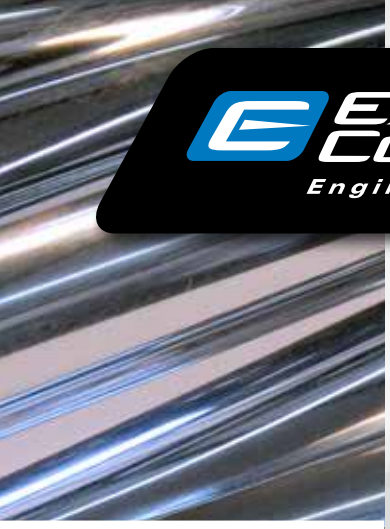
EXTREME COATINGS
Engineered Surfaces

Wear & Corrosion Resistant Solutions | *Improving Service Life and Performance of Your Most Valuable Parts*



EXTREME COATINGS
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A Global Leader in Thermal Spray Coating Solutions

Extreme Coatings is a world leader providing wear-resistant coating solutions which are used for surface engineering in a variety of industries. Since 1996, we have been developing and deploying innovative, superior coating products and services to countries across the globe.

Our team offers an effective, solution-oriented approach which makes use of advanced thermal spray technology and proprietary coating formulations. The exceptional quality of our products has enabled them to become trade standards in the plastics and rubber industry for feedscrews, mixing rotors, tip assemblies and other parts; as well as in the oil and gas industry for downhole mud rotors and fracture pump plungers.

Successful Solutions, Impressive Results

Extreme Coatings encapsulates complex industrial components, protecting them from wear and corrosion. By increasing wear resistance, service life is increased and performance is dramatically enhanced.

We use state-of-the-art HVOF thermal spray technology to apply wear and corrosion resistant coatings. Extreme Coatings is a world leader for Tungsten Carbide Coatings on injection molding and extrusion feedscrews and mixing rotors in the plastic & rubber industry. In the Oil & Gas Industry, we are #1 in North America for mud rotor restoration and chrome plating replacement and also a leading supplier for fracture pump plunger coatings. We have coated numerous components for many industries adding major value through performance improvement and longevity.

Our focus always remains on our customers' requirements, and is demonstrated by our dedication to the resources for developing effective, successful surface engineering solutions for specific industries and equipment.

Experience & Expertise

Our industry experience has afforded Extreme Coatings the opportunity to service over 30,000 parts, and our technological expertise has equipped us with ability to offer bottom-line solutions like no other competitor in the industry. Our proprietary technologies yield a finished product that offers greater value than most all other surface engineering solutions on the market.

This competitive advantage significantly lowers our customers' operating costs through extended service life and a reduction in machine downtime. We view each job as unique, and we take pride in offering a service model that is customized to fulfill individual client needs to advance their productivity.

Typical Components Protected to Maximize Value

Plastic & Rubber Industry

- Injection Molding Feedscrews
- Extrusion Feedscrews
- Continuous Mixing Rotors
- Non-Return Value/Tip Assemblies
- Ultrasonic Horns
- Dies

Oil & Gas

- Mud Rotors
- Fracture Pumps
- Mandrels
- Drive Shafts
- Flow Diverters
- Bearings

Other Items

- Converyor Augers
- Pump Sleeves
- Hydraulic Shafts
- Heat Exhanger Tubes
- Fans

Innovation & Technology

Extreme Coatings uses HVOF thermal spray technology to apply premium wear-resistant and corrosion-resistant coatings to complicated machine parts. These coatings are hard, dense and porosity free and can be applied up to .040" (1mm) thick. Our proprietary formulations of hard carbides, ceramics and alloys achieve a degree of resistance to wear and corrosion unmatched by conventional alloys. After coating, our unique diamond grinding / polishing process provides a mirror-like finish that further reduces friction and adhesive wear. We can completely encapsulate new or used machine components.

