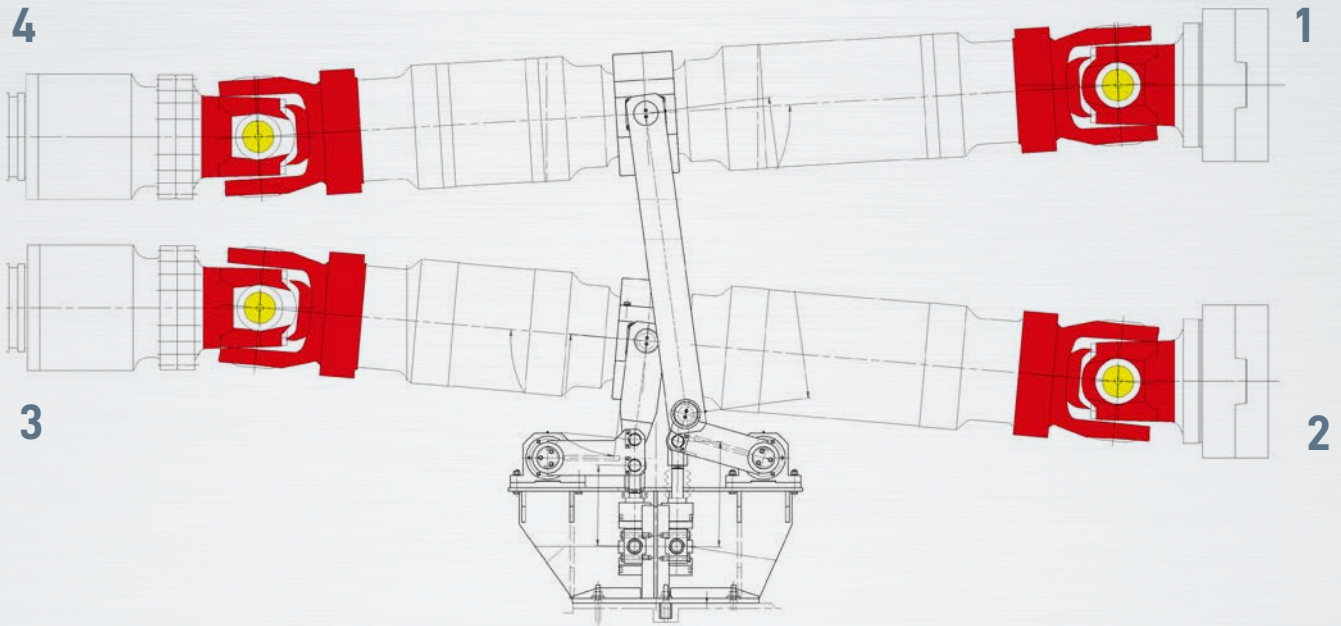




## **ABS New Cardan Knuckles doubles the output of the production of the original ones at Ternium's Churubusco plant**

**These are the largest Cardan Knuckles installed in the Americas  
More than 8 million tons of steel produced and still running  
5 million Nm of working torque**



