New Seal in Horizontal Ball Mill

By Motofrenos

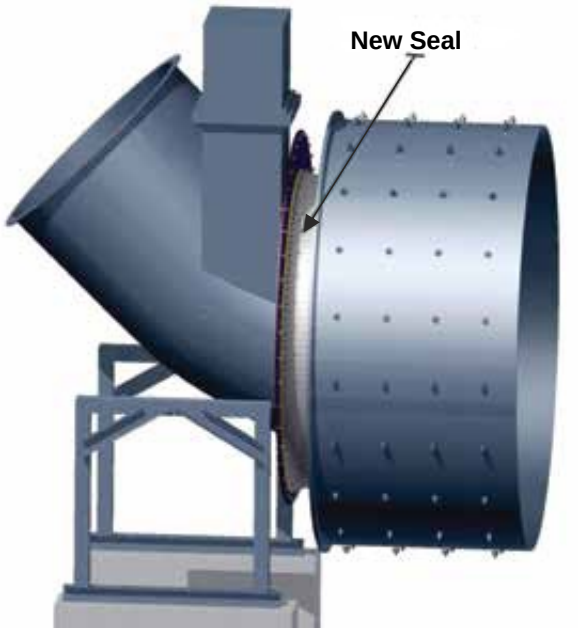
A practical and efficient solution for the cement and mining industry

Motofrenos, a company established in Colombia - South America, founded in 1978, specializes in design and manufacturing of external leaf seals for inlet and outlet of rotary kilns, dryers and coolers. This is done with the sole purpose of reducing the entry of false air.

We currently are present in 21 countries, with more than 200 seal installations in 27 cement and mining companies. Our clients acclaim the suitability of the Seal Plus seals manufactured by Motofrenos and the market acceptance they have.

Today our new type of seal is a truly integral solution in such an important stage of the process as the grinding is. This seal promises to be a high performance alternative for the productivity of cement plants and the industry in general which operate such equipment.

The seal on the horizontal ball mill also allows preserving the environment since losses of coal used as alternative fuel, raw materials or finished products have a high impact on it.



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Mill seal, a new challenge for our project scope

Our first seal design was installed on a raw mill of FLS, manufactured in 1992, with a diameter of 2,500 mm and a length of 12,400 mm. The seal installed by Motofrenos has been operating since last November at the Rio Claro plant in Colombia. This plant is owned by Cementos Argos, one of the leading multinational companies in the cement sector and a major participant in the Colombian cement industry.

The past 3 years have been a real challenge for the project area at Motofrenos because we set out to develop a innovative and reliable seal. The big challenge was to move from designing seals for rotary kilns and dryers with a speed between 3 and 5 RPM to building one for a mill which reaches speeds up to 15 times higher, as it is the case on a mill with a rotation of 55 RPM, where the seal is currently installed.

The study of thermal aspects and friction coefficient of steel and components was a vital part of the research carried out by our team at Motofrenos. We could confirm that the chosen materials efficiently tolerated the demands of mill operations. These materials received continuous testing for more than two years in simulators and recognized chemical and metallographic analyses laboratories, which will provide the needed high reliability in the operation of the seal. In addition the trust in our company was fundamental and this was demonstrated at the Rio Claro plant considering that on that time their silos were below target. And if the seal would have presented fatigue or premature wear, the drop in plant productivity due to increased false air would have been very representative.

The safety factor alongside the much higher mill speed was always our biggest concern. The design of the mill seal could not become a copy of our seal for rotary kilns, on which we have a broad experience. The weight and density of the components were essential to the seal assembly, the falling off or fatigue of any of its parts due to the high speed was a risk, which is why we carried out all required security protocols.

Planning and execution of the assembly

Every time a seal installation is to be made, our design staff starts to take appropriate measures in the field already weeks before the expected date of erection. From there, a design is developed with a specific solution for the customer. In this particular case, thanks to that preparation work, we determined that the rectangular loading chute and the mill cover did not meet the geometric parallelism tolerance. This aspect alerted us to the existing differences between our measurements and the information on the drawings supplied by the customer.

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This is normal because we knew that the equipment due to wear and variation in temperature can differ significantly to its original measures.

The hatch to place lifters at the top of the mill was another element that represented a challenge in the assembling and it required to be removed. Also the great decentricity presented by the elbow relative to the mill entrance cover made of this mounting quite a challenge.

This experience helped us to define the basic principle of the lathe among the procedures that we will use from now on. That is to say, given the apparent circumference on which the bases are arranged on the mill shell, it is necessary to place a metal marker on a properly prepared turret and trace the point where such bases would be set. After that, by welding the bases and placing the false cowling, it will have the most appropriate geometric concentricity tolerance that can be achieved because this way the mill eccentricity can largely be eliminated.