Coating Formulas for Ultimate Effectiveness

Our coating formulations have been designed for optimal effectiveness with our thermal spray application processes. Our winning CarbideX coating formulations combine tungsten carbide and carefully selected alloys or metals to provide the most economical wear solution available. By producing coating materials from micro and sub-micron raw material we assure high bond strength with uniform conformance to the most complicated shapes and surfaces. We constantly test new formulations for a growing range of products and applications that result in even greater toughness, consistency and performance enhancement.

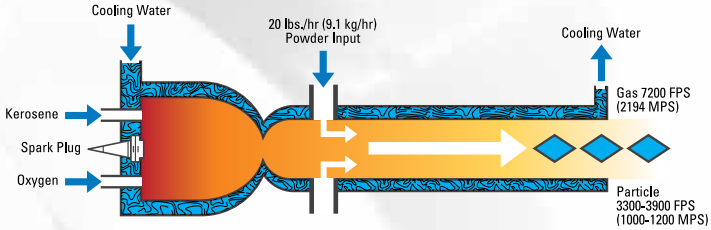
The CARBIDEX® Advantage

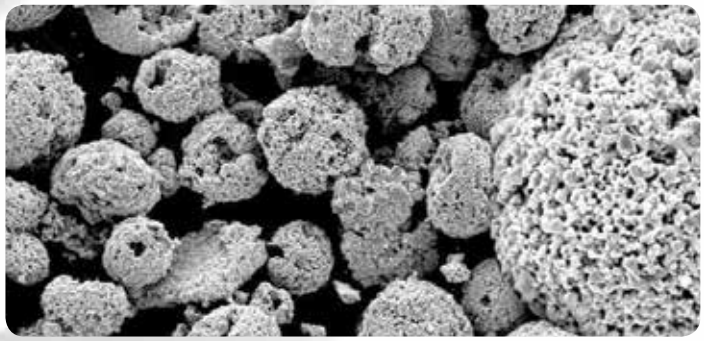
CarbideX Formula	Alloy Composition	Hardness
C1000	Formulation of Tungsten Carbide, Cobalt Matrix ***Key Characteristics:*** *Ultimate abrasion resistance with moderate corrosion resistance*	68-71 HRC
C1000Ni	Formulation of Tungsten Carbide, Nickel Matrix ***Key Characteristic:*** *Ultimate abrasion and moderate to good corrosion resistance*	68-71 HRC
C1000-17	Formulation of Tungsten Carbide, Cobalt Matrix ***Key Characteristic:*** *Ultimate abrasion and moderate corrosion resistance with ductility*	66-68 HRC
C1000Cr	Formulation of Tungsten Carbide, Cobalt, Chrome Matrix ***Key Characteristic:*** *Ultimate abrasion and good to excellent corrosion resistance*	69-70 HRC
C4000	Formulation of Carbon, Chromium, Nickel Matrix ***Key Characteristic:*** *Moderate corrosion and abrasion resistance with high temperature performance*	55-60 HRC
C5000 (CPR)	Proprietary Formulation of Carbides within a Nickel Chrome Cobalt Matrix ***Key Characteristic:*** *Moderate wear, extreme corrosion, economical*	58-62 HRC
C6000	Proprietary Formulation of Carbides within a Nickel Chrome Cobalt Matrix ***Key Characteristics:*** *Moderate wear, moderate corrosion, very economical*	58-62 HRC
C9000	Formulation of Tungsten Carbide (micron & nanometer particles), Cobalt Matrix ***Key Characteristic:*** *Excellent wear resistance and good corrosion resistance specially formulated for fine particle abrasion*	68-71 HRC

It's All in the Application: HVOF Thermal Spray Technology

HVOF (High Velocity Oxygen Fuel) thermal spray technology allows us to apply coatings with extremely low porosity and high bond strength. A mixture of fuel and oxygen are combusted within a thermal spray gun producing temperatures near 6000ºF (3300ºC).

