Particle Protection

Clifford S. Graul, A.J. Weller Corp., USA, presents an innovative method of protecting surfaces from high temperature ultra fine particle abrasion.

Introduction

Cement plants are notorious for ultra fine particle abrasion, which wears all types of equipment and processes. Roanoke Cement, a Titan America Business, located in Troutville, Virginia, USA, is no exception to these industry phenomena.

After years of continuous patching and repair of its coal mill multiclone, Roanoke Cement decided to replace the old unit and line the newly fabricated multiclone with a long-term solution. The plant's maintenance manager had suspected a loss in coal grinding efficiency, which was due in part to an air leak in the coal mill multiclone. Coal fineness is critical to combustion efficiency, therefore the company requires that 90% of its coal fines pass through a 200 mesh screen. Furthermore, as the fineness decreases, the coal usage increases and the quality of clinker can be threatened. Roanoke Cement processes 17 - 20 tph of coal, and clinker production averages 3800 tpd.

The coal mill multiclone is located between the clinker cooler and the coal mill and is designed to remove clinker dust from the gas stream before it enters the coal mill. This gas is then used as a heat source and air volume for the coal grinding process. The highly abrasive nature of clinker dust, which has operating temperatures of 300 - 500 ˚F and can potentially spike to 1000 ˚F, offered a tough set of operating conditions for conventional lining materials.

Connecting inlet feed to the multiclone.

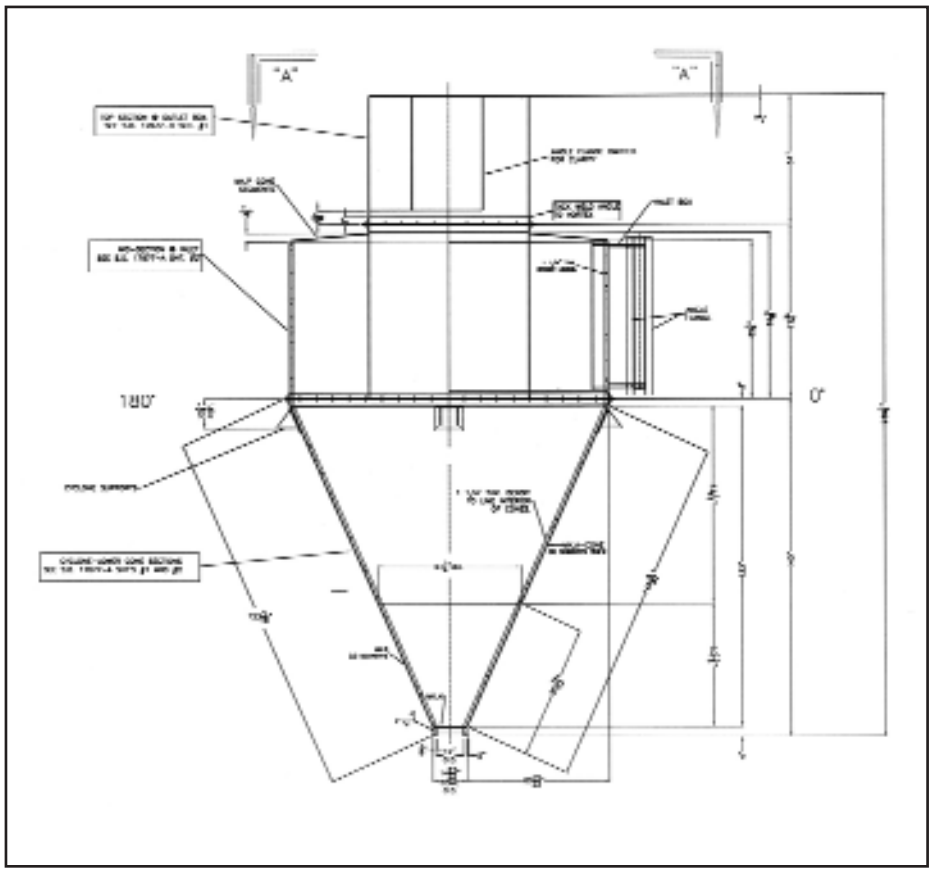

Figure 1. The elevation multiclone.


Lifting upper section.


Upper section in place.