The production and mechanical results, after 100 days of continuous operation were:

- Ÿ Increased mill performance of 4% average TPH.
- Ÿ 20% reduction in false air entry due to the mill inlet seal.
- Ÿ 7% reduction in power consumption of the mill air exhauster.

An increase in the mill production was noticed, which currently reaches averages between 7% and 11% higher than it had been working before. It was also observed that due to the seal assembly, this production is being achieved with 7% less power demand on the air exhauster.

In the following chart the performance log day by day in November and December is shown, and the increase by 11%.of the average production per day in November can be seen

Attached is an oxygen measurement at the entrance and exit of raw mill 1before the mill seal mounting and after that assembly.

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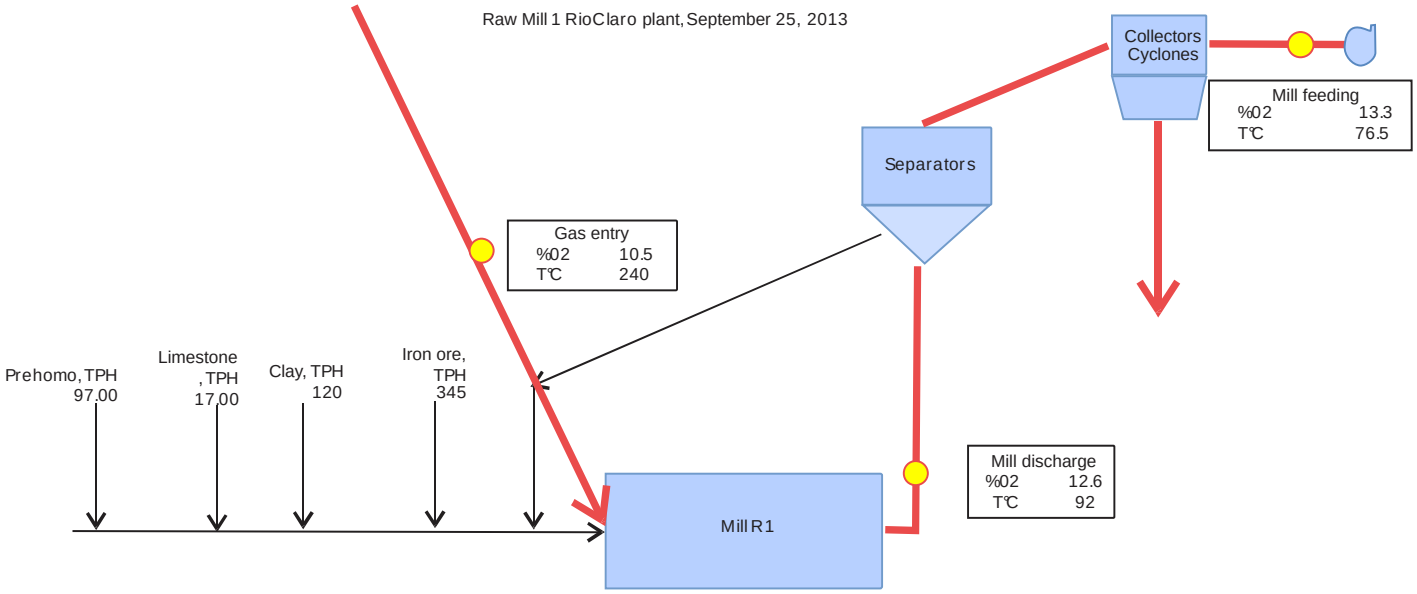
Before the mounting

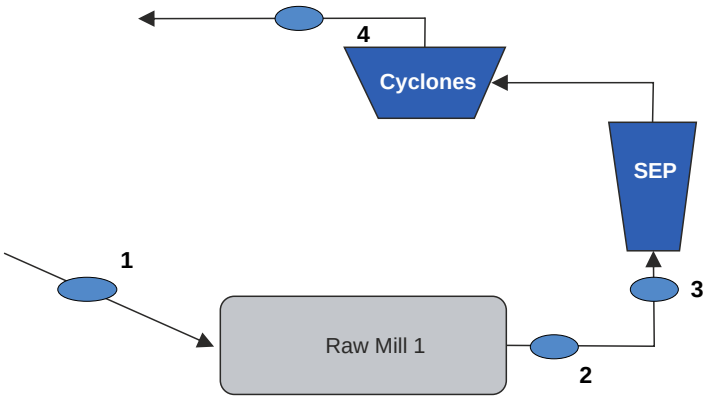


After the seal mounting

	Oxigen profile Raw 1	%O2
1	Mill feeding	11.35
2	Mill discharge (dead step	11.68
3	Mill discharge (under the separator)	*12.1
4	Cyclone outlet duct	12.81

NOTE:

*This value may be affected by the size of the sampling point that is great, allowing air inlet while the measurement is performed, therefore the value may be less.