Powder particles are injected into the high-pressure gas stream created by the combustion and accelerate down the barrel of the spray gun at several times the speed of sound. At these speeds and temperature conditions, semi-molten particles adhere to the substrate with superior bond strength – exceeding 10,000 PSI. During coating application, the product rotates methodically in front of the HVOF thermal spray gun until the coating builds to the specified thickness. This process creates the strongest bond and highest hardness value as compared to any other thermal spray process.



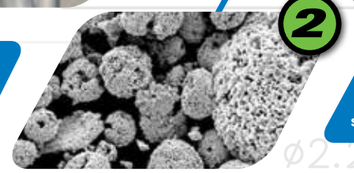


Research & Development

At Extreme Coatings, our mission is to continually research and develop new technologies that benefit our clients in every industry we service. Our goal is to remain the experts in the field of metallurgy and set the bar in engineered surface solutions. Our proprietary coating formulas protect and extend the service life of your most valuable parts, saving you money and enhancing your bottom line.

The Extreme Coatings Process


1. Inspect new or reconditioned part to be processed


2. Confirm all processing details and coating formula


3. Strip & repair as necessary to OEM spec minus coating specification


4. Prepare the surface via grit blast


5. Application of the coating via HVOF


6. Sprayed and sealed - application dependent


7. Finish polishing with diamond abrasive


8. Inspect and measure


9. Part complete with mirror finish

Application Expertise

Extreme Coatings has carved a niche in reducing wear and increasing the life of complex metal machine components of any size and almost any geometry. In any industry where abrasion, adhesion or corrosion reduce product life, for new or used parts, we offer a surface solution.

Plastic & Rubber Industry

Feedscrews and mixing rotors which are used in the plastic and rubber industry often experience extreme wear problems on the outside diameter, flight sides and roots. The demand for plastics to have longevity or strength in more aggressive environments has led chemical engineers to add fillers, binders and other abrasion or corrosive materials to polymers, resulting in further increased wear and corrosion on feedscrews and mixing rotors.

Extreme Coatings offers an effective solution for this problem.

Feedscrews & Mixing Rotors - Injection Molding, Extrusion, Blow Molding, Twin Mixers/Blenders

Partial Encapsulation

Extrusion feedscrews that primarily experience wear on the outside flights can benefit from our FliteGuard option. By coating only the top of the flight with extremely wear-resistant materials, the life of a feedscrew can be significantly extended. Repair or replacement can be delayed from four to six times when compared to feedscrews protected by conventional hard-facing alloys.

Encapsulation

Full encapsulation completely protects the entire working surface of a feedscrew with a premium abrasion and corrosion resistant coating. Our coatings are perfect for injection molders and extruders when processing fiberglass, calcium carbonate, titanium dioxide and metals, ceramic or other highly abrasive fillers.

Proprietary Finishing Process

Super-Finishing technologies provide a final surface profile of less than 4 Ra ui (.10 Ra um). This mirror-like finish, which shines more than chrome, reduces friction, reduces adhesive wear and maintains a tight tolerance for high output and longer barrel life.

Custom Solutions

In some cases, we coat only the section or area that is wearing most rapidly. In these situations, an evaluation is performed and a tailored solution recommended.

The Results Are Clear

- Tight tolerance of close tolerance system maintained
- Cost per pound or kilogram/hour decreases
- Screws last at least two times longer
- Two to four times more production
- Less preventive maintenance (DOWNTIME)
- Barrel life is improved
- Scrap rate decreases
- Output remains consistent
- Cycle times remain consistent
- Polymer integrity maintained

- A: Is an Encapsulated Feedscrew via HVOF with one of our CarbideX formulas and polished to a mirror finish
- B: Is the cut away Feedscrew showing our coating layer uniformity.

Oil & Gas Industry Solutions

Drilling operations of the oil and gas industry expose parts to the harshest of elements, resulting in exposure that leads to extreme wear and corrosion in a very brief period of time. Mud motor rotors, which are critical to the drilling operation, are particularly susceptible to abrasion and corrosion when drilling in high chloride, acidic or alkaline muds. Failure can be costly and time consuming.

Extreme Coatings HVOF applied coating formulas extends service life in multiples when compared to chrome plating.

