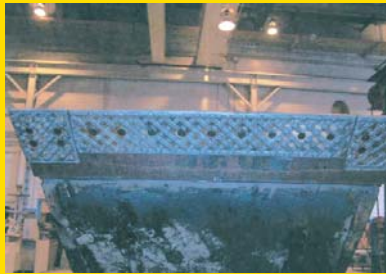


Solutions for Difficult Wear Challenges

Eutectic Hardfacing Guide



Castolin Eutectic®
Eutectic Castolin



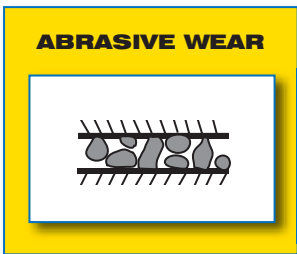
ABRASION + IMPACT

- Causes loss of part shape and performance due to surface loss by abrasion.
- Causes metal fatigue due to impact.
- Toughness with intermediate hardness are key properties needed to combat this type of wear.



GOUGING ABRASION

- Caused by heavy ore or mineral lumps rubbing against a surface with enough point loading force to gouge out material.
- Toughness and high hardness are key properties to resist gouging abrasion.



GRINDING ABRASION

- Also known as "3-body abrasion". This causes wear due to high surface stresses imparted from surface-to-surface by material being ground or crushed.
- Smoothness and hardness are primary properties that resist grinding abrasion.

PROCESS	PRODUCTS	DIAMETER	DESCRIPTION	PROPERTIES	APPLICATIONS
FCAW-Open Arc	AN 4923	7/64"-1/8"	An FeCrMoTi wire with ultra-fine titanium carbides and tough martensitic structure.	For wear involving abrasion and severe impact. Does not need a build-up alloy. Rc45-55. DCEP(+)	<ul style="list-style-type: none"> • Clinker Crusher Rolls • Refuse Crusher Hammers • Muller Tires • Sheepfoot Tampers
	OA 4625 FW Chrom Iron	7/64" 1/16"-0.045"	FeCrC wires with combined hardness and toughness properties supported by a large volume of chromium carbides.	Ideal for combining wear involving both impact and abrasion. Rc 45-50. DCEP(+)	<ul style="list-style-type: none"> • Drag Line Bucket Lips. • Dredger Parts • Bag Packer Screws • Pug Mill Augers
	OA 3205 FW Mang Steel	7/64"-1/16" 1/16"-0.045"	High manganese wires for rebuilds and cushioning layers for final-pass hardfacing.	Best when impact is major cause of wear. Work hardens in service to Rc45 DCEP(+)	<ul style="list-style-type: none"> • Frog re-builds • Crusher mantels and concaves. • Bucket repairs
GMAW-Cored Wire	DO*14	1/16"-0.045"	Deposits a balanced combination of impact and abrasion resistant weld metal.	Weld deposits resist moderate abrasion with impact. Multi-layer build-ups are crack-free. Rc 45 with three passes. DCEP(+)	<ul style="list-style-type: none"> • Pump Shells • Hog Anvils • Hot Forming Dies • Tampers & Rams • Debarker Hammers
SMAW-Stick	ChromCarb N6006	3/16"- 5/32"-1/8"	Deposits are mirror-smooth, which reduces start-up wear. Deposits are supported by a large volume of primary chromium carbides.	Deposits are resistant to high compression and impact with abrasion. Rc 55-60. AC-DCEP(+)	<ul style="list-style-type: none"> • Crusher Spiders • Crusher Hammers • Latch Bars • Auger Flights
	XHD 6899	5/32"-1/8"	Specially alloyed to resist abrasive wear and impact at moderate temperatures. (approx. 800°F)	Best for hot abrasion with impact when hot hardness is needed. Rc25. Work Hardens to Rc45. AC-DCEP(+)	<ul style="list-style-type: none"> • Stoker Screws • Impact Dies • Sintering Grates • Ash Plows

