

AXEL & Steel Mills

Tailored Grease Technology for Your Most Demanding Applications



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Market Introduction

Since the early days of the steelmaking industry in the late 19th century, a gradual evolution of the production process to continually meet the changing needs of an increasingly industrialised and connected world has resulted in steel, in all its forms, forging a reputation that today sees it as the world's most popular construction material.

From the structural framework that ensures the stability and safety of infrastructure such as buildings, bridges, transport networks and vehicles to the aesthetic or functional finishing touches it can bring to household appliances, medical equipment and the latest consumable technology, steel is an integral part of modern life.

The durability and versatility of the finished product lies at the heart of steel's success. However, operational efficiency of the production process is an equally important factor when it comes to optimising costs and staying competitive.

The key to productivity and operational efficiency in any industry is reliable equipment, but of them all, the conditions endured during the process of manufacturing steel are perhaps the most severe. With the potential to greatly limit the life of moving components that keep equipment operational, the process of grease selection here is critical to maintaining optimum equipment performance across the entire plant.

AXEL Knowledge

The modern steel manufacturing process represents one of the most hostile and challenging environments in which industrial machinery and equipment are located and expected to perform reliably.

Conditions such as extremely high temperatures, excessive loads, high vibrational activity and the presence of corrosive process waters are sufficiently challenging when encountered individually. Within the steel mill, they join forces placing additional emphasis on the importance of appropriate grease selection.

At AXEL, our in-depth knowledge of grease technologies combined with an understanding of operational demands has enabled our team of experts to develop a range of product platforms capable of enhancing component protection when exposed to the severe conditions experienced within a steel plant.

Longer component and equipment life are key to reliability, extended service intervals and reduced product consumption.

This in turn contributes to improved operational efficiency and optimised productivity.

AXEL: Dedicated to Greases. Differentiated for You.

AXEL: Grease Technology That Can Take the Heat

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Protecting the Process & Productivity

The Steel Making Process

The modern steel making process consists of 6 stages:

- **1. Ironmaking** where iron ore, coke and lime are melted in a blast furnace resulting in molten iron.
- 2. Primary steelmaking where the molten iron is converted to molten steel using either a basic oxygen furnace or electric arc furnace.
- **3. Secondary steelmaking** where the composition of the molten steel is adjusted depending on the properties required in the final product.
- Continuous casting where the molten steel is passed through cooled molds then drawn, solidified and cut into slabs, blooms or billets.
- **5. Primary forming** where the cast defects are eliminated whilst achieving the required shape and surface quality.
- 6. Manufacturing, fabrication & finishing where the finished properties of the steel are determined through the use of secondary forming techniques such as shaping, machining, surface treatments and coating.

Overview of Key Steps in a Typical Hot Rolling Process



Tailoring the Technology

Challenging Conditions

The steel making process is subject to a number of challenging conditions including:

- · Extreme temperatures
- Moderate to low speeds combined with very high loads
- · Exposure to corrosive process waters
- · Shock loads and high vibrational activity

Technology Platform

The key features of a reliable technology platform include:

- · Structural integrity and thermal stability from appropriate thickener technology
- · High viscosity liquid phase for film strength
- Optimised balance of additives to support the protection of components and equipment



Key Components & Protective Priorities

Across the different sections of the steel production process there is a range of equipment that relies on specific components for their mobility and functionality.



Plain or Journal Bearings

Plain or journal bearings are the most simple form of bearing consisting of a journal or shaft which can rotate freely within a metal sleeve or shell. The most common movement experienced within a plain bearing is oscillation without making a full rotation. It is for this reason that plain bearings often operate under boundary lubrication conditions which results in metal-to-metal contact.

Within the steel production process, examples of plain bearings can be found in the pivot points of the ladle lifting and tipping equipment around the ladle turret or in the linkages of conveyor systems used to transport raw materials to the blast furnace.



Geared components can be used to transfer power from a driven source into controlled, mechanical movement and, depending on the nature of the application, the geared component will be configured differently. One consistent feature of many applications where there is a meshing of gear teeth is the need to protect against the effects of both rolling and sliding motion between the metal surfaces.

