

WEARTECH® SHS™ 9172HV

Severe Abrasion, Thermal Spray Powder

Application Process

High Velocity Oxy-Fuel
Thermal Spraying (THSP-HVOF)

Material Chemistry (wt%)

| | |
|------------|---------|
| Chromium | < 25% |
| Tungsten | < 15% |
| Niobium | < 12% |
| Molybdenum | < 6% |
| Boron | < 5% |
| Carbon | < 4% |
| Manganese | < 3% |
| Silicon | < 2% |
| Iron | Balance |

Microhardness (HVO .3)

1000 - 1100 kg/mm² typical

Wear Resistance

ASTM G65-04 Procedure B
Typical mass loss 0.07 g

Bond Strength

ASTM C633-01
10 ksi (69 MPa)

Coating Properties

Density (g/cm³) 7.59
Porosity/Oxides < 5%

Impact Resistance

Drop Impact Testing:
No delamination/cracking
at 480 in-lbs

Coating Description

SHS9172HV is an iron based steel alloy which features exceptional resistance to abrasion, corrosion resistance, erosion, impact and high temperature oxidation.

Key Performance Characteristics

- Excels in high sulfur and elevated temperature environments where fly-ash and bed-ash erosion occurs
- Exceptional abrasion resistance for a metallic material
- Significant corrosion and high temperature oxidation resistance
- Very high bond strength across a range of substrate materials, including aluminum, copper, carbon steel and stainless steel
- Can be finished to very high surface specifications as a replacement for hard chrome
- Hardness and corrosion and wear resistance is superior to hard chrome

SHS9172HV coatings feature exceptional resistance to abrasion and a significant ability to withstand corrosion and high temperature oxidation. SHS9172HV is especially resistant to elevated temperature sulfidation attack and is widely used for elevated temperature erosion and corrosion protection of heat exchange tubes in coal fired boilers. As a replacement for hard chrome, SHS9172HV provides improved resistance to mechanical damage and can be polished to a very high surface finish. While conventional corrosion resistant materials are relatively soft, SHS9172HV in the as-sprayed condition provides hardness and wear resistance equivalent to hard chrome. SHS9172HV has excellent damage tolerance applicable to harsh service environments in a wide range of industrial applications. Additionally, the extremely fine microstructure of SHS9172HV improves toughness, ductility and fatigue resistance.

Resistance to Abrasion and Erosion

SHS9172HV is a glass-forming steel alloy formulated with high concentrations of transition metals which readily dissolve in the glass structure. When applied using benchmark thermal spray parameters, an amorphous matrix is formed which contains hard complex nanoscale borocarbide precipitates. When compared to existing competitive coatings, the microstructures formed in the as-sprayed or fully devitrified (heat treated after spraying) state provide superior resistance to abrasive wear and fine particle erosion.

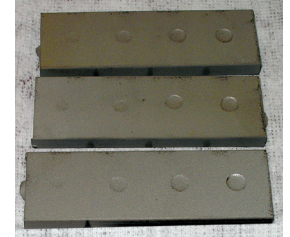
Damage Tolerance

SHS9172HV coatings feature superior toughness and resiliency. Impact testing was done using a Gardner drop impact testing machine at impact energies of 120, 240, 360 and 480 in-lbs. As-sprayed SHS9172HV coating samples withstood impacts of up to 480 in-lbs without cracking, chipping or delaminating, while demonstrating the ability to deform with the substrate. Additionally, the specific high-transition metal chemistry (chromium, molybdenum, tungsten and niobium) of SHS9172HV provides excellent corrosion resistance. The ability to withstand high impact and resist extreme abrasion and corrosion makes SHS9172HV an excellent hard chrome alternative.