PROCESS	PRODUCTS	DIAMETER	DESCRIPTION	PROPERTIES	APPLICATIONS
FCAW-Open Arc	OA 3952 FW Mixed Carbide	7/64"-1/16"	Complex carbide flux-cored wires with enhanced wear resistance due to multi-type carbides. eg. Cr-Mo-Cb-W.	Resists ambient and high gouging wear at temperatures up to 1200°F. Rc 63 as deposited. DCEP(+).	<ul style="list-style-type: none"> • Hot Cement Cones • Mixer Blades • Slag Ladles • Slurry pipes
	OA 4652	7/64"	A highly alloyed wire which maintains high hot hardness and abrasion resistance up to +1000°F.	Excellent for both gouging and sliding abrasion applications. Rc 62 as deposited. DCEP(+)	<ul style="list-style-type: none"> • Conveyor Screws • Pug Mill Paddles • Slag Handling Equipment
GMAW-Cored Wire	DO*33	1/16"-0.045"	Highly alloyed metal-cored wire that deposits wear resistant precipitates of columbium, boron and chromium.	Use for both severe fine particle abrasion at elevated temperatures as well as gouging abrasion. Rc+65. DCEP(+)	<ul style="list-style-type: none"> • Clamshell Buckets • Ball Mill Scoops • Fan Blades • Auger Flights
SMAW-Stick	XHD N6715	3/16" 5/32"-1/8"	Specially formulated electrode for slag-free deposits. Highly resistant to high temperature abrasion, including gouging wear.	Abrasion resistant properties are maintained up to 1200°F. A low arc force reduces dilution for high hardness single-pass deposits. RC65. AC/DCEN(-)	<ul style="list-style-type: none"> • Clinker Chains • Sinter Equipment • Slurry Pumps • Clam Shell Buckets • Dredge Parts
	XHD N6710	3/16" 5/32"-1/8"	For combating high pressure gouging abrasion. Point loading resistance is enhanced by chromium matrix.	Weld deposits consist of a tough matrix supporting a high volume of wear resistant carbides. Rc65 (1 pass). AC/DCEN(-)	<ul style="list-style-type: none"> • Chute Liners • Mill Liners • Crusher Check Plates • Scoop Lips
	Ultimum N112	3/16"	A unique tungsten carbide composite alloy which deposits a tungsten-enriched matrix and finely sized carbides.	For maximum abrasion resistance including hard particle erosion resistance. Rc65 AC/DCEP(+)	<ul style="list-style-type: none"> • Muller Plows • Rasp Bars • Conveyor Fans

PROCESS	PRODUCTS	DIAMETER	DESCRIPTION	PROPERTIES	APPLICATIONS
FCAW-Open Arc	OA 4603	7/64"-0.045"	A FeCrCMnSi wire with a finely dispersed carbide network supported by a tough hyper-eutectic structure which imparts dilution tolerance.	For wear involving abrasion with high stress. Rc 55-60. DCEP(+)	<ul style="list-style-type: none"> • Clinker Crusher Rolls • Refuse Crusher Hammers • Bucket Lips • Conveyor Screws
	OA 4601 FW HighChrom	7/64" 1/16"-0.045"	FeCrC wires with high hardness supported by platelet carbides in a tough, chromium-enriched matrix.	Best for combating wear involving both sliding and high stress abrasion. Rc 55-60. DCEP(+)	<ul style="list-style-type: none"> • Drag Line Bucket Lips. • Dredger Parts • Conveyor Chutes • Discharging Augers
GMAW-Cored Wire	DO*10	1/16"-0.045"	An FeCrCBMn wire with quick freezing qualities for out-of-position welding. A double carbide network helps reduce spalling	Weld deposits resist abrasion with moderate impact. Rc 56 with two passes. DCEP(+)	<ul style="list-style-type: none"> • Pump Shells • Bucket Floors • Muller Tires • Dredger Links
	EutecTrod 5003	3/16" 5/32"-1/8"	Superior weldability with mirror smooth deposits. Weld metal is supported by a large volume of hexagonal chromium carbides.	Deposits are resistant to high-point load stress abrasion. Rc 55-60. AC/DCEP(+)	<ul style="list-style-type: none"> • Bucket Latch Bars • Crusher Hammers • Impact Breaker Bars • Mixer Paddles
	AbraTec N700	5/32" - 1/8"	A hardfacing alloy with sufficient chromium to form both primary and secondary carbides	Point loading resistance is improved due to the presence of fine carbide precipitates. Rc60. AC/DCEN(-)	<ul style="list-style-type: none"> • Cement Grinder Rings • Pulverizer Bars • Pug Mill Paddles • Ash Plows



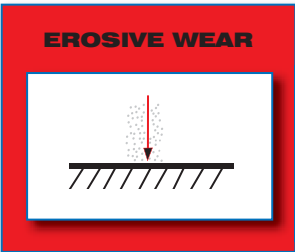
ABRASIVE WEAR

SLIDING ABRASION

• Also known as “2-body abrasion” or “low-stress abrasion”, causes metal loss due to surface micro-grooving.

