WHITE PAPER

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Lubrisense™

Introductory issue

AXEL

AXEL CHRISTIERNSSON

Introduction to Lubrisense White Papers

Lubrisense™ White Papers are being introduced by Axel Christiernsson to act as a forum for the review of technical and application developments in the lubricating grease market. They are intended to catalyse dialogue between all technical and commercial participants with an interest in the use of grease as a lubricant.

Machinery and equipment designers and engineers, grease consumers, formulators, manufacturers and distributors, together with suppliers of raw materials will find interest in White Papers, as will experts in the areas of the toxicology and ecotoxicology of lubricants and the related legislative and regulatory developments.

The principal objective is to enable the process of innovation, in the design of grease formulations and their application, by the involvement of all the participants who have an interface with the development of machinery and lubricants.

Based on sound scientific principles and a wealth of experience, Lubrisense™ White Papers will seek to establish the reference points for our industry.

Lubrisense™ is AXEL's term for applied knowledge within lubricating grease.

Background

The operating demands on lubricating grease have become increasingly challenging over the past two decades.

Today, the advancement of grease technology is fundamentally an interdisciplinary activity. The cross-fertilisation of concepts in chemistry, physics, bioscience and environmental science is absolutely essential for the development of the future innovative response to lubrication challenges.

Traditionally, during the development of greases, there has been a significant focus on the chemistry of the rather complex mix of lubricant base oils, the viscosity modifying soaps and polymers and the additional components which, for example, offer enhanced oxidative stability or lubricity.

The chemistry of manufacture has, of course, featured centrally in the developments in grease technology, but also the chemistry of the interface between the machinery and the grease components has inevitably attracted significant attention.

THE HISTORY OF AXEL SINCE THE INDUSTRIAL REVOLUTION

In 1848, when Axel Abraham Christiernsson was born in Bjurtjärn, Sweden, the industrialisation of Europe was rapidly increasing in pace. Axel qualified as an engineer in 1867 and worked for a number of companies, as a blacksmith, a book-keeper and as an engineer, before eventually founding his own company, on October 31, 1888.

Industrialisation and mechanisation were leading to a rapidly increasing demand for quality lubricants. The AXEL company produced these lubricants and other chemical products at its plant, Kemisk Tekniska Fabriken Örnen, near Stockholm and by 1897, turnover had reached more than 1 million Kronor, with net profits of over 15%.

By the early 20th century, the AXEL organisation had expanded its business activities to include a subsidiary in Finland and was also trading in more than 700 product lines.

On his retirement, in 1909, Axel Christiernsson was followed by a dynamic managing director, Carl Gideon Johansson, who led the company to a listing on the Swedish stock exchange in 1918, just in time for Axel Christiernsson to see this culmination of his work, before passing away in 1919.

Around this time, the number of employees had expanded to 2000 and the company had also opened activities as far afield as Brazil. The product portfolio in the grease range contained several high performance materials including graphite greases.

The company restructured in the early 1920's to allow its component groups to focus on their individual core activities.

AXEL returned to a business concentrating on grease, with production units in Stockholm and Gothenburg, together with a trading office in Malmö.

By 1930, the technical challenges for greases were becoming increasingly important, with more demanding and higher temperature applications. Collaboration with the Volvo automobile company, with railway companies, together with bearing manufacturers, such as SKF, resulted in a number of innovations. Products with a greater tolerance to higher temperature conditions were introduced, based for example on sodium stearate derivatives.

AXEL continued to invest and, in 1940, the production capacity in Stockholm was replaced by a new facility at Värtan, also near Stockholm.

Innovation and Technology

Increasingly, innovation in grease is being driven by a fundamental understanding of the physics of the interactions between the surfaces of equipment and the grease itself, as it performs its multifunctional role at the interface.

It is the physical structure of grease that offers the formulator this multifunctional capability and the semi-solid structure thus differentiates grease from lubricating oil. But increasingly, it is the understanding of the third body physics at the machine's surfaces that enables the formulator to optimise the technical capability of the grease.

The study of tribology and the effects of friction, wear and lubrication at the machinery interface is key to the future advance in grease technology, as is an understanding of the rheology of grease and its viscous flow under the operating load.

Machinery operates under increasingly demanding conditions. Equipment designers may be seeking higher operating speeds, higher tolerance to extreme temperatures, energy economy through lower friction and longer machinery life coupled with less frequent maintenance. Under operating conditions the equipment and grease may encounter aggressive gases, liquids and solids or may be in a sensitive environment such as food or pharmaceutical processing.

The grease formulator is asked to contribute to these goals whilst also designing the lubricant to offer low toxicity, low ecotoxicity, low environmental impact and compliance with the regulatory requirements applying to the specific application of the equipment.