In heavy industry where loads and vibrational activity are particularly high, a grease will need the combined support of high base oil viscosities and solid lubricants to protect the metal surfaces.

In the steel mill, examples of geared components can be used in the ladle tilting mechanism (bull gear) or in the form of a slew ring gear that enables the controlled rotation of the ladle turret ahead of the continuous caster process.

Continuous Caster





Protective Priorities

- · Stable grease structure
- · Thermal & oxidative stability
- · Robust film strength according to loading conditions
- · Resistance to static loading
- Solid lubrication to support protection against oscillation & reciprocating motion as well as shock loads

Protective Priorities

- · Stable grease structure
- Thermal & oxidative stability
- · Resistance to water ingress and its effects
- · Robust film strength according to loading conditions
- · EP and anti-wear performance
- Solid lubrication to protect against rolling and sliding motion as well as shock loads



Rolling element bearings come in a wide range of sizes and configurations depending on the nature of their intended purpose and the market segment in which they are applied.

Within the steel segment alone, there are several different types of rolling element bearings used across every section of the production process in applications including raw material conveyors, guide rails, back-up and work rolls in the four high rolling mill and coilers.

Though the bearing configurations may be different depending on the equipment and their intended purpose, the fundamental lubrication requirements within a steel plant are essentially consistent.



Protective Priorities

- · Stable grease structure
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- · Resistance to water ingress and its effects
- · Robust film strength according to loading conditions
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AXEL: Taking Grease Performance to the Extreme

Target Benefits

- · Optimise grease performance
- · Prolong component protection
- Extend service life
- Reduce relubrication intervals
- Reduce component & lubricant consumption
- Reduce operational costs
- · Increase productivity
- · Optimise operational efficiency

AXEL Platform Technologies for Steel Mills

AXEL	Platform Technology	Example Variants	Suitable for
Caliac	Caliac combines the multipurpose benefits of a conventional lithium thickener technology with the enhanced water resistant characterisitcs of calcium to provide a versatile platform for those exposed applications not requiring the added thermal resistance of a complex thickener technology	Caliac 17xx Series – Heavy Duty Mineral	Plain and rolling element bearings where thermal stability is not a primary requirement e.g. cooling beds
Axellence	Axellence is an excellent, multi- functional lithium complex platform technology for applications exposed to higher operating temperatures	Axellence 26xx Series – Heavy Duty Mineral/Polymer Axellence 6xx Series – Multipurpose Synthetic	Plain and rolling element bearings operating across a wide range of operating conditions when combined with the correct base oil viscosity e.g. electric motors
Calsullence	Calsullence is a high performance calcium sulphonate complex thickener technology that combines excellent thermal stability, EP performance and corrosion resistance making it a versatile heavy duty technology for particularly exposed and arduous conditions	Calsullence 16xx Series – Functional Heavy Duty Mineral	Plain and rolling element bearings exposed to high temperatures, high loads and the ingress of external contaminants such as corrosive process waters e.g. rollers in the continuous caster or rolling mills



AXEL - Your Global Partner

Global Presence

With over 125 years of experience, AXEL has expanded dramatically to become one of the leading global producers and suppliers of lubricating greases, with state-of-the-art manufacturing facilities in Sweden, France, the Netherlands and the USA.

AXEL partners with many of the leading lubricant companies around the world who choose us because of our unique Customised Label™ concept.



Serving the leading lubricants companies across the globe.

AXEL Unique Offerings

Customised Label™

AXEL's Customised Label[™] strategy ensures that every product leaving our plants is customised to your needs and labelled in your name. At AXEL we do not have our own brand and do not compete with our customers.

AXEL products are produced under the strictest quality standards including ISO 9001, 14001, 21469 and TS 16949.

AXEL Customised Label™ Your brand. Your markets. Our knowledge.

AXEL Premium Services

AXEL provides you with the ability to tailor your Service Level Agreement (SLA) according to your specific needs.

- · Ease of Supply Partnering for Production
- · Product Development
- Logistical Management
- Technical Support and Services
- Marketing and Sales Support



Ease of Supply™ "The products and services we provide become an integral part of your value chain."



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