• High hardness and a very smooth surface are key properties to resist this type of wear.

PROCESS	PRODUCTS	DIAMETER	DESCRIPTION	PROPERTIES	APPLICATIONS
FCAW-Open Arc	AN 4811 FW Tung Carbide	7/64"-1/16"	Both wires contain a large volume of ultra abrasion resistant tungsten carbides contained in a chromium toughened matrix.	An optimized cost-to-life ration plus outstanding wear resistance is achieved with single passes. Rc62-65. DCEP(+)	<ul style="list-style-type: none"> • Sand Slinger Cups • Conveyor Fans • Ore Chutes • Auger Bits
	OA 4652	7/64"-1/8"	Both wires deposit weld metal with large volumes of complex carbides such as Cr-W-Nb-Mo	Deposits are highly resistant to most forms of sliding abrasion. Deposits grind and/or wear to a very smooth finish. Rc62-64. DCEP(+)	<ul style="list-style-type: none"> • Earth Moving Equipment • Conveyor Screws • Discharge Chutes • Ore Handling Equipment • Cement Baggers
GMAW-Cored Wire	DO*33	1/16"-0.045"	Highly alloyed wire with hard-phase particulates of Cb-B-Cr contained in chromium rich matrix	Can be used for both sliding and fine particle erosion at both room temperatures up to 1200°F Rc65-68. DCEP(+)	<ul style="list-style-type: none"> • Fan Blades • Conveyor Chains • Pump Chambers • Dust Extractors • Ash Elbows
SMAW-Stick	Ultimum 112	3/16"	A unique tungsten carbide composite alloy which deposits a tungsten-enriched matrix supported by finely-sized dispersed carbides.	For maximum sliding abrasion resistance. Including resistance to hard particle erosion. Rc65. AC/DCEP(+)	<ul style="list-style-type: none"> • I.D. Fan Blades • Conveyor Chutes • Cement Screws • Slurry Pipes
	XHD 6715	3/16" 5/32"-1/8"	A multi-carbide alloy formulated to be slag free. Highly resistant to both sliding wear and high temperature particle wear.	Low arc-force and low dilution properties enable high hardness single pass weld metal to be deposited. Rc65. AC/DCEN(-).	<ul style="list-style-type: none"> • Mill Liners • Cement Dryers • Conveyor Screws • Hot Cement Cones • Scoop Lips



EROSIVE WEAR

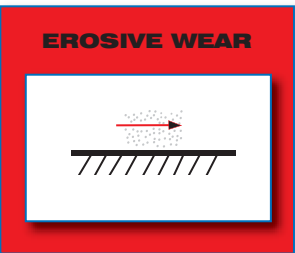
IMPINGEMENT EROSION

• Also known as “large angle particle impact wear”, this causes metal loss due to repeated surface deformation.

• The key property to resist this type of wear in weld metal deposits is toughness when particles contact the surface at high angles and high speeds.

