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WH-76, Mayapuri Industrial Area
Phase-I, New Delhi 110 064, India

T: +91-(0)11-2811-5021
F: +91-(0)11-2811-5021
E: acmecast@acmealloys.com
W: www.acmealloys.com

Coal Burner (Coal Nozzle Tips) Wear in Thermal Power Plants

ACME® Heat Resistant Alloy Solutions for High Temperature Wear

Fossil fuel is the main source of energy for steam power plants. Coal is the major fuel with inorganics varying widely. Coal burners are subjected to wear due to this during operation. With stringent pollution control norms, low NO_x burners are imperative for climate control permitted emission levels with ability of high combustion levels and improved thermal efficiency.

Coal is the prime fuel for power generation across the globe. More than sixty percent of electricity is produced by coal. Coal contains organic material, an inorganic portion, and moisture. There are other components like sulphur., trace metals like arsenic, mercury, lead, antimony and others that form a very small percentage. The inorganic portion in coal varies highly making it difficult to predict any standard behavior. As coal under the earth is a heterogeneous material, it makes it still difficult.

Coal burners, both in wall fired boilers and in tangential fired boilers, are subjected to wear during their operation. The rate of wear on the burner is attributed to several factors and metallurgical failure phenomena. Most of the power plant shut downs are attributed to failures of boiler tubes and coal nozzle tips. Turbine failures are not regular and intermittent.

1 Percentage of Ash Content

Percentage of ash (Inorganic portion): As the percentage of ash in coal increases, the wear increases, but the rate of wear need not be the same for same percentage of ash coals. Please provide coal analysis of coal being used at your power plant. Do you use blended coal as fuel?

2 The Chemical Composition of the Ash

Knowing the constituents which make up the ash in coal facilitates our understanding of the reason for the difference in rate of wear of the burner using the same percentage of ash in coal. It is seen that the silica in coal plays a major role in erosion of coal burners.

3 Velocity Adopted for Fuel-Air Mixture

It has been learnt that the velocity adopted has an influence on the wear rate on the coal burner. The higher the velocity, the higher the rate of wear, but this cannot be varied much as it depends on the burner requirement, the flame front anchoring point, etc. The effect of velocity is more predominant in the case of pressure parts erosion in the boiler.

4 The Pulverized Coal Fineness

Coal fineness has an influence on the rate of wear depending upon the segregation of ash from organic portion of the coal.

5 Duty Cycle

The number of hours operated- uninterrupted, standby, intermittently or phased change over patterns.

6 Geometry of the Burner/Coal Nozzle Tips

Burner /coal nozzle tip wear is a complex phenomenon. Amongst several factors affecting wear, burner/nozzle tip geometry plays a paramount role. Current research both by power plant equipment manufactures as well as academic, computational fluid dynamics (CFD) studies (both software based as well as real time combustion results) reveal that geometry does have significant influence on coal combustion patterns, exhaust gas analysis, fuel combustion efficiency, and burner/coal nozzle wear.

7 Material (Alloys) for the Burner/Coal Nozzle Tips/ Splitter Plates

As burners are subjected to heat radiation from burning fuel, they are made of very high alloy steels. The more often preferred material is stainless steel. However, to contain wear and improve life a lot of methods like weld overlay, cladding, or metal spraying are adopted. AcmeCast, offers various heat resistant alloys to choose from along with a range of weld overlay or claddings to enhance wear life of surfaces subjected to high temperature wear, abrasion, and corrosion.

8 The Flame Profile and Distance from the Burner/Coal Nozzle Tip

The flame intensity and flame distance from the burner tip has two influences on the wear of the burner. One, it leads to warping of the burner tip and second, it creates eddies which accelerates wear.

9 Burner Load

The load carried by the burner, which is basically the quantity of coal flow through the burner. In addition, factors like percentage ash, chemical composition, the number of hours of operation, etc. cannot be tailored to contain the wear of the burner components. The designers adopt mainly weld overlay or cladding or metal spraying to improve life of the coal burner. The method chosen will depend on the ash percentage and composition of coal being used in the boiler, the cost, and the life enhancement period.

Talk to us of your end applications needs. We can be of help in reducing down time, optimising successful operation runs, improving combustion efficiency with coal nozzle tip components compatible with coal nozzle fabricated assemblies that offer lower-life cycle cost.

Vishal Kumar
T: +91-98-111-15423
E: vishal@acmealloys.com

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