Mud Motor Rotors - Directional Drilling Power Section

Restoration

A full-service mud rotor repair and coating facility owned and operated by Extreme Coatings uniquely strips both carbide and chrome plated rotors, exposing damages that can be repaired by welding, blending and re-coating to specification.

Full Encapsulation

Full encapsulation completely protects the entire working surface of the mud rotor with long- lasting carbide. This approach is appropriate when drilling in all muds and brines.

CPR Coating Formulations Line

Traditional carbide coatings can be applied as well as one of our cost-effective, proprietary HVOF Chrome Plating Replacement (CPR) coatings line.

Proprietary Finishing Process

Super-Finishing technologies provide a final surface profile of less than 4 Ra ui (.10 Ra um). This mirror-like finish, which shines more than chrome, reduces friction and increases stator life.

Customer Solutions

Custom application formulations are available on your request.

The Results Are Clear

- Maximize rotor life
- Reduce parts cost
- Improve stator life
- Decrease cost per rotational hour
- Enable consistent rate of penetration (ROP)
- Substantially improve overall fleet utilization
- Extend asset life

- A: Is a Encapsulated Mud Rotor via HVOF with one of our CarbideX formulas and polished to a mirror finish
- B: Is the cut away of the Mud Rotor showing our coating layer uniformity.

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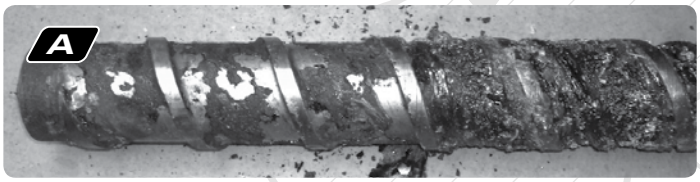
See the Difference: Product Performance

At Extreme Coatings, our focus is on increasing the performance of our customers' parts; extending service life and making a difference to the bottom line. Here are a few examples of how we have helped our clients. For a more complete list of examples, please visit our website.

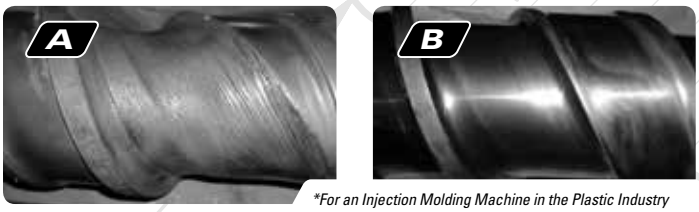
*Product for an Injection Molding Machine in the Plastic Industry

- A: Is a standard powder metal Feedscrew after 6 months processing highly abrasive ceramic filled polymer.
- B: Is a CarbideX C9000 coated Feedscrew after 12 months in the same process with more life remaining.



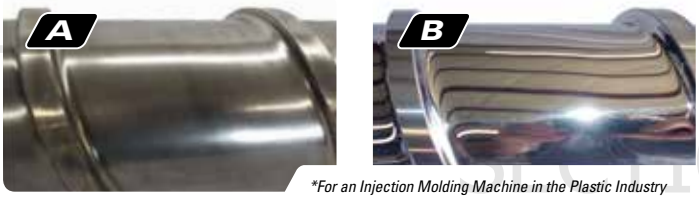
*For an Extruder Machine in the Plastic Industry

- A: Is a Nitrided Steel Feedscrew processing PVC after 10 Months of processing.
- B: Is a CarbideX -CPR coated Feedscrew after 10 months in the same process with more life remaining.



