

Riley Power CCV® Burner Components

Kennametal's Conforma Clad™ provides extended performance for these CCV design features:

- 1 Proprietary Venturi coal nozzle that concentrates the coal to the center.
- 2 Flame stabilizer ring that creates a recirculation zone for flame shape and stability.
- 3 Low-swirl spreader that divides the coal stream into 4 smaller streams.
- 4 Spreader support tube that holds the spreader in place and can be used to house thermocouples and/or igniters.
- 5 Protective sleeve that supports the inlet end of the spreader support tube.
- 6 Spreader support tube legs that provide additional wear life by enabling rotation of support tubes.



As an expert in the development and application of wear protection solutions for equipment in extreme environments, Kennametal has a proven solution to ensure that your low NOx burner components maintain the performance that you expect. With Kennametal's Conforma Clad™ advanced wear protection, you get the best of both worlds — proven low NOx burner technology that is able to maintain sustained performance by holding critical component geometries for extended run times.

The CCV[®] (Controlled Combustion Venturi) burner was developed by Riley Power in the early 1980s to address the power industry's need for an efficient wall-fired coal burner to reduce NOx emissions.

Since NOx generation is affected by flame temperatures (increases exponentially at temperatures above 2750 °F), short, highly turbulent flames (characteristic of earlier burner designs) generated NOx from the nitrogen and oxygen in the air used to burn the coal.

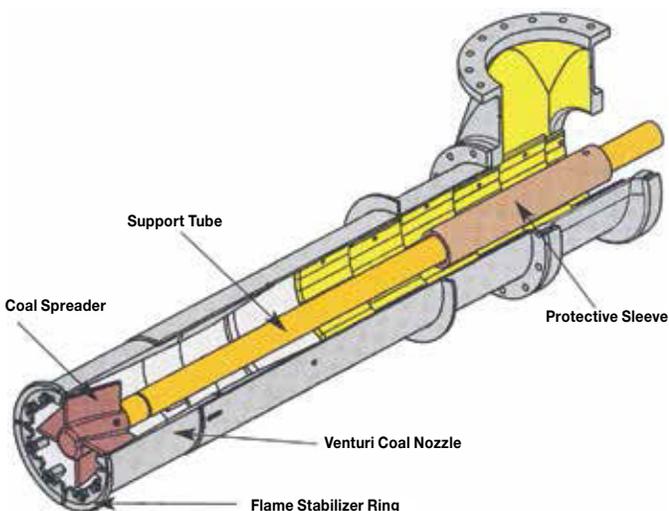
A new CCV[®] burner produces a less turbulent, slower mixing flame that results in lower NOx emissions.

Prior to Conforma Clad, Riley Power was using a weld overlay for wear protection on the leading edges of their low NOx burner components. Typical replacement cycles for coal-fired applications were every 12–18 months.

Field tests show that Conforma Clad extends the operating life of these same burner components 2–3 times longer than that of the original unprotected component.

Riley Power CCV[®] Burner Assembly

Conforma Clad tungsten carbide wear protection is in use with Low NOx burner components throughout the U.S. The areas indicated show the key components affected by severe erosion that have benefited from Kennametal Conforma Clad's technology.



The Venturi Coal Nozzle

The proprietary Riley Venturi Coal Nozzle concentrates the coal to the center. Pulverized coal is subsequently divided into smaller streams with the tungsten carbide clad low-swirl spreader.

- The fuel inlet of the cast stainless steel Venturi is protected with infiltration brazed tungsten carbide.
- One-piece design provides for a smooth transition and the reduction of eddy currents that could potentially cause down-stream wear.
- Superior erosion resistance of Conforma Clad tungsten carbide material maintains critical geometries that directly impact optimal burner performance.



Integrated Coal Nozzle with Flame Stabilizer Ring

A new integrated coal nozzle with a flame stabilizer ring is now available for Riley Power CCV[®] Burners. The new design provides better flame attachment throughout the boiler range and includes upgraded materials for longer service life. The ring is now an integral part of the coal nozzle assembly, eliminating the mounting blocks and bolts used in previous versions. A 1" thick cast insert is protected by Conforma Clad[™] tungsten carbide wear protection on the leading edges of the spreader support tube legs, the coal spreader, and flame stabilizer ring. In addition, the latest wear-resistant materials can be used in construction of the burner Venturi. The support tube has been redesigned to include four support legs, allowing for periodic rotation to help extend the coal spreader wear life.

Combustion Improvements with a Kennametal Conforma Clad Protected Flame Stabilizer Ring

- Better low-NOx flame attachment throughout the boiler load range.
- Decreased slagging at the burner front.
- Smaller secondary air diverter, minimizing surface area for slag attachment.
- Decrease in NOx by 15% from previous NOx levels.
- Decreased NOx sensitivity versus O2 levels.
- Improvement in UBC trend.

Unprotected components have the average wear rate of about 12–18 months.

By cladding these components with Conforma Clad, you minimize the effects of severe wear and maintain OEM tolerances much longer. Although wear life is dependent on operating conditions, a 3+ year life is predictable with Conforma Clad's tungsten carbide protection.



Spreader Support Tube

The stainless steel spreader support tube is used to hold and maintain the spreader in the correct position. The tube has front supports (note latest versions have 4 legs that allow for repositioning in order to distribute wear).