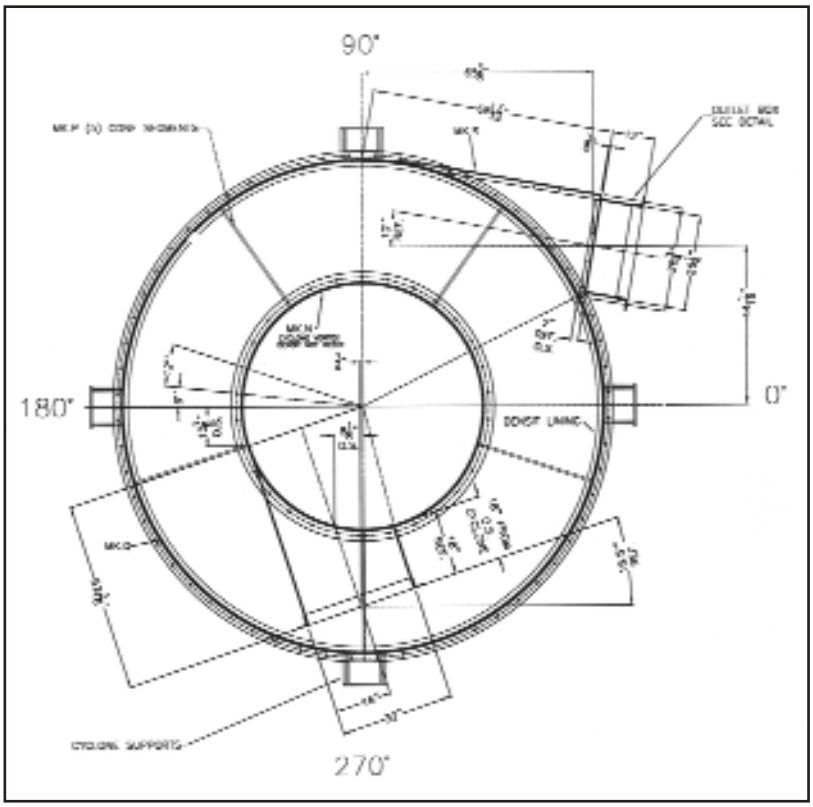

Figure 2. Plan view "A-A" and orientation.

Roanoke Cement has used abrasion resistant steel liners with limited success. In addition, experiments with two-part ceramic epoxies failed to provide the long-term solution that it was seeking. In each case, the high operating temperatures proved to be their undoing.

Composite technology

Composite technology merges a diverse number of materials into a specific application, only utilising costly materials in critical areas, thus reducing the overall cost.

A.J. Weller Corp. is the exclusive North and South American distributor for Weller Densit, a product developed by Densit a/s a division of FLS. Densit is a chemically bonded composite specifically designed for ultra fine particle abrasion applications. It can be applied by trowel or as a castable liner. The product is prepared by mixing the Densit compound with a small amount of water in a special paddle pan mixer. This starts a chemical reaction that hardens the product to a solid, ultra dense state. Typically, Densit sets in 45 min and reaches working hardness in 1 - 2 days, depending on the temperature.

Technology advantages

Strong, jointless bonding

A Densit wear liner makes use of a mechanical bond in the form of an expanded metal mesh, which is then welded onto the steel surface to be protected. This method has many advantages. The difference in thermal expansion between steel and the ceramic composite material becomes absorbed; therefore broad cracks and the risk of spalling are avoided.

Self-supporting

Due to its strong mechanical properties, the product is self-supporting, and in most cases can be applied to worn parts, thereby eliminating the need to fabricate a new support structure. This allows the Densit to be applied seamlessly to complex geometrical shapes during field installation.

High temperatures

The standard Weller Densit products, Wear Flex 1000 and Wear Flex 2000, can be used up to 600 °F. Wear Flex 2000 HT can be used up to 1800 °F. Densit has more thermo shock resistance than basalt and ceramics, yet has no refractory type insulating capabilities, although it can be applied over refractories to enhance their wear protection.

Old cone removed.

The Roanoke experience

In February 1998, the A.J. Weller Corp. had installed 375 ft^2 of Densit Wear Flex 2000 in Roanoke Cement's Fuller plenum dust collector. The Densit lining system was selected because of the large surface area to be covered, the need for quick field installation, and its ability to form a seamless liner. This application eliminated the plant's wear problem and to date is fully functional. Based on this experience, Roanoke Cement called upon A.J. Weller for help with its newest area of concern: its coal mill multiclone.

Coal mill multicone solution

The A.J. Weller fabrication shop designed and built a new multiclone lined with one Densit Wear Flex 2000 HT, which was 1.25 in. thick. The multiclone was built in three sections for ease of shipment and installation. Each section was fabricated; a stainless steel rod was then tack welded to the surface, followed by stainless steel mesh. This gave 0.25 in. of space, to which the Densit was then applied. The seams were mitered on a 45 ˚ angle for added protection.

Roanoke Cement selected Densit Wear Flex 2000 HT based on the high operating temperatures, the abrasive nature of the clinker dust and its desire for a long-term wear lining solution.

Conclusion

In January 1999, the new coal mill multiclone was delivered and installed. The plant's maintenance planner admits that he is surprised that the Densit lining system has held up as long as it has, given the tough operating conditions. Prior to replacing the multiclone with the Densit lining system, the maintenance manager estimated that the plant was spending 1500 man hours/year in clean up costs. By installing the Densit liner system, the company has completely eliminated a maintenance, housekeeping and potential process problem area. After 3 yrs in service, the lined coal mill multiclone has shown virtually no wear and is no longer a maintenance issue. Roanoke Cement now looks to Densit lining materials for future wear protection problems in other areas of its cement operations.

Reprinted from **WORLD CEMENT** May 2002