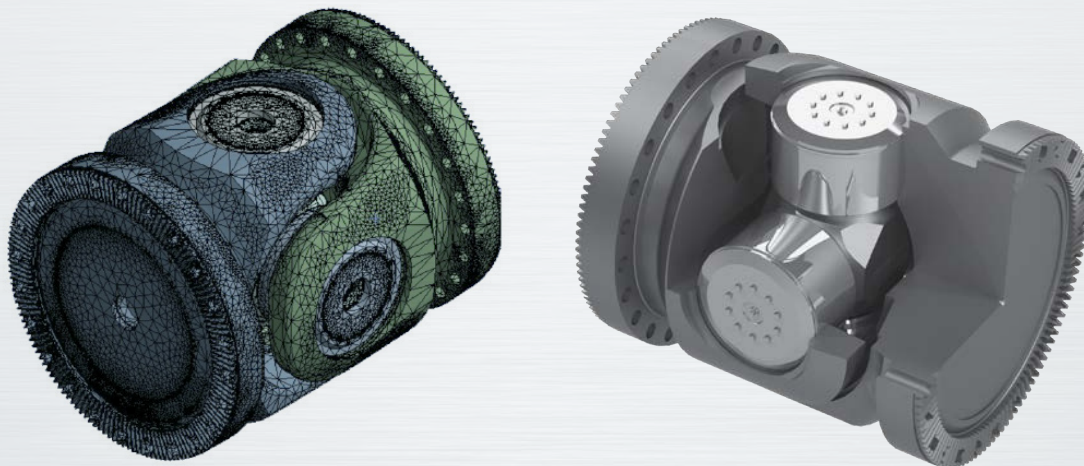


## ABS and Ternium: a solid and trusting relationship

For some years now, Ternium, a leading company in the steel industry in Mexico and LATAM, has been making important improvements in the Churubusco Hot Mill to manufacture Dual Phase steel. This special steel, mainly used in the automotive industry, has an excellent balance between strength and ductility.

ABS's relationship with Ternium Mexico has been thriving since 2000. Since then, we have been collaborating regularly on different projects, particularly in the development of mechanical components for the Cardan shafts of the reversible mill 3 (MC3) of the hot rolling mill at its plant in Churubusco.

First, ABS designed the journal cross and bearing assemblies, then constructed the entire Cardan Knuckles. In 2023 the couplings from the node to the roller, which ABS designed and ACB and MGS Gears fabricated, will be dispensed, and installed.