- The inner tube can be used to house thermocouplers and/or igniters.
- The protective sleeve prevents pulverized coal from eroding the spreader support tube.
- Air vanes are designed to direct the flow of air and pulverized coal.



Low Swirl Coal Spreader

Riley Power's low-swirl coal spreader is an essential component in distributing pulverized coal to the burner flame. In order to maintain critical geometries and coal distribution patterns, the coal spreader fins are protected with Conforma Clad tungsten carbide wear protection. Leading edges of the spreader fins receive an extra layer of protection.

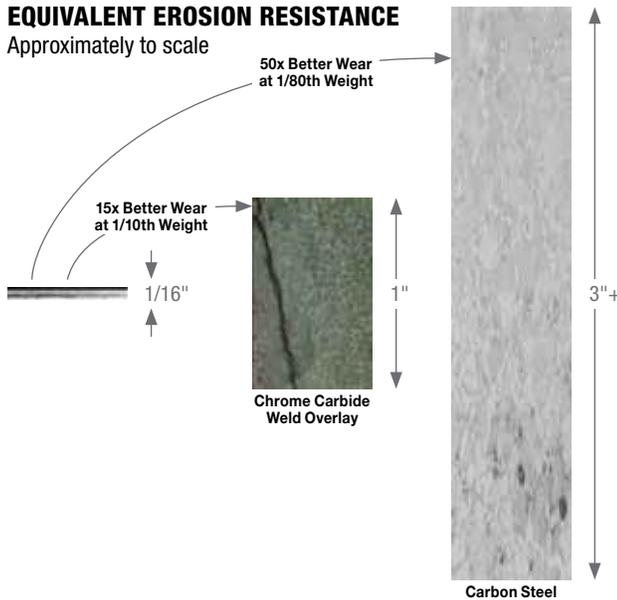


Performance Data

The Conforma Clad™ process uses infiltration brazing to bond tungsten carbide to the base material of a component forming a hard yet tough and uniform-protective cladding that provides superior wear resistance to abrasion, erosion, and corrosion, even under high-temperature conditions. Because of its extremely high metallurgical bond strength, Conforma Clad resists abrasion up to 3–5 times better than typical alumina ceramic tiles, which are also limited by their low adhesive bond strength. This severe wear protection maintains critical geometries of burner components, which means that coal spreaders, spreader tubes, spreader sleeves, and flame stabilizer rings can deliver the required performance until the plant's next scheduled outage.

EQUIVALENT EROSION RESISTANCE

Approximately to scale



One sixteenth inch (1/16") of Kennametal's Conforma Clad tungsten carbide wear protection performs 15x better against erosive wear than an equivalent layer of chrome carbide weld overlay and 50x better than carbon steel. Because of its extremely high metallurgical bond strength, the cladding is up to 5x more erosion resistant than typical nickel chromium alloy castings alone.

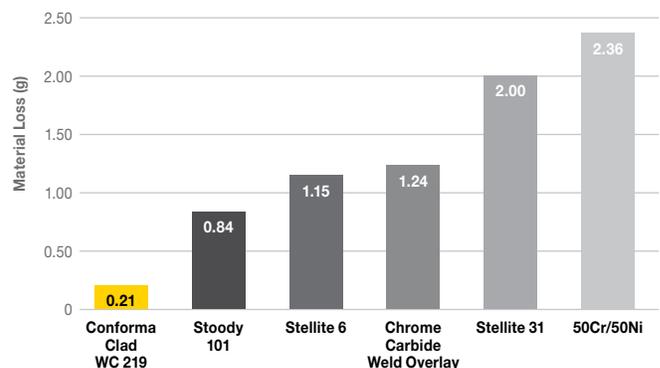
EROSION RESISTANCE

Riley Power conducted laboratory testing, following ASTM G73 standards, on low swirl coal spreaders to determine the best erosion protection from fine-grit black beauty coal slag. Testing was conducted at a 90° impingement angle with a particle velocity of 240 ft/sec for 30 minutes. Conforma Clad provided excellent wear protection while retaining critical component geometries. Conforma Clad increased Riley Power's low-swirl coal spreader life from 1–2 years to 3–4 years.

Babcock Power, CCV-DAZ Development Project

EROSION TEST (ASTM G73)

90° Impingement Angle, 240 ft/sec (30-minute test)



UP TO 6X BETTER
Erosion Resistance than Chrome Carbide Weld Overlay

Success Story — Wisconsin Electric

Kennametal protects low NOx burner components at coal-fired power plants throughout the country, including Wisconsin Electric, Valley Station's CCV® burner spreaders. Coal spreaders are essential components in distributing pulverized coal to the burner flame and are designed to enhance combustion by controlling the flame length and minimizing NOx and Unburned Carbon (UBC). In order to maintain critical geometries and coal distribution patterns, the coal spreader vanes are protected with Kennametal's Conforma Clad tungsten carbide cladding.

The Valley Station plant's burner components experience increased erosion rates because of high burner velocities (approximately 87 ft/sec) and the coal's high silica and alumina content.

Wisconsin Electric tripled the service life of their Riley® 74 (50Cr/50Ni with Cb) spreaders by applying .040" of Conforma Clad tungsten carbide cladding to the spreader's leading edges.

Low-Swirl Coal Spreader
Wisconsin Electric **tripled the service life** of their Controlled Combustion Venturi burner components with Kennametal Conforma Clad.



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