

kluber grease equivalent chart

Understanding the Kluber Grease Equivalent Chart: Your Guide to Lubricant Selection

kluber grease equivalent chart is a vital tool for engineers, maintenance professionals, and procurement specialists seeking precise lubrication solutions. When a specific Kluber lubricant isn't readily available or a cost-effective alternative is required, understanding equivalents becomes paramount. This article delves into the complexities of Kluber grease, the importance of equivalent selection, and how to navigate a Kluber grease equivalent chart effectively. We will explore the key performance characteristics that define a lubricant's suitability, common reasons for seeking equivalents, and the critical factors to consider to ensure optimal performance and equipment longevity. By the end of this comprehensive guide, you'll be equipped to make informed decisions when faced with Kluber lubricant selection and the need for viable alternatives.

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The Importance of Kluber Lubricants

Kluber Lubrication is a globally recognized leader in the field of specialty lubricants. Their products are engineered to meet the demanding requirements of a vast array of industries, from automotive and aerospace to food processing and renewable energy. Kluber greases are renowned for their exceptional performance under extreme conditions, including high temperatures, heavy loads, and aggressive chemical environments. The precision formulation of Kluber lubricants ensures reduced friction, wear, and energy consumption, directly contributing to extended equipment life and operational efficiency. Their commitment to innovation means they constantly develop advanced lubrication solutions tailored to specific application challenges.

Why Seek a Kluber Grease Equivalent?

Several compelling reasons drive the need to find a Kluber grease equivalent. Supply chain disruptions, unexpected shortages, or the desire to optimize costs can all necessitate exploring alternatives. In some cases, a facility might be transitioning to a new equipment manufacturer whose specifications align with a different lubricant brand. Furthermore, end-users may discover that a competitor's product offers comparable performance at a more competitive price point. Understanding Kluber grease equivalents allows for continued operational reliability and cost-effectiveness without compromising the critical lubrication needs of machinery.

Key Factors in Kluber Grease Equivalence

Determining a true Kluber grease equivalent is not simply a matter of matching brand names. Several fundamental characteristics must be carefully considered. The base oil type, the thickener system, and the additive package are the primary determinants of a grease's performance profile. Each of these components plays a crucial role in how the grease will behave under specific operating conditions. Ignoring any one of these factors can lead to suboptimal performance, premature equipment failure, and increased maintenance costs. A thorough understanding of these elements is the foundation for successful lubricant selection.

Understanding Lubricant Base Oils

The base oil constitutes the bulk of a grease formulation, typically ranging from 70% to 95%. Its properties dictate many of the grease's overall

characteristics. Mineral oils, derived from petroleum, are common and cost-effective, suitable for many general-purpose applications. Synthetic base oils, such as polyalphaolefins (PAOs), esters, and silicones, offer superior performance in extreme temperatures, enhanced oxidative stability, and better biodegradability. For instance, a Kluber grease formulated with a PAO base oil will likely require a synthetic equivalent to match its performance in high-temperature applications.

The Role of Thickening Agents in Grease

The thickener is responsible for transforming the base oil into a semi-solid grease structure. Common thickeners include lithium, calcium, sodium, and complex soaps, as well as non-soap thickeners like polyurea and PTFE. Each thickener imparts different properties, such as water resistance, temperature stability, and mechanical shear stability. For example, a Kluber grease using a complex lithium thickener will exhibit excellent high-temperature performance and water washout resistance, and an equivalent should ideally feature a similar thickener or a combination that mimics these properties.

Additives: Enhancing Lubricant Performance

Additives are crucial for fine-tuning a grease's performance to meet specific application demands. These can include extreme pressure (EP) additives to protect against wear under heavy loads, anti-wear agents, rust and corrosion inhibitors, antioxidants to prevent degradation, and tackifiers to improve adhesion. The type and concentration of additives in a Kluber grease are critical. An equivalent lubricant must possess a comparable additive package to provide the same level of protection and performance characteristics. For example, a Kluber grease used in a heavily loaded bearing will require an equivalent with robust EP and anti-wear additives.

Decoding a Kluber Grease Equivalent Chart

A Kluber grease equivalent chart is a valuable resource that cross-references specific Kluber product numbers with alternative lubricants from other manufacturers. These charts are typically organized by Kluber product series or by application. They will often provide details on the base oil type, thickener, NLGI (National Lubricating Grease Institute) consistency number, and key performance characteristics like temperature range and water resistance. Interpreting such a chart requires a systematic approach, comparing the essential properties of the specified Kluber grease with those of the potential equivalents.