PROCESS	PRODUCTS	DIAMETER	DESCRIPTION	PROPERTIES	APPLICATIONS
FCAW-Open Arc	OA 3205 FW Mang Steel	7/64"-1/16" 1/16"-0.045"	Both wires deposit weld metal high in manganese. Repeated impacts impart increasing wear resistance.	After weld peening changes the structure for improved performance. Work hardens in service to Rc45. DCEP(+)	<ul style="list-style-type: none"> • Deflector Plates • Centrifugal Pump Casings • Pipelines/Chutes at high impact areas.
GMAW-Cored Wire	DO*80	0.045"	A high cobalt alloy with excellent resistance to surface deformation.	Weld deposits contain very fine undissolved carbides contained in a tough matrix. Hot hardness maintained up to 1000°F. Work hardens in service to Rc45. DCEP(+)	<ul style="list-style-type: none"> • Gate Valves • High Pressure Valves • Deflector Plates • Exhaust Valves • Hot Baffle Plates
	DO*14	1/16"-0.045"	A balanced formulation for abrasion and impact applications involving large, air-entrained particles.	A special iron-based alloy with additions of Cr-Mo-W-V to promote a balanced hardness, range a fine, and dense grain structure. Work hardens to Rc45. DCEP(+)	<ul style="list-style-type: none"> • Screen Classifiers • Dust Extractors • Agitators • Impeller Blades • Coal Blowers
SMAW-Stick	XHD CastoStar 1	5/32"-1/8"	For applications involving erosion at temperatures up to 1000°F.	Weld metal is highly alloyed with additions of Cr-Mo-Co-W to provide temperature stability and carbide-enhanced toughness. Rc40. AC/DCEP(+)	<ul style="list-style-type: none"> • Kiln Stirrers • Hot Ash Blowers • Deflectors • Tuyers

Note 1: For **high speed**, high angle particle erosion, recommend one of the products described above.
 Note 2: For **low speed**, high angle particle erosion, rubbers and polymeric materials are preferred.
 Note 3: For **low speed**, low angle particle erosion, refer to products covered under ABRASIVE EROSION.



EROSIVE WEAR

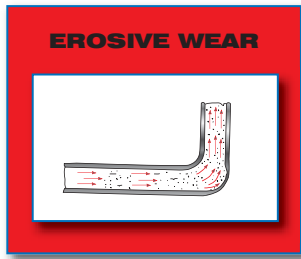
ABRASIVE EROSION

• Also known as “scratching abrasion”, this is caused by the micro-machining action of hard particles along a surface.

• High hardness and deposit smoothness are the key properties to resist this type of wear.

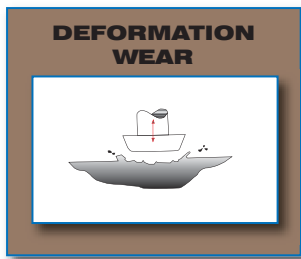
PROCESS	PRODUCTS	DIAMETER	DESCRIPTION	PROPERTIES	APPLICATIONS
FCAW-Open Arc	AN 4811 FW Tung Carbide	7/64"-1/16"	Both wires contain a large volume of ultra abrasion resistant tungsten carbides contained in a chromium toughened matrix.	An optimized cost-to-life ration plus outstanding wear resistance is achieved with single passes. Rc62-65. DCEP(+)	<ul style="list-style-type: none"> • Sand Slinger Cups • Conveyor Fans • Cyclone Separators • Air Blast Equipment
	OA 4652 FW Mixed Carbide	7/64"-1/16"	Both wires deposit weld metal with large volumes of complex carbides such as Cr-W-Nb-Mo	Deposits are highly resistant to most forms of sliding abrasion. Deposits grind and/or wear to a very smooth finish. Rc62-64. DCEP(+)	<ul style="list-style-type: none"> • Dust Extractor fans • Conveyor chutes • Discharge Chutes • Pump Casings • Suction Fan Impellers
GMAW-Cored Wire	DO*33	1/16"-0.045"	Highly alloyed wire with hard-phase particulates of Cb-B-Cr contained in chromium rich matrix	Can be used for both sliding and fine particle erosion at both room temperatures up to 1200°F Rc65-68. DCEP(+)	<ul style="list-style-type: none"> • Fan Blades • Mill Liners • Fuller Pumps • Dust Extractors • Ash Elbows
SMAW-Stick	Ultimum 112	3/16"	A unique tungsten carbide composite alloy which deposits a tungsten-enriched matrix supported by finely-sized dispersed carbides.	For maximum sliding abrasion resistance. Including resistance to hard particle erosion. Rc65. AC/DCEP(+)	<ul style="list-style-type: none"> • I.D. Fan Blades • Conveyor Chutes • Cement Screws • Slurry Pipes
	XHD 6715	3/16" 5/32"-1/8"	A multi-carbide alloy formulated to be slag free. Highly resistant to both sliding wear and high temperature particle wear.	Low arc-force and low dilution properties enable high hardness single pass weld metal to be deposited. Rc65. AC/DCEN(-).	<ul style="list-style-type: none"> • Mill Liners • Cement Dryers • Conveyor Screws • Hot Cement Cones

