray and Fuse Powder Welding Hard Face Powders

Fusible Alloys with Carbide Hardphase

Chemistry	Particle Size	Product	Manufacture	Applications
Tungsten Carbide / Self-Fluxing Blend			Data Sheet DSMW-0025	
WC 45(Ni 7.6Cr 2.5Fe 1.7B 3.3Si 0.3C)	-150 +45 µm	WOKA 53025	Gas Atomized Blend	- Carbide hardness: 2000 – 2300 HV0.1 (CTC) - Matrix macrohardness: - WOKA 53025: 37 – 44 HRC - WOKA 53045, WOKA 56006: 50 – 55 HRC - WOKA 53114; WOKA 53134: 57 – 63 HRC - WOKA 53164: 45 – 50 HRC - Resists abrasion - Choose higher matrix ratio and chromium content for better corrosion resistance - Choose higher matrix ratio for better impact resistance - WOKA 53025: High impact resistance - Choose higher carbide hard phase for better erosion resistance - For tailing pipelines, decanter screws, mining equipment, agricultural equipment, chipper knives, petrochemical equipment - Service up to 500 °C (930 °F)
WC 45(Ni 11Cr 2.8Fe 2.5B 3.9Si 0.25C)	-150 +45 µm	WOKA 53045		
WC 40(Ni 12Cr 2.8Fe 2.4B 4Si 0.65C)	-125 +45 µm	WOKA 56006		
WC 50(Ni 15Cr 3.5Fe 3.2B 4.4Si 0.65C)	-106 +20 µm	WOKA 53114		
WC 40(Ni 15Cr 3.5Fe 3.2B 4.4Si 0.65C)	-106 +20 µm	WOKA 53134		
WC 40(Ni 7Cr 3Fe 3B 4.5Si 0.5C)	-106 +20 µm	WOKA 53164		

Carbide Blend Materials

Chemistry	Particle Size	Product	Manufacture	Applications
Spherical Cast Two-Phase Tungsten Carbide (CTC-S)			Data Sheet DSMW-0028	
WC-W ₂ C	-90 +45 μm	WOKA 50055	Fused, Crushed, Plasma Densified	▪ Carbide hardness: 2700 – 3100 HV0.1 (CTC-S) ▪ Spherical tungsten carbide-cobalt for use as a hard phase blend component ▪ High hardness, excellent abrasion resistance with good impact resistance ▪ For a wide range of applications for construction, earth moving, tunneling, heavy equipment, agricultural, oil and gas drilling, recycling and mining equipment ▪ Service up to 500 °C (930 °F)
Fused and Crushed Two-Phase Tungsten Carbide (CTC)			Data Sheet DSMW-0029	
WC-W ₂ C	-125 +45 μm	WOKA 50009	Fused & Crushed	▪ Carbide hardness: 2000 – 2300 HV0.1 (CTC) ▪ Irregular tungsten carbide for blending with self-fluxing matrix material ▪ High hardness, excellent abrasion resistance with fair impact resistance ▪ For a wide range of applications for construction, tunneling, heavy equipment, agricultural, oil and gas drilling, biomass, wood processing, recycling and mining equipment ▪ Service up to 500 °C (930 °F)
	-90 +45 μm	WOKA 50005		
	-53 +20 μm	WOKA 50001		
Monocrystalline Tungsten Carbide (MTC)			Data Sheet DSMW-0030	
WC	-90 +45 μm	WOKA 50105	Carburized & Crushed	▪ Carbide hardness: 1700 – 2000 HV0.1 (MTC) ▪ Blocky tungsten carbide for use as a blend, filler or “drop-in” material ▪ Hard and abrasion-resistant with moderate impact resistance ▪ Minimal dissolution during processing ▪ For a wide range of applications for construction, tunneling, heavy equipment, agricultural, oil and gas drilling, biomass, wood processing, and mining equipment ▪ Service up to 500 °C (930 °F)