## A technical challenge within the reach of very few!

### ENGINEERING



### MANUFACTURING

Knot and Crosshead



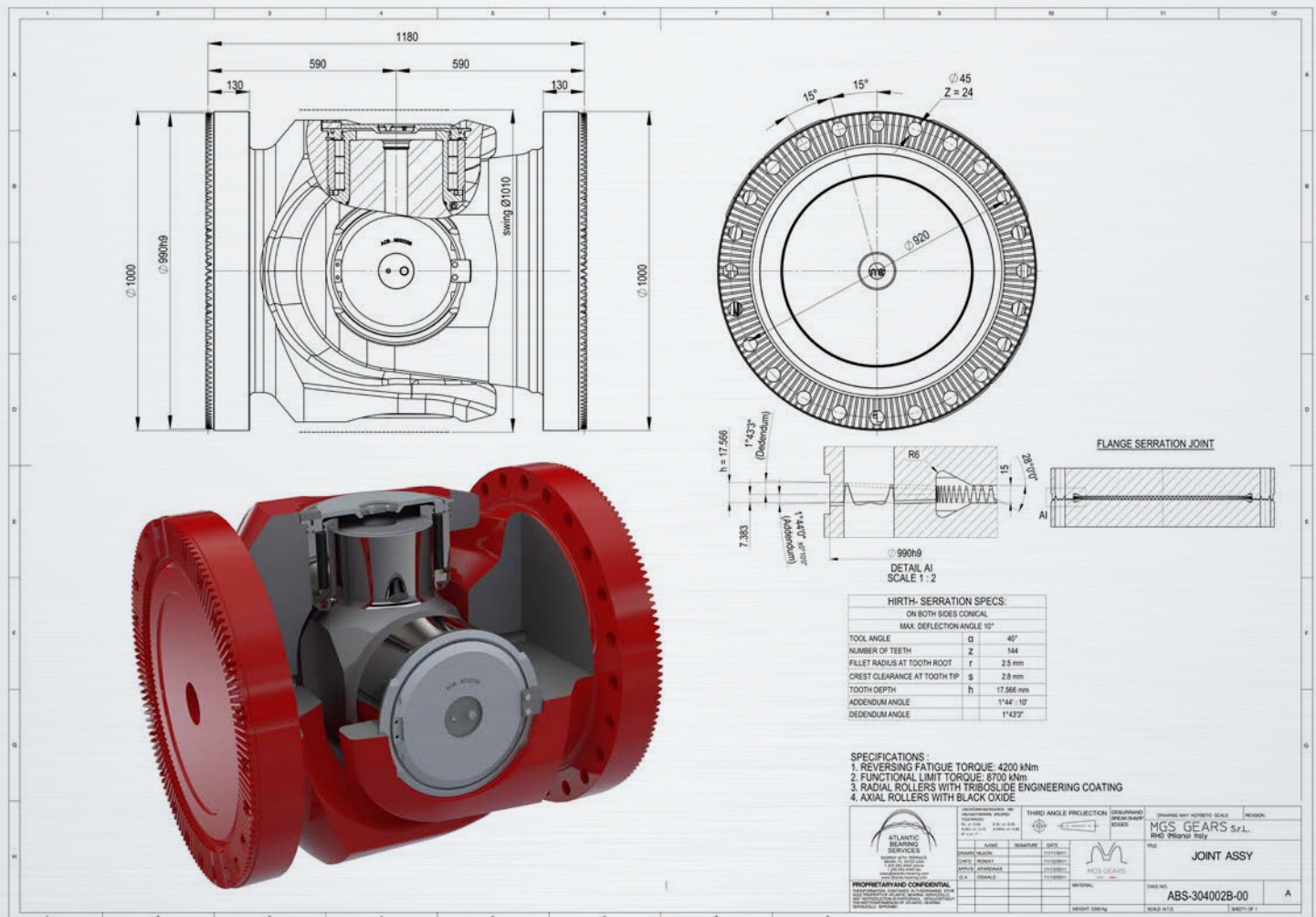
### MANUFACTURING

Bearings and Special Seals



Cardan Knuckles are subjected to very demanding working conditions: high torque, high impact loads due to the rolling process, change of direction of rotation, and high temperatures. The original cardan Knuckles of Ternium's reversible mill (MC3) had begun to show signs of wear and demanded a solution that would offer greater resistance, increase their load capacity, and facilitate maintenance tasks.

Achieving compliance with the technical requirements through a design that integrated the cardan knuckles in the system without altering its measurements or modifying the mounting characteristics posed a significant technical challenge.



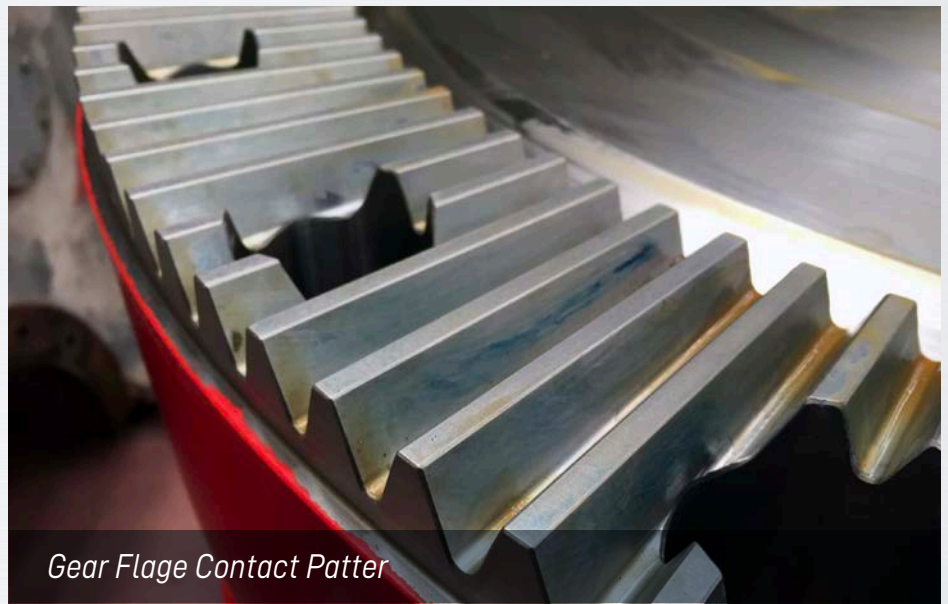
Drawing of the new ABS design, with components from ACB and MGS Gears, resulting in new technical properties that considerably surpassed those of the original component.