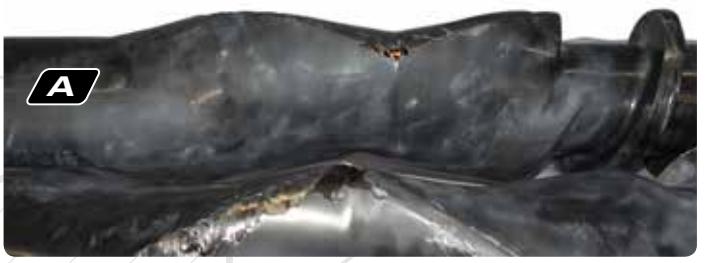
*For an Injection Molding Machine in the Plastic Industry

- A: Is a 105mm Feedscrew after 3 months processing 40% GF (Glass Filled) Nylon.
- B: Is a 105mm CarbideX C1000 coated Feedscrew after 10 months processing 40% GF (Glass Filled) Nylon with more life remaining.



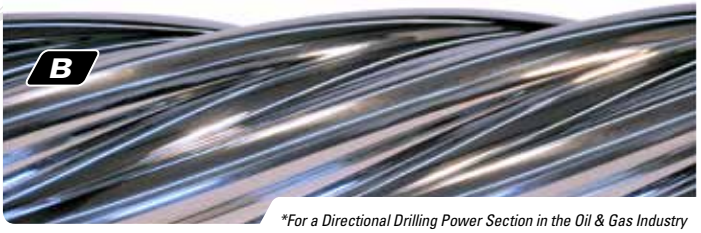
*For an Injection Molding Machine in the Plastic Industry

- A: A CarbideX C4000 coated 150mm Feedscrew that has been in operation 95 months processing CPVC and various materials. Prior to this first coating the customers chrome plated screws lasted only 6 months on this unique application.
- B: Is the refurbished 150mm Feedscrew striped, coated and polished to a <4 RA ui for super value and extended life and performance.



*For a Compounding-Mixing Machine in the Plastic & Rubber Industry

- A: Is a Chrome Plated (HCP) Mixing Rotor after 12 months processing.
- B: Is the same Mixing Rotor that has been stripped, repaired and coated with CarbideX – CPR then polished to a mirror finish. These parts last 30–36 months on average and can be refurbished multiple times.



*For a Directional Drilling Power Section in the Oil & Gas Industry

- A: Is a Chrome Plated Mud Rotor that was run in high chloride muds that caused corrosion due to permeation of the micro-cracks and pores which corroded the underlying steel.
- B: Is a CarbideX – CPR processed Mud Rotor that was stripped, repaired and coated for corrosion and abrasion resistance then polished to a mirror finish. This product extends service life and effectiveness for lower cost per rotational hour. 30% more life and effectiveness has been realized.

Testing & Validation

Don't just take our word for it. Third-party tests confirm our findings. Tests were performed on a variety of materials to establish a guide to performance of each when in stress and abrasion-wear modes.

ASTM G65 A – Sliding Abrasion Test

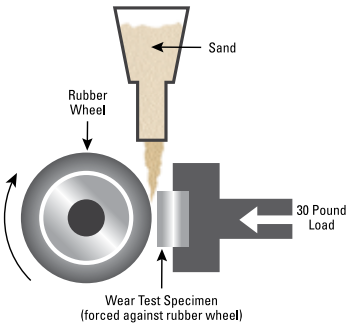
The ASTM G65 test simulates sliding abrasion conditions under moderate pressure, using dry sand metered between a rubber wheel and a block coupon of the material being evaluated. The test allows comparison of wear-resistant materials by their volume loss in cubic millimeters, with materials of higher wear resistance showing lower volume loss.

