DES-CASE®

Case Study

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Extensive Savings and Life Extension of Steel Belt Gearbox

RMF SYSTEMS
A Des-Case Brand

OLUHS1A
Offline Filtration Unit

INDUSTRY:
Steel

INDUSTRY DESCRIPTION

A sinter plant operates in a highly abrasive and dirty environment, where dust and fine particles are constantly present. This makes contamination control vital for environmental, safety reasons and keeping critical equipment like gearboxes running reliably. A sinter plant plays a crucial role in the operations of smelters, particularly in the metallurgical industry where raw materials like iron ore fines, limestone, and coke breeze are processed to produce a sintered product. This product, known as sinter, serves as a vital feedstock for the subsequent stages of metal production, such as blast furnaces in steelmaking or non-ferrous metal smelters.

The sintering process begins when the prepared mixture is spread onto a sintering bed. This bed, housed within the sintering plant, is where the transformation takes place. As the material passes through a sintering machine—typically a continuous strand sintering machine—it is subjected to controlled heating. This causes the granules in the mixture to fuse together, creating a porous but cohesive mass known as sinter.

The steel belt plays an integral role in the sintering plant, particularly within the sintering machine. It supports and conveys the sinter material, manages heat distribution, and facilitates a controlled processing environment.

Its smooth surface makes cleaning and maintenance straightforward, helping to prevent residue buildup that could compromise product quality or machine efficiency.

Durability is another key advantage. The steel belt withstands the extreme heat and mechanical stress of the sintering process, ensuring a long service life and reliable operation.

Additionally, its design supports precise control over the thickness and size distribution of the sintered product, meeting stringent quality standards for further processing in steelmaking or other metal production operations.

THE CHALLENGE

Particle contamination in steel belt gearboxes creates major problems for sintering plants. Fine sinter dust, usually chromium in this application, and abrasive particles accelerate wear on gears, bearings, and seals, leading to frequent repairs, increased costs, and production delays.

Gearbox lubrication systems are highly vulnerable to contamination. Fine particles enter into the clearances between moving parts, causing 3-body abrasion and particle induced contact fatigue. This accelerates wear and can lead to early failure of gears, bearings, and other components, requiring more frequent oil changes and reducing overall reliability.

Seals, meant to block out contaminants, often fail under continuous particle exposure. Once breached, abrasive materials enter the gearbox and cause internal damage, further reducing performance and increasing the need for repairs or full replacements.

As contamination builds up, gearbox efficiency declines. Friction increases, gear movement becomes less smooth, and overall performance suffers. This impacts throughput and can compromise sintering quality, leading to delays and production losses. Maintenance becomes an ongoing challenge.

Inspecting and cleaning contaminated gearboxes demands significant time and resources, often requiring shutdowns or reduced operating speeds. Without regular maintenance, contamination-related damage escalates, threatening the reliability and longevity of gearboxes.

Environmental and safety concerns add another layer of complexity. Fine particles generated during wear or maintenance create health risks and require dust containment measures to comply with safety regulations. Proper dust management is essential to protect workers and maintain a safe operational environment.

These challenges are compounded by the significant cost of steel belt gearboxes, which can cost upward of $270K a year. With a delivery timeline of 52 weeks from order, unplanned failures or replacements severely disrupt plant operations and budgets. Addressing particle contamination is therefore critical to maintaining operational efficiency, reducing costs, and ensuring reliable performance in sintering plants.

SPECIFICATIONS

- Gearbox brand: David Brown Santasalo
- Oil type: Fuchs Renolin CLP 320
- Oil volume: 27 gal (105 Liters)
- Oil temperature: Varies, ambient temperature

THE SOLUTION

Because of the cost, lead time and criticality of these gearboxes, Filtration Management Solution (FMS), an authorized distribution partner of Des-Case in South Africa, has installed an RMF Systems Offline Filtration unit (OLUHS) including a heater, Contamination Monitoring Sensor (CMS), Oil Quality Sensor (OQS) and glass fiber filter elements to lower, monitor and maintain the target cleanliness levels and quality of the lubricant at a sinterplant in South Africa. A desiccant breather (ACM61) was fitted to the drive gearbox to exclude moisture and particle contamination along with a 3D Bullseye® for easy monitoring of the oil level and to assist with visual oil analysis.