Spray and Fuse Powder Welding Hard Face Powders

Carbide Blend Materials

CONTINUED

Chemistry	Particle Size	Product	Manufacture	Applications
Tungsten Carbide Cemented Sinter Pellets (CTCP)				Data Sheet DSMW-0026
WC 6Co	-125 +75 µm	WOKA 50505	Agglomerated, Sintered & Densified	▪ Carbide hardness: 1400 – 1600 HV0.1 (CTCP) ▪ Spherical tungsten carbide-cobalt for blending with self-fluxing matrix material ▪ Excellent combination impact and abrasion resistanceFor plowshares, cultivator blades, wood processing knives, drillstring stabilizers and tool joints, heavy equipment chains and bearings ▪ Service up to 500 °C (930 °F)
Cemented Tungsten Carbide Cobalt Hard Metal Grit (SCTC)				Data Sheet DSMW-0031
WC 6Co	-90 +53 µm	WOKA 50168	Sintered & Crushed	▪ Carbide hardness: 2000 – 2300 HV0.1 (SCTC) ▪ Sintered and crushed tungsten carbide-cobalt for blending with self-fluxing matrix material ▪ Excellent abrasion resistance; very good impact resistance
	-90 +45 µm	WOKA 50155		▪ For construction equipment and agricultural wear plates, tunnelling machinery, harvester blades, mining classification screens and crushers, heavy equipment mixer blades ▪ Service up to 600 °C (1100 °F)

Oxy-Acetylene Welding Rod / Wire

Iron-Core, Coated Rod and Wire

Chemistry	Diameters	Product	Manufacture	Applications
Iron-Core with Chromium Carbide and Iron-Based Matrix Coating				Data Sheet DSMW-0005
Fe 38Cr 4.9C 2.5Mn 1Si	Rod: 5 or 6 mm Wire: 5 or 6 mm	WokaDur FeCr	Extruded and Coated, Flexible	- Carbide hardness: 1600 – 1800 HV0.1 - Deposit hardness: 60 – 65 HRC - Produces extremely hard deposits on mild and low alloy steels - For mining, oil and deep drilling, clay and concrete processing, agricultural and earth-moving equipment - Service up to 650 °C (1200 °F)

Nickel-Core, Coated Rod and Wire

Chemistry	Diameters	Product	Manufacture	Applications
Nickel-Core with Tungsten Carbide and Nickel-Based Matrix Coating				Data Sheet DSMW-0006
W 30Ni 2.5Cr 2.7C	Rod: 4, 5, 6 or 8 mm Wire: 4, 5 or 6 mm	WokaDur NiA	Extruded and Coated, Flexible	- Carbide hardness: - WokaDur NiA: 2000 – 2300 HV0.1 (CTC) - WokaDur NiA-Plus: 2000 – 3100 HV0.1 (CTC / CTC-S) - Deposit hardness: - WokaDur NiA: 52 – 58 HRC - WokaDur NiA-Plus: 58 – 65 HRC - Excellent wear and corrosion protection on most steel substrates - Use WokaDur NiA-Plus when additional hardness and wear resistance is required - For stabilizers and other downhole drilling equipment, augers, impellers, mixer plates for brick and clay manufacturing, chemical processing decanter screws - Service up to 500 °C (930 °F)
	Rod: 4, 5, 6 or 8 mm Wire: 4, 5 or 6 mm	WokaDur NiA-Plus		

Filled Rod

Chemistry	Diameters	Product	Manufacture	Applications
Tubular Steel Rod, Tungsten Carbide Filled				Data Sheet DSMW-0004
W 40 Fe 2.4C	3.2, 3.5, 4, 5, or 6 mm	WokaDur A	Filled Tubular Rod	- Carbide hardness: - WokaDur A: 2000 – 2300 HV0.1 (CTC) - WokaDur A-Plus: 2700 – 3100 HV0.1 (CTC-S) - WokaDur AM: 1700 – 2000 HV0.1 (MTC) - Deposit hardness: - WokaDur A: 55 – 60 HRC - WokaDur A-Plus: 60 – 65 HRC - WokaDur AM: 50 – 55 HRC - Excellent wear protection on mild and low-alloys steel substrates - Use WokaDur A-Plus when additional hardness and wear resistance is required - Use WokaDur AM for additional wear resistance - For road construction, mining, oil field and drilling equipment, agitators in chemical and food processing - Service up to 500 °C (930 °F)
	3.5, 4, 5 or 6 mm	WokaDur A-Plus		
W 30 Fe 4.6C 1.2Mn	3.2, 4 or 4.7 mm	WokaDur AM		