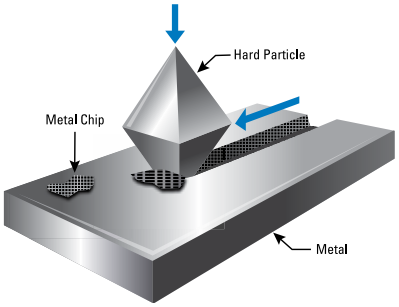
Test Conditions

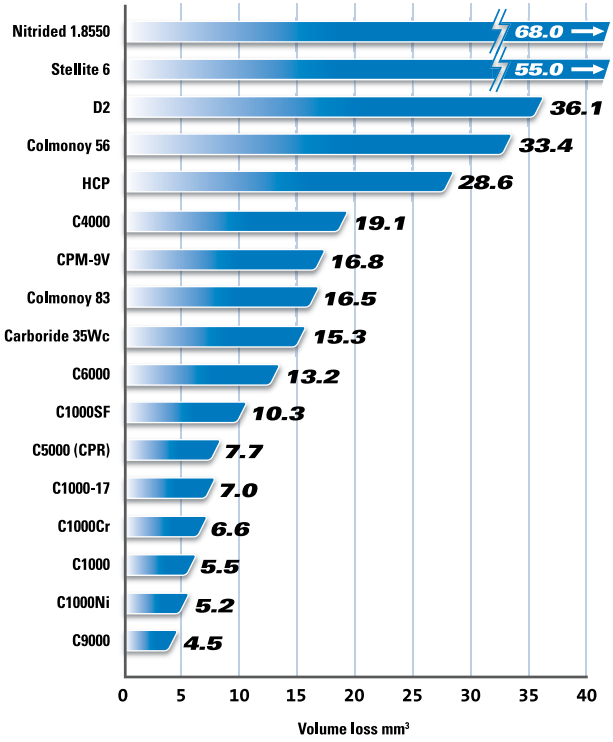
Tested for 6000 revolutions at a load of 30 lb. (13.6 kg) using a 9 inch (229 mm) diameter rubber wheel and dry sand.

Low-Stress Abrasion

Abrasive wear occurs when hard particles are compressed with normal pressure against the surface of a metal causing material removal.







ASTM G77 – Adhesive Wear Test

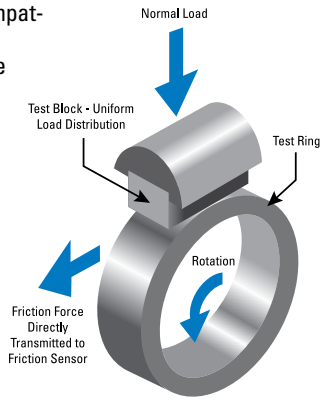
The ASTM G77 test determines the resistance of materials to metal-to-metal sliding wear. Utilizing a block-on-ring testing machine to rank pairs of materials according to their sliding-wear compatibility characteristics, this test replicates "adhesive, metal-to-metal" wear. Results are reported as volume loss in cubic millimeters for both the block and the ring. Materials of higher wear resistance have lower volume loss. Friction coefficents may also be established during this test.

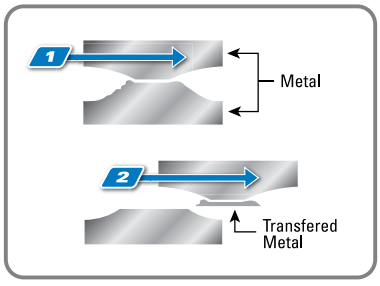
Test Conditions

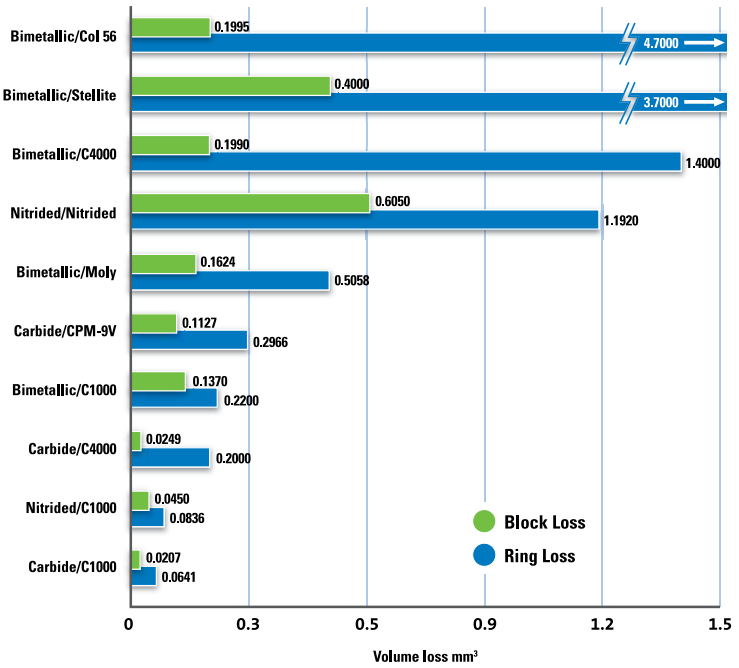
Tested on 3000 meter slide length. Fixed load and stepped load to COF seizure. Mineral oil lubricant used, 30,000 revolutions, 300 RPM and 300 POUNDS FORCE