## The engineering of ABS, the reliability of ACB, and the precision of MGS Gears

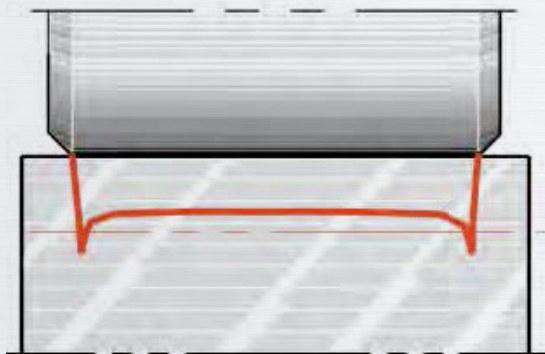
*A "dream team" for the new design!*

Our ABS engineers devised a plan of action, using the latest technologies in simulation and analysis (elasto-linear and elasto-plastic), to ensure that the design features matched the work requirements of the system and the technological capabilities of custom production and manufacturing with the highest precision of ACB and our manufacturers in Italy, MGS Gears.

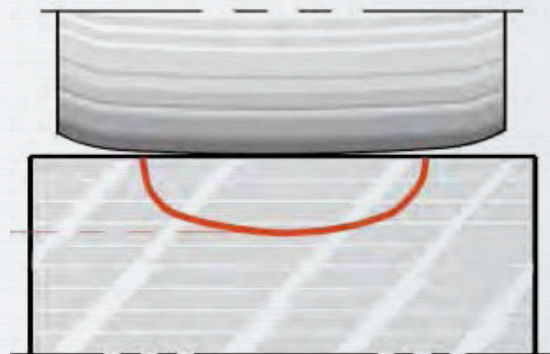


*Gear Flange Contact Patter*

**Original design**



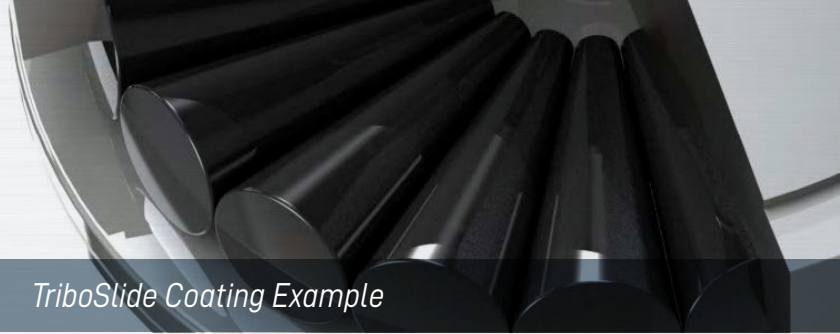
**ACB Design**



**Rollers with optimum crown profile**, that minimizes Hertzian stress concentration on contact. Super finishing was applied, which is a high-precision process that improves the geometry and finishing of the final surface by eliminating defects and burns generated during the grinding operation.

## TriboSlide coating

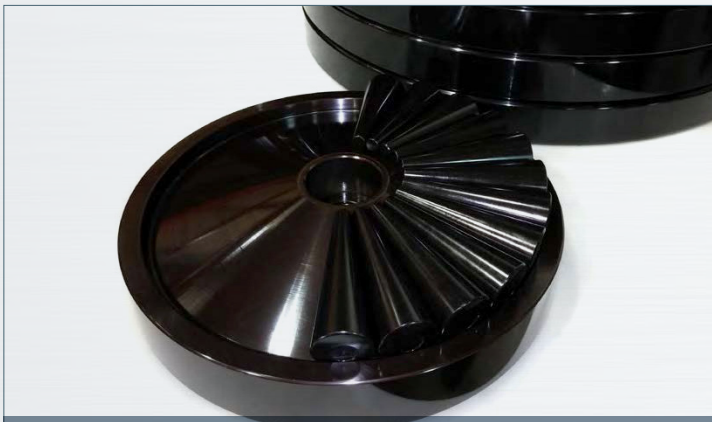
TriboSlide coating on bearings improves hardness, reduces coefficient of friction, and reduces abrasive and adhesive wear.