Oxy-Acetylene Welding Rod / Wire

Sintered Rod

Chemistry	Carbide Size	Product	Manufacture	Applications
Coarse Grained Tungsten Carbide with Copper Alloy (“Nickel-Silver”) Matrix			Data Sheet DSMW-0008	
W 20Cu 16Zn 4Ni 3Co 3C	2.4, 4, 5.6, 7.1, 8.75 or 10.25 mm (nominal)	WokaDur SA 100	Sintered	▪ Carbide hardness: 1300 – 1600 HV0.1 ▪ WokaDur SA 100 (coarse carbide): for extreme sliding wear resistance on drill bits used in earth or stone, gimlet bits, rotating drill crests ▪ WokaDur SA 100-T (coarse, sharp-edged tetrahedral carbides): for fishing tools on deep drilling tooling, stabilizers and tap drills ▪ Service up to 500 °C (930 °F)
	10 x 9.5 x 8.4 mm	WokaDur SA 100-T		
Coarse Grained Tungsten Carbide with Nickel Alloy Matrix			Data Sheet DSMW-0009	
W 38Ni 5Cr 3Co 3C 1.5Fe 1.5Si	2.4, 4, 5.6, 7.1, or 8.75 mm (nominal)	WokaDur SA 100-Ni	Sintered	▪ Carbide hardness: 1300 – 1600 HV0.1 ▪ Excellent abrasion resistance and cutting properties ▪ WokaDur SA-100-Ni (coarse carbide): for downhole drills and core bits, slant drilling tools, stabilizers, mining and roundry tooling ▪ WokaDur SA 100-Ni-T (coarse, sharp-edged tetrahedral carbides): for fishing tools, stabilizers, drills used in oil and gas, tunnelling, concrete and mining, foundry tooling ▪ Service up to 500 °C (930 °F)
	10 x 9.5 x 8.4 mm	WokaDur SA 100-Ni-T		

Blend Materials for Oxy-Acetylene and Arc Welding

Carbide Blend Materials

Chemistry	Particle Size	Product	Manufacture	Applications
Spherical Cast Two-Phase Tungsten Carbide (CTC-S)			Data Sheet DSMW-0028	
WC-W ₂ C	-600 +300 μm	WOKA 50072	Fused, Crushed, Plasma Densified	▪ Carbide hardness: 2700 – 3100 HV0.1 (CTC-S) ▪ Spherical tungsten carbide-cobalt for use as a hard phase blend component ▪ Use WOKA 50057 for MIG or TIG ▪ Use WOKA 50072 for oxy-acetylene or SMAW ▪ High hardness, excellent abrasion resistance with good impact resistance ▪ For a wide range of applications for construction, earth moving, tunneling, heavy equipment, agricultural, oil and gas drilling, recycling and mining equipment ▪ Service up to 500 °C (930 °F)
	-150 +63 μm	WOKA 50057		
Fused and Crushed Two-Phase Tungsten Carbide (CTC)			Data Sheet DSMW-0029	
WC-W ₂ C	-1.6 +1 mm	WOKA 50816	Fused & Crushed	▪ Carbide hardness: 2000 – 2300 HV0.1 (CTC) ▪ Irregular tungsten carbide for use as a hard phase blend material, filler material or ‘drop-in’ constituent ▪ Use WOKA 50024, WOKA 50028 or WOKA 50816 for oxy-acetylene ▪ Use WOKA 50028 for SMAW ▪ Use WOKA 50007 or WOKA 50024 for GMAW or GTAW ▪ High hardness, excellent abrasion resistance with fair impact resistance ▪ For a wide range of applications for construction, tunneling, heavy equipment, agricultural, oil and gas drilling, biomass, wood processing, recycling and mining equipment ▪ Service up to 500 °C (930 °F)
	-700 +300 μm	WOKA 50028		
	-212 +150 μm	WOKA 50024		
	-150 +63 μm	WOKA 50007		
Monocrystalline Tungsten Carbide (MTC)			Data Sheet DSMW-0030	
WC	-425 +250 μm	WOKA 50131	Carburized & Crushed	▪ Carbide hardness: 1700 – 2000 HV0.1 (MTC) ▪ Blocky tungsten carbide for use as a blend, filler or “drop-in” material ▪ Hard and abrasion-resistant with moderate impact resistance ▪ Minimal dissolution during processing ▪ Use Woka 50107, Woka 50115, WOKA 50120 or Woka 50131 for oxy-acetelyene welding, SMAW, or GMAW ▪ Use Woka 50107, Woka 50115 or Woka 50120 for GTAW ▪ For a wide range of applications for construction, tunneling, heavy equipment, agricultural, oil and gas drilling, biomass, wood processing, and mining equipment ▪ Service up to 500 °C (930 °F)
	-180 +75 μm	WOKA 50120		
	-180 +63 μm	WOKA 50115		
	-150 +63 μm	WOKA 50107		