Note that **ABRASIVE EROSION** occurs when particles strike the surface at impact angles less than 30°



SLURRY EROSION

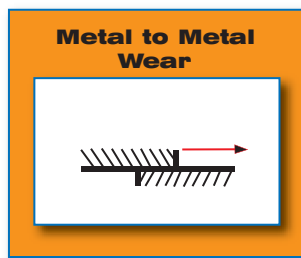
- This form of abrasion involving a liquid carrier. The large-scale wear effect is similar to two-body sliding abrasion
- Smoothness and high hardness are key properties for resisting this type of wear.



IMPACT WEAR & HIGH COMPRESSIVE WEAR

IMPACT WEAR: Repeated impacts cause wear due to either sever deformation (SOFT-HARD combinations) or fatigue fracture (HARD-HARD combinations).

HIGH COMPRESSIVE WEAR: High static overloads or high loads involving a rolling member to cause wear due to surface fatigue.



METAL-TO-METAL WEAR

...or sliding wear as it is sometimes described, causes metal loss at the surface-to-surface contact zone due to the basic mechanism of adhesion followed by tearing.

Progressive adhesion-tearing eventually leads to critical loss of surface metal and failure.

PROCESS	PRODUCTS	DIAMETER	DESCRIPTION	PROPERTIES	APPLICATIONS
FCAW-Open Arc	AN 4811 FW Tung Carbide	7/64"-1/16"	Both wires contain a large volume of ultra abrasion resistant tungsten carbides contained in a chromium toughened matrix.	An optimized cost-to-life ration plus outstanding wear resistance is achieved with single passes. Rc62-65 DCEP(+)	<ul style="list-style-type: none"> • Mud Pumps • Well Pumps • Agitators • Slurry Pumps
	OA 4652	7/64"-1/16"	Both wires deposit weld metal with large volumes of complex carbides such as Cr-W-Nb-Mo	Deposits are highly resistant to most forms of sliding abrasion. Deposits grind and/or wear to a very smooth finish. Rc62-64. DCEP(+)	<ul style="list-style-type: none"> • Flotation Systems • Down Hole Equipment • Wet Cement Pumps • Sludge Pumps
GMAW-Cored Wire	DO*33	1/16"-0.045"	Highly alloyed wire with hard-phase participates of Cb-B-Cr contained in chromium rich matrix	Can be used for both sliding and fine particle erosion at both room temperatures up to 1200°F Rc65-68. DCEP(+)	<ul style="list-style-type: none"> • Oil Booster Pumps • Conveyor Chains • Pump Chambers • Wet Ash Elbows
SMAW-Stick	Ultimum 112	3/16"	A unique tungsten carbide composite alloy which deposits a tungsten-enriched matrix supported by finely-sized dispersed carbides.	For maximum sliding abrasion resistance. Including resistance to hard particle erosion. Rc65. AC/DCEP(+)	<ul style="list-style-type: none"> • Stirrer Paddles • Sullage Pumps • Cement Screws • Slurry Pipes
	XHD 6715	3/16" 5/32"-1/8"	A multi-carbide alloy formulated to be slag free. Highly resistant to both sliding wear and high temperature particle wear.	Low arc-force and low dilution enable high hardness single pass weld metal to be deposited. Rc65. AC/DCEN(-).	<ul style="list-style-type: none"> • Sewage Agitators • Cement Dryers • Conveyor Screws