Additionally, FMS installed an IsoLogic® breather to the driven gearbox to exclude particle and moisture contamination from entering the gearbox and to be able to monitor the health of the oil on a daily basis. FMS also fitted a drain port adapter to the driven gearbox to be able to connect the suction of the OLUHS and to allow proper oil sampling methods. A breather adapter kit was installed to connect the breather with the return line of the OLUHS. All these products were installed on 2 critical gearboxes that support operations of a steel belt at a sinter plant.

THE RESULTS

The implementation of the filtration system accompanying Des-Case solutions at the sinter plant in South Africa yielded rapid and substantial improvements in gearbox oil cleanliness levels and overall equipment health.

Prior to installation, oil cleanliness was recorded at ISO 4406 23/22/19—an unacceptable level that posed serious risks to gearbox longevity. Within just two days of operation, the cleanliness improved to 16/14/11, and by day seven, it reached an exceptional level of 15/13/10. This outcome not only exceeded the industry cleanliness target of 18/16/13, but also positioned the gearboxes well below the critical contamination threshold.

The removal of chromium particles—a particularly abrasive contaminant common in ferrochrome sinter plants—was a standout result. This specific contaminant was fully eliminated, demonstrating the effectiveness of the glass fiber filter elements.

Iron wear was reduced by a factor of 2.5, based on particle count analysis and corroborated by industry-standard life extension charts. This reduction suggests that critical gearbox components, such as gears and bearings, are now operating under significantly less mechanical stress, leading to smoother operation and fewer failures.

All installed products improved the equipment life on two critical gearboxes that are essential to the operational continuity of the plant. This targeted intervention ensures sustained performance of vital infrastructure and contributes directly to improved sinter quality and throughput.

ISO Cleanliness Level

Before		After 2 days		After 7 days
23/22/19	→	16/14/11	→	15/13/10

RETURN OF INVESTMENT (ROI)

The financial and operational impact of the filtration upgrade is both immediate and long-term. Prior to the installation, the average life expectancy of these gearboxes was 15 years. At a cost of $270,00 per gearbox, this equates to an annual operating cost of $18,000 not including the cost of routine maintenance task such as oil changes and oil analysis. Based on the improved level of fluid cleanliness, gearbox life extension charts suggest a 2-2.5x increase in gearbox life, a fact that is confirmed by the significant reduction in iron wear rates after the filtration system was installed. Based on a 30 year lifespan, the annual cost for each gearbox is reduced to just $9,000.