Blend Materials for Oxy-Acetylene and Arc Welding

Carbide Blend Materials

CONTINUED

Chemistry	Particle Size	Product	Manufacture	Applications
Tungsten Carbide Cemented Sinter Pellets (CTCP)			Data Sheet DSMW-0026	
WC 6Co	-1.4 +0.6 mm	WOKA 50236	Agglomerated & Sintered	- Carbide hardness: 1400 – 1600 HV0.1 (CTCP) - Spherical tungsten carbide-cobalt for blending with self-fluxing matrix material - Excellent combination impact and abrasion resistance - WC 6Co: best impact resistance - WC 6Ni: better corrosion resistance - For plowshares, cultivator blades, wood processing knives, drillstring stabilizers and tool joints, heavy equipment chains and bearings - Service up to 500 °C (930 °F)
	-1.18 +0.85 mm	WOKA 50502		
	-600 +425 µm	WOKA 50610		
	-250 +125 µm	WOKA 50512		
	-180 +75 µm	WOKA 50504		
	-125 +75 µm	WOKA 50505		
	-425 +250 µm	WOKA 50503		
WC 6Ni	-250 +125 µm	WOKA 50530		
Cemented Tungsten Carbide Cobalt Hard Metal Grit (SCTC)			Data Sheet DSMW-0031	
WC 6Co	-9.5 +8.0 mm	WOKA 50973	Sintered & Crushed	- Carbide hardness: 1400 – 1800 HV0.1 (SCTC) - Sintered and crushed tungsten carbide-cobalt for blending with self-fluxing matrix material - Excellent abrasion resistance; very good impact resistance - Larger particle size distributions may be used for cutting applications - For construction equipment and agricultural wear plates, tunnelling machinery, harvester blades, mining classification screens and crushers, heavy equipment mixer blades - Service up to 600 °C (1100 °F)
	-8.0 +6.35 mm	WOKA 50972		
	-6.4 +4.8 mm	WOKA 50976		
	-4.8 +3.2 mm	WOKA 50975		
	-3.2 +1.6 mm	WOKA 50974		
	-1.1 +0.8 mm	WOKA 50966		
	-700 +300 µm	WOKA 50178		

Arc Welding Rod, Wire, Electrodes

Iron Base Wire

Chemistry	Diameter	Product	Manufacture	Applications
Iron Based Cored Wire, Tungsten Carbide Filled				Data Sheet DSMW-0010
Fe 43W 2.9C 1.6Mn	1.6, 2.4 or 2.8 mm (0.063, 0.095 or 0.110 in)	WokaDur OAM	Cored Wire	- Carbide hardness: 1700 – 2000 HV0.1 (MTC) - Deposit hardness: 60 – 67 HRC - Resists harsh, abrasive environments and mineral-induced sliding wear - Not appropriate for impact resistance - For concrete, ceramic, brick and clay processing, conveyor screws, mixer and scraper blades and augers in mineral-bearing environments - Service up to 500 °C (930 °F)