Industrial Uses

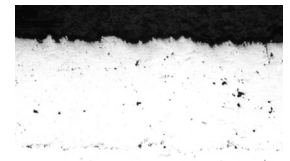
Power Generation

Impact Testing



As-sprayed SHS9172HV coatings demonstrate the ability to deform with the substrate without cracking, chipping or delaminating

Coating Microstructure



Optical micrograph at 100x of a typical SHS9172HV coating taken at 100x

CUSTOMER ASSISTANCE POLICY

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Subject to Change – This information is accurate to the best of our knowledge at the time of printing. Please refer to www.lincolnelectric.com for any updated information.

WEARTECH® SHS® 9172HV

Severe Abrasion

KEY FEATURES

- Excels in high sulfur and elevated temperature environments where fly-ash and bed-ash erosion occurs
- Exceptional abrasion resistance for a metallic material
- Significant corrosion and high temperature oxidation resistance
- Very high bond strength across a range of substrate materials, including aluminum, copper, carbon steel and stainless steel.
- Can be finished to very high surface specifications as a replacement for hard chrome
- Hardness and corrosion and wear resistance is superior to hard chrome

TYPICAL APPLICATIONS

- Oil & Gas
- Power Generation
- Mining
- Pulp & Paper

| Size Micron (µm) | 10 lb (4.5 kg) Bottle |
|------------------|-------------------------|
| +15/-53 | P9172-15/53 (ED035734*) |

* EDO numbers have been discontinued and replaced by the Wearthech part numbers for the cross selling program.

MECHANICAL PROPERTIES

| Vicker's Hardness (HV0.3) | Wear Resistance | Bond Strength ksi (MPa) |
|---------------------------|---|--------------------------------------|
| 1000 - 1100 | ASTM G65-04 Procedure B 0.07 g mass loss | ASTM C633-01 Glue Failure 10 (69) |

DEPOSIT COMPOSITION

| %Fe | %C | %Cr | %B | %Mo | %Nb | %W | %Mn | %Si |
|---------|----|-----|----|-----|-----|-----|-----|-----|
| Balance | <4 | <25 | <5 | <6 | <12 | <15 | <3 | <2 |

TYPICAL OPERATING PROCEDURES

| Feeder Speed (rpm) | Gas Flow (cfh) | Powder Feed Rate lb/hr (g/min) | Spray Distance in (mm) | Deposit Rate (mil/pass) |
|-------------------------------|---------------------|--------------------------------|------------------------|-------------------------|
| 270 (6 pitch screw) | 21 | 10 (75.6) | 14 (356) | 0.2-0.4 |
| Fuel Flow Rate gal/hr (l/min) | Fuel Pressure (psi) | Oxygen Flow Rate (cfh) | Oxygen Pressure (psi) | Combustion (psi) |
| 6 (0.45) | 120 | 1900 | 135 | 100 |

* This procedure was developed on a TAFA JP5000. Changes in equipment, materials, and substrates may change optimum procedures. Listed procedures should only be used as a starting point.

| IMPORTANT: SPECIAL VENTILATION AND/OR EXHAUST REQUIRED |
|---|
| Fumes from the normal use of some welding products can contain significant quantities of components - such as chromium and manganese - which can lower the 5.0 mg/m ³ maximum exposure guideline for general welding fume. |
| BEFORE USE, READ AND UNDERSTAND THE SAFETY DATA SHEET (SDS) FOR THIS PRODUCT AND SPECIFIC INFORMATION PRINTED ON THE PRODUCT CONTAINER. |

Material Safety Data Sheets (MSDS) and Certificates of Conformance are available on our website at www.lincolnelectric.com

TEST RESULTS

Test results for mechanical properties, deposit or electrode composition and diffusible hydrogen levels were obtained from a weld produced and tested according to prescribed standards, and should not be assumed to be the expected results in a particular application or weldment. Actual results will vary depending on many factors, including, but not limited to, weld procedure, plate chemistry and temperature, weldment design and fabrication methods. Users are cautioned to confirm by qualification testing, or other appropriate means, the suitability of any welding consumable and procedure before use in the intended application.

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