*TriboSlide Coating Example*

## Quality and resistance in all mechanical components

- Highly alloyed forged steel knuckle was used instead of the original manufacturer's cast steel.
- Bearings are from case-hardened and tempered steel to increase their surface hardness and resistance to impact loads.
- Highly alloyed forged steel journal cross have induction hardened raceways up to 8 mm in depth. This allows for knuckle recovery multiple times at a fraction of the cost of a new knuckle, thereby achieving optimally prolonging its service life.



*Black Oxide coating on bearings*

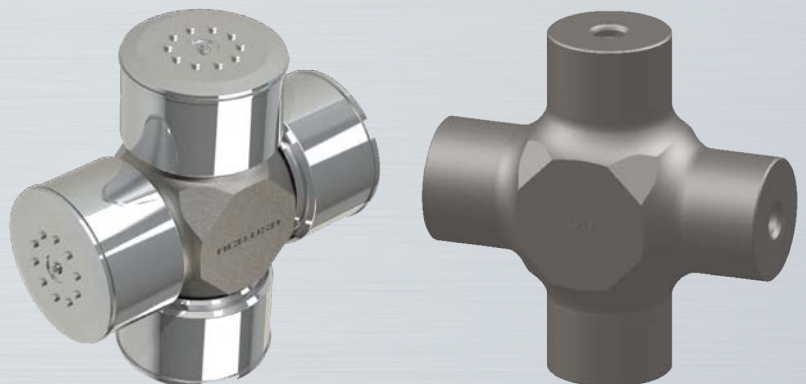


## Black Oxide anti-wear coating

The Black Oxide anti-wear coating on journal cross and bushings increases the resistance to corrosion between the ring and the yoke bore, and to most of the degradations suffered by steels at high temperatures, improving their tribological behavior.

## Optimal journal cross design

Radio between trunnion and journal cross nucleus have been designed to reduce stress in the most critical zones.