Nickel Base Wire and Rod

Chemistry	Diameter	Product	Manufacture	Applications
Nickel Based Cored Wire, Tungsten Carbide Filled			Data Sheet DSMW-0021	
W 45Ni 2.4C 1.8B	1.6, 2.4 or 2.8 mm (0.063, 0.095 or 0.110 in)	WokaDur NiE-Tube	Cored Wire	▪ Carbide hardness: ▪ WokaDur NiE-Tube: 2000 – 2300 HV0.1 (CTC) ▪ WokaDur NiE-Tube-Plus: 2700 – 3100 HV0.1 (CTC-S) ▪ WokaDur NiE-TM: 1700 – 2000 HV0.1 (MTC) ▪ Deposit hardness: ▪ WokaDur NiE-Tube: 52 – 58 HRC ▪ WokaDur NiE-Tube-Plus: > 58 HRC ▪ WokaDur NiE-TM: 47 – 55 HRC ▪ WokaDur NiE-Tube-Plus for better hardness ▪ WokaDur NiE-TM for better wear resistance and resistance to carbide dissolution ▪ Extremely abrasion and erosion resistant ▪ For oil and gas drill strings, mining, lumbering, wood mill, chemical processing and food processing applications ▪ Service up to 500 °C (930 °F)
	1.6, 2.4 or 2.8 mm (0.063, 0.095 or 0.110 in)	WokaDur NiE-Tube-Plus		
	1.4, 1.6, 2.4 or 2.8 mm (0.055, 0.063, 0.095 or 0.110 in)	WokaDur NiE-TM		
Tubular Nickel Rod, Tungsten Carbide Filled			Data Sheet DSMW-0022	
W 37Ni 5.2Cr 2.0C 1.5Si 1.2B	2.8, 4, or 5 mm	WokaDur NiA-Tube	Filled Tubular Rod	▪ Carbide hardness: 2000 – 2300 HV0.1 (CTC) ▪ Deposit hardness: 55 – 65 HRC ▪ Extremely abrasion resistant; good corrosion resistance ▪ For oil and gas, agricultural, chemical processing and food processing applications ▪ Service up to 500 °C (930 °F)

Arc Welding Rod, Wire, Electrodes

Dip-Coated Electrodes

Chemistry	Diameter	Product	Manufacture	Applications
Dip Coated Tubular Nickel Electrode, Tungsten Carbide Filled				Data Sheet DSMW-0012
W 35Ni 3.5C 1.1B	4, 5 or 6 mm	WokaDur NiE	Dip Coated, Filled Tubular Rod	▪ Carbide hardness: ▪ WokaDur NiE: 2000 – 2300 HV0.1 (CTC) ▪ WokaDur NiE-Plus: 2700 – 3100 HV0.1 (CTC-S) ▪ WokaDur NiE-M: 1700 – 2000 HV0.1 (MTC) ▪ Deposit hardness: 50 – 65 HRC ▪ WokaDur NiE-Plus for better hardness ▪ WokaDur NiE-M for better wear resistance and resistance to carbide dissolution ▪ Extremely resistant to abrasive and corrosive stress with good impact resistance ▪ For mining, agriculture, chemical processing and food processing applications ▪ Service up to 500 °C (930 °F)
	4 or 5 mm	WokaDur NiE-Plus		
	5 or 6 mm	WokaDur NiE-M		
Dip Coated Tubular Steel Electrode, Tungsten Carbide Filled				Data Sheet DSMW-0011
W 40Fe 3.7C	4, 5 or 6 mm	WokaDur E	Dip Coated, Filled Tubular Rod	▪ Carbide hardness: ▪ WokaDur E: 2000 – 2300 HV0.1 (CTC) ▪ WokaDur E-Plus: 2700 – 3100 HV0.1 (CTC-S) ▪ Deposit hardness: 50 – 65 HRC ▪ WokaDur E-Plus for better hardness ▪ Maximum abrasion resistance with fair impact resistance ▪ For oil drilling and mining applications, processing of abrasive media, earth moving and construction equipment ▪ Service up to 500 °C (930 °F)
	5 or 6 mm	WokaDur E-Plus		

Sintered, Dip-Coated Electrodes

Chemistry	Diameter	Product	Manufacture	Applications
Dip Coated, Sintered Tungsten Carbide Electrode with Nickel and Iron				Data Sheet DSMW-0024
W 7.7Fe 10Ni 7.3C	3, 4 or 5 mm	WokaDur S80-Ni-TIG	Dip Coated, Sintered Rod	- Deposit hardness: 60 HRC minimum - Appropriate for TIG processing - Produces hard surfaces resistant to sliding and abrasive mineral wear; impact should be avoided - Use on almost any type of steel substrate; can be used on thin walls and edges - For draw knives, roll mandrels, extrusion dies, deburring knives, pressure rolls, baffle plates, wire guides and capstans - Service up to 500 °C (930 °F)
Dip Coated, Sintered Tungsten Carbide Electrode with Iron, Chromium Carbide and Niobium				Data Sheet DSMW-0023
W 16.5Fe 6Cr 7.5C 4Nb	4 or 5 mm	WokaDur S70	Dip Coated, Sintered Rod	- Deposit hardness: 63 – 70 HRC - Produces hard surfaces that resist wear, abrasion and erosion from hard minerals; impact should be avoided - Use on almost any type of steel substrate; can be used on thin walls and edges - For concrete, brick and clay applications such as conveyor screws and mixer blades - Service up to 500 °C (930 °F)