Innovation in grease is a cyclical or iterative process. The improved understanding of the physics and chemistry at the interface of machinery and lubricant renews the challenge for the research chemist and the formulation technologist.

The capability to develop or introduce an innovative chemical component and, in particular, the capability to manufacture and supply the formulated grease in an appropriate way is a significant contributing factor to the innovation process.

One of the greatest innovations in grease technology occurred in the 1940's with the development of lithium-based greases. In 1948, AXEL introduced the lithium-barium grease SKF 48 and an increasing number of lithium products were developed and marketed by AXEL in the 1950's.

The Johnson group, at that time one of the largest industrial conglomerates in Scandinavia, took over the AXEL facilities in Gothenburg and Stockholm in the 1960's and further investment was made at Värtan, with a plant expansion.

The markets for higher technology greases continued to fragment, with more challenging applications requiring specific grease formulations.

Products were based on an increasingly wide raw material portfolio, to provide the solutions to customers' lubrication requirements. The first anhydrous calcium grease, based on 12-hydroxystearic acid, was introduced at this time.

AXEL focused most of its manufacturing activities in the Gothenburg area in the 1970's and acquired a lube factory owned by SAPA, in Nol, during 1973. This facility was expanded with the commissioning of a new grease production unit in 1982. During this period, the introduction of lead-free greases, for applications such as railway hubs, provided a breakthrough in environmental improvement. The increasing use of central lubrication systems in many engineering applications catalysed the development of the Accent range of greases.

During the 1980's, a decision of the greatest importance to the commercial and technical future of AXEL was made. The company would focus on the supply of products and services to intermediate clients in the grease supply chain, rather than approaching the final, down-stream grease user.

These intermediate clients marketed lubricating greases under their own brand or label and AXEL positioned itself to provide them with a customised source of product, technology and service.

In 1989, AXEL received an award from the American lube organisation NLGI (National Lubricating Grease Institute) for outstanding work in grease rheology.

The last decade of the 20th century was marked by an increasing pace of technological development, an internationalisation of the grease market and a greater focus on production rationalisation by manufacturers.

AXEL were instrumental in the formation of the European Lubricating Grease Institute (ELGI) and had representation on the board of directors.

The Way Forward

Lubrisense™ White Papers will be addressing the whole grease community. Topics will include the fundamentals of grease formulation, manufacture, delivery and application together with focused reviews of specific issues and applications.

AXEL wish to encourage a dialogue by inviting guest contributors, with specific expertise, to review aspects of the full breadth of opportunities and pressures that impact on the development, supply and application of grease.

Papers will be drawn from leading experts in industry, universities, research institutes and government, together with input from AXEL's own contributors.

It is intended that the White Papers will be responsive to the requirements of the readers and dialogue will be actively encouraged. Articles will not only encompass the basics of grease technology and application, but also specific topics across the complete spectrum of the issues surrounding grease.

Lubrisense™ White Papers are intended to be reference points for the world of grease.

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A major technical step forward centred on AXEL's development of lithium-calcium complex grease, the technology for which was extended into the portfolio of the Alassca™ range; early sales were into very challenging arctic mining applications.

The Timac company and its production unit, located at Heijningen in the Netherlands, was acquired in 1991 and during the mid-1990's both the Swedish and Dutch facilities achieved ISO 9000 quality assurance standard.

At this time, AXEL developed bismuth containing greases for demanding applications where improved friction properties and longer bearing life were required.

The newly integrated, European Research Department increased the rate of new product development; lithium-calcium Caliac™ and lithium-calcium complex Grizzly greases were developed for challenging uses such as steel manufacture.

And in 1995, the American NLGI again recognised AXEL's technical contributions with an award for a paper on Alassca™.

In 1997 the ownership of AXEL passed from the Johnson group, who wished to concentrate on their new core activities, trading and real estate, to the Fairford Holding company, with whom ownership remains today.

A significant step forward came in 1998 with the establishment of the AXEL Innovation Centre and the development of customer support and collaboration within the Lubrisense™ initiative, enabling the grease market to access the fundamental expertise of the AXEL group.

A number of developments were commercialised at this time; synthetic lithium complex grease for truck hubs which achieved outstanding success, unconventional grease thickener systems, a modern range of bio-greases based on renewable resources and new additives in fluorinated greases. In addition, a new, patented, polymer grease technology has proved very successful in extending the relubrication intervals in demanding applications such as power generation wind turbines.

In the new millennium, focus continued on the quality and capability of production and supply. In Sweden, the factory in Nol achieved ISO 14.001 environmental qualification in 2001 and, in the Netherlands, an expansion of the production facilities in Heijningen came into operation in 2003. An additional capacity expansion is currently being planned to meet the growing demand for customised label™ products and will be fully operational by early 2005.

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