PROCESS	PRODUCTS	DIAMETER	DESCRIPTION	PROPERTIES	APPLICATIONS
FCAW-Open Arc	OA 3205 FW Mang Steel	7/64"-1/16" 1/16"-0.045"	High manganese wires for re-builds and shape-reforming worn parts.	High compressive strength imparts resistance to both impact wear and bulk fatigue wear. Work hardens in service to Rc45. DCEP(+)	<ul style="list-style-type: none"> • Reclaimer Wheels • Crusher Concaves • Crusher Hammers • Bucket Teeth
	AN 4923	7/64"-1/16"	Deposits tough, impact-resistant weld-metal supported by both shock and load bearing titanium carbides.	Resists wear damage due to fatigue resulting from repeated impacts or high pressure cyclical loading. Rc45-55. DCEP(+)	<ul style="list-style-type: none"> • Driving Tumblers • Latch Bars • Refuse Hammers • Breaker Plates
GMAW-Cored Wire	DO*05	1/16"-0.045"	A high manganese-chromium wire for severe impact applications. Can be used either as a build-up or final pass hardfacing alloy.	High fatigue and compressive strength reduces spalling and deposit break-out on austenitic manganese casings and low-steels. Rc20, Work hardens to Rc45. DCEP(+)	<ul style="list-style-type: none"> • Roll Crushers • Digger Teeth • Rail Frogs • Deflector Plates
SMAW-Stick	FerroTrode 2-B	1/4" 3/16"-5/32"	A chromium-toughened alloy for use on carbon and low alloy steel parts subject to severe impact.	Weld deposits are largely pearlitic which provides a combination of impact and compressive strength. Rc30. DCEP(+)	<ul style="list-style-type: none"> • General Re-builds • Track Links • Slip Joints • Rollers & Shafts
	EutecTrode 40	3/16"-5/32"	A work hardened austenitic manganese electrode highly suited to heavy impact service.	Due to high plastic strain properties, weld deposits become tougher in service. Rc20, Work Hardens to Rc45+. DCEP(+)	<ul style="list-style-type: none"> • Impact Bars • Shovel Pads • Drive Lugs • Latch Pads

PROCESS	PRODUCTS	DIAMETER	DESCRIPTION	PROPERTIES	APPLICATIONS
FCAW-Open Arc	OA 3010	7/64"	A Fe-Mn-C alloy ideal for both undercladding and re-builds on carbon steels.	Weld metal consists of a tough pearlite-ferrite structure with the amount of free ferrite being moderated by a balanced carbon level. Rc37. DCEP(+)	<ul style="list-style-type: none"> • Ladle Pins • Latch Bar Keeps • Ball Eyes • Clutch Lugs • Travel Sprockets
GMAW-Cored Wire	DO*14	1/16"-0.045"	A Cr-Mn-C enriched, iron-based alloy which develops a tough surface skin during sliding. This reduces metal-to-metal wear on unlubricated parts	Both Single and multi-pass deposits are supported by a tempered martensitic structure. Rc45. DCEP(+)	<ul style="list-style-type: none"> • Shovel Housing Rolls • Dragline Pins • Ingot Buggy Pistons • Cable Sheaves
SMAW-Stick	FerroTrode 2-B	5/32"	A Fe-Mn-C alloy with chromium added for improved compressive strength and surface film integrity.	For highly machinable re-builds on carbon and low alloy steels. Toughness and load carrying capacity reduce metal to metal friction. Rc30. AC/DCEP(+)	<ul style="list-style-type: none"> • Gear Teeth • Gear Splines • Slewing Rollers • Worn Shafts • Steel Bearings
	XHD 6804	1/8"-5/32"	A "super" alloy containing Cr-Co-Mo for enhanced frictional resistance to elevated temperatures.	Due to highly enriched weld deposit composition, overlays are resistant to galling at both room elevated temperatures. Rc50. AC/DCEP(+)	<ul style="list-style-type: none"> • Press Forming Tools • Hot Billet Guides • Hot Shear Blades • Fretted Surfaces • Bearing Boxes

Note: The effects of metal-to-metal wear can vary quite significantly depending on the surface materials being used and sliding conditions. The three most important classes of sliding wear are:
1) ADHESIVE, which can be mild or severe. 2) CUTTING OR PLOWING, which involves 2-body abrasion or scoring. 3) SURFACE FATIGUE, recognized by surface pitting or spalling.



Eutectic Corporation
N94 W14355 Garwin Mace Drive
Menomonee Falls, WI 53051 USA
P 800-558-8524 • F 262-255-5542
www.eutectic.com

Eutectic Services
12300 Carmen Avenue
Milwaukee, WI 53225 USA
P 800-558-8524 • F 262-255-5542