Adhesive Wear

Adhesive wear occurs when surface asperities on two materials contact under load, which converts relatively low force into super high pressure. Friction results between two points, creating micro-welds (adhesion) that subsequently fracture and cause undesirable fragments that impart abrasive wear to the two mating surfaces.







Coating or Alloy	Description /Composistion	HRC Rc	Volume Loss mm3
C9000	Formulation - Nano Tungsten Carbide, Cobalt	68-71	4.5
C1000Ni	Formulation - Tungsten Carbide, Nickel Matrix	68-71	5.2
C1000	Formulation - Tungsten Carbide, Cobalt	68-71	5.5
C1000Cr	Formulation - Tungsten Carbide, Cobalt, Chrome	69-70	6.6
C1000-17	Formulation - Tungsten Carbide, Cobalt Matrix	66-68	7
C5000 (CPR)	Formulation - Carbides within a Nickel-Chrome Matrix	58-62	7.7
C1000SF	Formulation - Tungsten Carbide, Nickel Chrome Boron	62-65	10.3
C6000	Formulation - Carbon, Chromium, Tungsten, Nickel	58-62	13.2
Carboride 35Wc	35% Tungsten Carbide + Nickel Chrome Boron	60	15.3
Colmonoy 83	Ni/Cr/B/WC	48	16.5
CPM-9V	Iron-Chrome-Vanadium-Moly	54-56	16.8
C4000	Formulation - Chrome Carbide, Chromium, Nickel	55-60	19.1
HCP	Hard Chrome Plating	68-72	28.6
Colmonoy 56	Ni/Cr/B	49	33.4
D2	Chrome Carbide Tool Steel	58-60	36.1
Stellite 6	Co/Cr/W	40	55
Nitrided 1.8550	Nitrided Nitralloy Steel	70	68

Formulations: Our CarbideX Products

ASTM TESTS COMPLY WITH **ASTM INTERNATIONAL STANDARDS**

Stationary Block	● Block Loss	● Ring Loss	Rotating Ring
BiMetallic (FeCr)	0.1370	0.2200	C1000
BiMetallic (FeCr)	0.1624	0.5058	Moly
BiMetallic (FeCr)	0.1990	1.4000	C4000
BiMetallic (FeCr)	0.4000	3.7000	Stellite
BiMetallic (FeCr)	0.1995	4.7000	Colmony 56
Carbide (WC)	0.0207	0.0641	C1000
Carbide (WC)	0.0249	0.2000	C4000
Carbide (WC)	0.1127	0.2966	CPM-9V
Nitrided Steel	0.045	0.0836	C1000
Nitrided Steel	0.605	1.192	Nitrided Steel

Volume loss mm^3

*Note: This test was mainly done to compare a misconception that a hard coated feedscrew (●Ring) in contact with a softer barrel liner (●Block) will cause premature wear to the barrel. This test clearly shows that our tungsten coatings do not wear a barrel faster than any other alloys commonly used for wear resistance and actually can increase the barrel life.

Great People, Products, Process

Our vast experience is at the service of our customers, because their success is our success!

- ***Customer Focus***
- ***Satisfaction Driven***
- ***Team Centric***

This dedication produces World Class Products and Services

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International: *001-727-528-3734* • ***Address:*** *2895 46th Avenue North, St. Petersburg, FL 33714 USA* • ***E-mail:*** *info@extremecoatings.net*

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