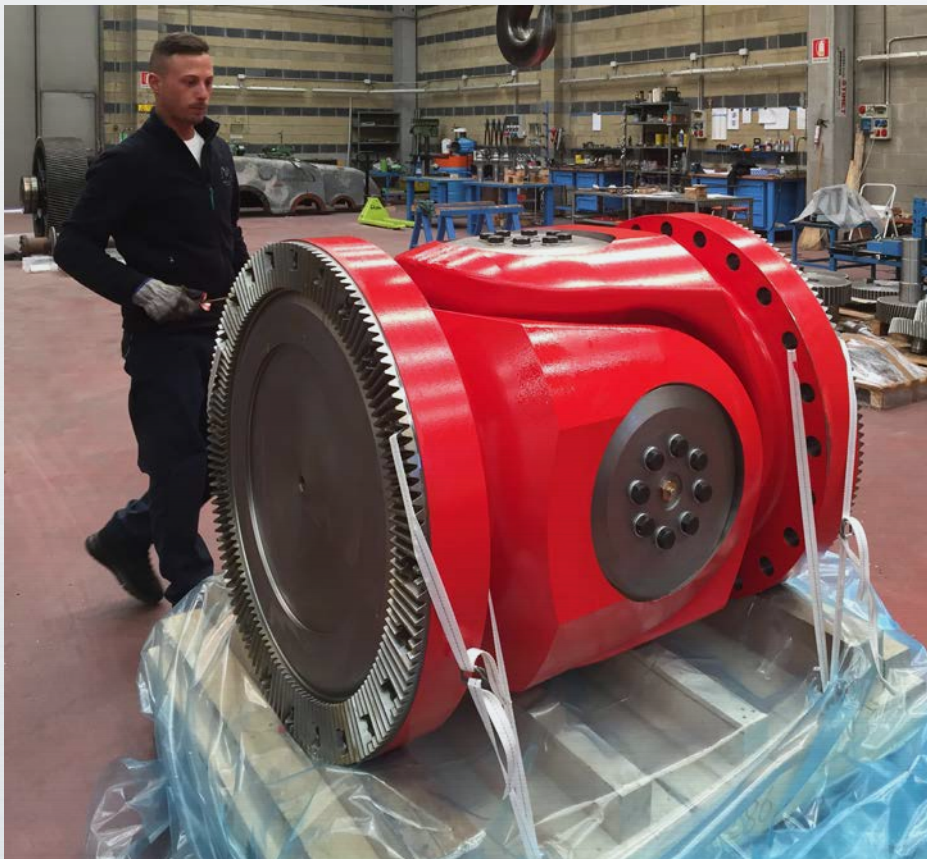
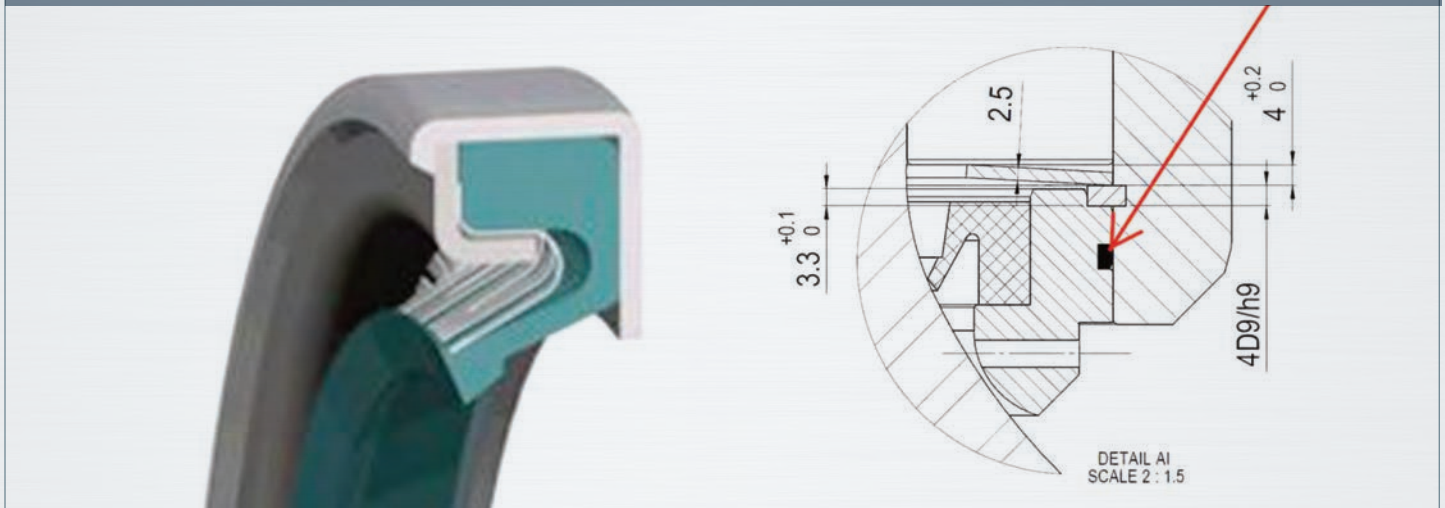




## Special Seals

Specially designed by Garlock for ABS radial seals, in Fluoroelastomer Viton™, and with seal support rings made of phosphor bronze to provide uninterrupted high performance in corrosive and high temperature environments.

*Radial seals with Viton and brass spring designed by Garlock for ABS*



## ABS, specialized customization, and reliability for the Steel Industry!

ABS and its specialized brands have a long history of supplying customized products and solutions to the steel industry, ensuring superior performance, and extending the life of your industrial equipment. Each of the components that make up our cardan shafts is manufactured from the highest quality steels and steel alloys and meet the most stringent quality standards in the market.