Notice how the false air drops approximately 20% with the seal

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Impact on the process when the false air is reduced.

In the raw grinding process, one of the main objectives is to reduce the humidity content as quickly as possible, since the grinding effect starts only when reducing the humidity below 1%. For that reason, some raw mill designs feature a drying chamber, prior to the grinding chambers.

Drying raw material is activated by the entering of hot gases from the mill clinker cooler. False air entrance to the crude mill decreases the amount of these hot gases which are sucked into the mill and therefore decreases the amount of supplied heat. Drying the raw material therefore takes longer, or it even cannot be reached completely before entering the mill grinding chambers in mills with a drying chamber.

That reduced achieved drying has a negative influence on the grinding process, since it estimated that 1% of humidity can result in a decrease of up to 10% in the griding capacity.

The results obtained in Rio Claro installation confirm exactly what is mentioned above. Having succeeded in reducing the false air, resulted in a better drying, and therefore in an increase in production capacity.

The recovery of the investment in the installation of lamellar seals in horizontal ball mills for raw grinding is reached very quickly with that increased production and lower specific power consumption.

Preventive Seal Inspection

Part of the project is based on the continuous monitoring of the seal operation. The inspections that were made generated positive results in premature wear out of the wearisome parts.

This assessment has allowed the research and development areas at Motofrenos analyze the different parts of the seal, its status, hardness and fatigue. An optimum performance in high-weight parts that are not subject to wear has been noted, considering that these may change in structure due to high temperatures or unexpected spills in the process.

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This image details the continuous inspection we make to each of the 320 leaflets that make up the entire seal by verifying their status. While inspecting we take into account the mill speed and the temperature variation in the process at the moment of loading the mill and its radial deformity.

The following image shows another test passed, the state of the riding track.This item is in constant contact with the leaflet, the quality and formulation of the steel met the projected expectations, the wearing out after 4 months of constant operation was 3% considering that the riding track has a thickness of 10 millimeters.

We want to conclude by recognizing everyone at Cementos Argos in Colombia who participated in the implementation of this project. Thanks to them for believing in us.Today we have a product that makes a great contribution to the industry. To them goes our most sincere gratitude and appreciation.

Our References

BRASIL
Cimentos Votorantim
Holcim
Intercement
CSN Cimentos

USA
Cemex
Ash Grove
Calgon Carbon

MEXICO
Cemex
Cementos Cruz Azul

GUATEMALA
Cementos Progreso

HONDURAS
Lafarge

PERU
Unacem
Cementos Sur
Cementos Yura

PUERTO RICO
Esrroc

CHILE
Holcim
Cementos Melon
Xstrata Copper

NICARAGUA
Cemex

ARGENTINA
Holcim
Cementos Loma Negra
Cementos Avellaneda

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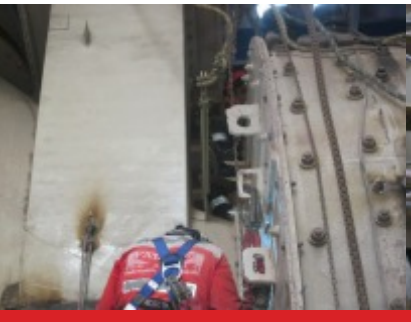

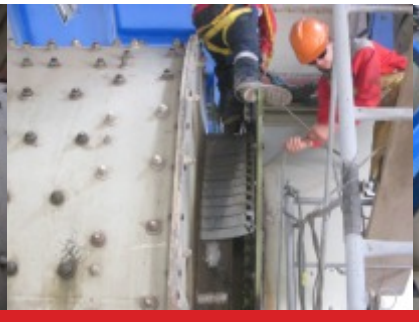
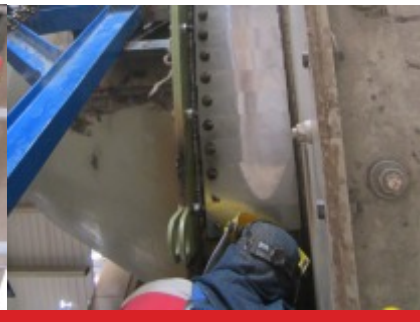

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