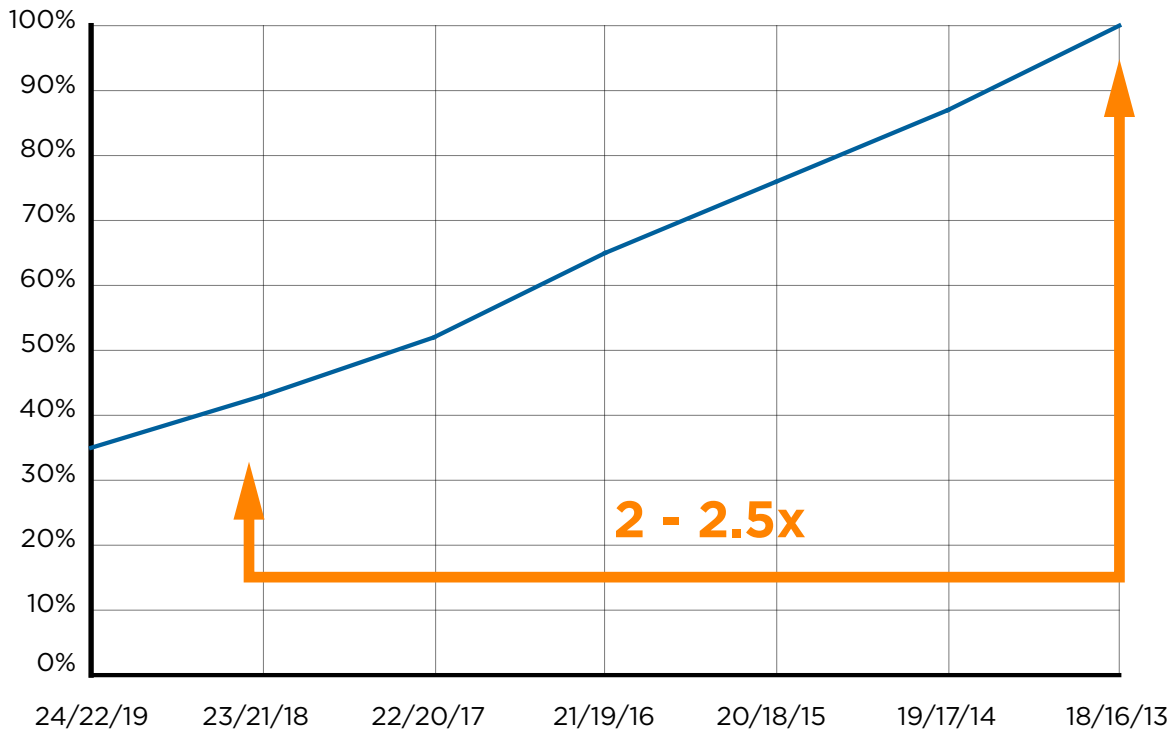
The total investment for outfitting two gearboxes—including all hardware, installation, and labor—was $26,000. This modest upfront cost delivers an impressive return, reaching payback in just 17 months. This successful deployment demonstrates that relatively minor investments in filtration and contamination control can yield substantial economic benefits.

Before	
ISO Cleanliness	23/21/19
Current gearbox life	15 years
Cost of a new gearbox	$270,000
Cost per year of gearbox life	$18,000

After	
ISO Cleanliness	15/13/10
Estimated increase in gearbox life	2x
Cost of a new gearbox	$270,000
Cost per year of gearbox life	$9,000

Annual costs avoidance	$9,000
Cost of the OLU	$13,000
Payback Period (Months)	17.3

Life Extension Chart



A visual comparison of ISO cleanliness levels before and after installation illustrates the steep reduction in contaminant levels, resulting in a life equipment extension of 2.5 times.

Based on an annual reduction in operating costs of $9,000 per gearbox, the small investment of $26,000 on two filtration systems is projected to yield net present value (NPV) cost avoidance of close to $35,000 over the next 5-years, equivalent to an annualized rate of return (IRR) of over 200%!

Number of gearboxes	2

Program Benefits					
Year	**1**	**2**	**3**	**4**	**5**
Cost avoidance per gearbox	$9,000	$9,000	$9,000	$9,000	$9,000
Costs avoidance of all gearboxes	$18,000	$18,000	$18,000	$18,000	$18,000
Labor ancillary repair costs (excluded)	$0	$0	$0	$0	$0
Production Losses (excluded)	$0	$0	$0	$0	$0
Total Benefits	**$18,000**	**$18,000**	**$18,000**	**$18,000**	**$18,000**

Program Costs					
OLU including installation costs	$26,000	$0	$0	$0	$0
Filter Changeouts (4 per year)	$0	$1,200	$1,200	$1,200	$1,200
Total Costs	$26,000	$1,200	$1,200	$1,200	$1,200
Net Cash Flow	-$8,000	$16,800	$16,800	$16,800	$16,800

Select Discount Rate (cost of capital)	15%

Discount Factor	87%	76%	66%	57%	50%
Discounted Net Cash Flow	-$6,957	$12,703	$11,046	$9,605	$8,353

Investment Analysis	
Five Year Net Present Value (NPV)	$34,751
Internal Rate of Return (IRR)	208%

Annual costs avoidance per gearbox

$9k
PER YEAR

Payback Period filtration products

17
MONTHS

Internal Rate of Return

200+
PERCENT

Offline Filtration Unit

Oil Quality Sensor

Contamination Monitoring Sensor

DC- IL- VG-4
Desiccant Breather

Bullseye®

ACM61RV
Desiccant Breather

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