Product Index

Product	Page	Product	Page	Product	Page
MetcoClad 6.....	5	WOKA 50055.....	10	WOKA 50532.....	9
MetcoClad 6F.....	5	WOKA 50057.....	6	WOKA 50538.....	9
MetcoClad 21.....	5	WOKA 50057.....	9	WOKA 50610.....	15
MetcoClad 23.....	5	WOKA 50057.....	14	WOKA 50816.....	14
MetcoClad 316L-Si.....	5	WOKA 50059.....	6	WOKA 50966.....	15
MetcoClad 625.....	5	WOKA 50059.....	9	WOKA 50972.....	15
MetcoClad 625F.....	5	WOKA 50072.....	14	WOKA 50973.....	15
MetcoClad 718.....	5	WOKA 50105.....	7	WOKA 50974.....	15
MetcoClad 52001.....	6	WOKA 50105.....	10	WOKA 50975.....	15
MetcoClad 52052.....	6	WOKA 50107.....	7	WOKA 50976.....	15
MetcoClad 53003.....	6	WOKA 50107.....	9	WOKA 53025.....	10
MetcoClad C-276.....	5	WOKA 50107.....	14	WOKA 53045.....	10
PlasmaDur 51021.....	8	WOKA 50115.....	7	WOKA 53114.....	10
PlasmaDur 51022.....	8	WOKA 50115.....	9	WOKA 53134.....	10
PlasmaDur 51027.....	8	WOKA 50115.....	14	WOKA 53164.....	10
PlasmaDur 51122.....	8	WOKA 50120.....	7	WOKA 56006.....	6
PlasmaDur 51132.....	8	WOKA 50120.....	9	WOKA 56006.....	8
PlasmaDur 51142.....	8	WOKA 50120.....	14	WOKA 56006.....	10
PlasmaDur 51202.....	8	WOKA 50131.....	14	WokaDur A.....	12
PlasmaDur 51222.....	8	WOKA 50155.....	7	WokaDur A-Plus.....	12
PlasmaDur 51302.....	8	WOKA 50155.....	9	WokaDur AM.....	12
PlasmaDur 51322.....	8	WOKA 50155.....	11	WokaDur E.....	17
PlasmaDur 51937.....	8	WOKA 50168.....	7	WokaDur E-Plus.....	17
WOKA 50001.....	6	WOKA 50168.....	9	WokaDur FeCr.....	12
WOKA 50001.....	10	WOKA 50168.....	11	WokaDur NiA.....	12
WOKA 50005.....	6	WOKA 50174.....	7	WokaDur NiA-Plus.....	12
WOKA 50005.....	9	WOKA 50174.....	9	WokaDur NiA-Tube.....	16
WOKA 50005.....	10	WOKA 50178.....	15	WokaDur NiE.....	17
WOKA 50007.....	6	WOKA 50236.....	15	WokaDur NiE-M.....	17
WOKA 50007.....	6	WOKA 50207.....	7	WokaDur NiE-Plus.....	17
WOKA 50007.....	14	WOKA 50207.....	9	WokaDur NiE-TM.....	16
WOKA 50009.....	6	WOKA 50502.....	15	WokaDur NiE-Tube.....	16
WOKA 50009.....	9	WOKA 50503.....	15	WokaDur NiE-Tube-Plus.....	16
WOKA 50009.....	10	WOKA 50504.....	9	WokaDur OAM.....	16
WOKA 50024.....	9	WOKA 50504.....	15	WokaDur S70.....	17
WOKA 50024.....	14	WOKA 50505.....	7	WokaDur S80-Ni-TIG.....	17
WOKA 50028.....	14	WOKA 50505.....	11	WokaDur SA 100.....	13
WOKA 50051.....	6	WOKA 50505.....	15	WokaDur SA 100-Ni.....	13
WOKA 50054.....	6	WOKA 50512.....	9	WokaDur SA 100-Ni-T.....	13
WOKA 50054.....	9	WOKA 50512.....	15	WokaDur SA 100-T.....	13
WOKA 50055.....	6	WOKA 50530.....	15		

Notes

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Weld Hardface and Cladding Materials

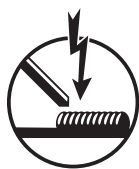
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