Common Kluber Grease Series and Their Equivalents

Kluber offers a wide range of specialized grease series, each designed for distinct purposes. Understanding these series helps in identifying appropriate equivalents. For instance, the Kluber ISOFLEX series is known for its low-temperature performance and use in demanding applications like precision instruments and automotive components. Equivalents for ISOFLEX greases would likely be other synthetic greases with similar low-temperature viscosity and good oil bleed characteristics. The Kluber Thermoplex series is engineered for high-temperature applications, often utilizing synthetic base oils and high-stability thickeners. Finding an equivalent here would necessitate looking for lubricants with comparable thermal stability and oxidative resistance.

Practical Steps for Using an Equivalent Chart

When utilizing a Kluber grease equivalent chart, begin by identifying the specific Kluber grease you are currently using or intend to use. Note down its key specifications: base oil type, thickener, NLGI grade, and operating temperature range. Then, consult the chart, looking for entries that match these parameters. Pay close attention to the recommended applications and any performance notes provided for the equivalent. It is advisable to cross-reference information from multiple sources or consult with a lubrication expert if there is any uncertainty about a potential substitute. Testing the equivalent in a non-critical application before widespread implementation is also a prudent step.

Potential Pitfalls and Avoid Them

Several pitfalls can arise when selecting Kluber grease equivalents. One common mistake is to focus solely on the NLGI consistency number, which only describes the grease's stiffness and not its actual performance capabilities. Another pitfall is overlooking the compatibility of additives, particularly with plastics or elastomers present in the machinery. Using a grease with incompatible additives can lead to seal degradation or material swelling. Furthermore, assuming that a "universal" grease will be a suitable equivalent for a specialized Kluber product is often a recipe for disaster. Always prioritize matching the critical performance requirements of the original Kluber lubricant.

Conclusion

Navigating the landscape of lubricants and their equivalents is essential for maintaining the integrity and efficiency of industrial machinery. A Kluber grease equivalent chart serves as an invaluable guide, but its effective use demands a comprehensive understanding of lubricant composition and performance characteristics. By carefully considering base oils, thickeners, additives, and specific application requirements, professionals can confidently identify suitable alternatives that meet or exceed the performance of their Kluber counterparts. This informed approach ensures operational continuity, cost optimization, and the prolonged life of critical equipment.

Frequently Asked Questions

What is a Kluber grease equivalent chart and why is it important?

A Kluber grease equivalent chart is a resource that lists alternative greases from other manufacturers that have similar properties and performance characteristics to specific Kluber Lubrication products. It's important for maintenance professionals, engineers, and procurement specialists to identify suitable replacements when a preferred Kluber grease is unavailable, too expensive, or if a specific application requires a different product that offers comparable lubrication benefits.

Where can I find a reliable Kluber grease equivalent chart?

Reliable Kluber grease equivalent charts are typically provided by lubricant distributors, independent lubrication consultants, or by specialized online databases. While Kluber Lubrication itself does not officially publish cross-reference charts for competitor products, many reputable third-party sources compile this information based on extensive research, technical data, and real-world application experience. It's crucial to verify the information with the supplier of the equivalent product.

What factors should I consider when using a Kluber grease equivalent chart?

When using a Kluber grease equivalent chart, consider: the base oil type (mineral, synthetic), base oil viscosity, thickener type (lithium, calcium, polyurea, etc.), NLGI grade, operating temperature range, load-carrying capacity, water resistance, and any specific additives (EP, anti-wear, rust inhibitors). The intended application and environmental conditions are also

critical to ensure proper performance and longevity of the lubrication.

Are there online tools or software that can help find Kluber grease equivalents?

Yes, there are several online lubricant selection tools and databases available that can assist in finding Kluber grease equivalents. Many lubricant distributors offer these tools on their websites, allowing users to input a Kluber product number or specific application requirements to find suitable alternatives from various brands. Some advanced software platforms also cater to industrial lubrication management and can incorporate cross-referencing capabilities.

What are the risks of using an incorrect Kluber grease equivalent?

Using an incorrect Kluber grease equivalent can lead to significant risks, including premature equipment wear, component failure, increased friction and energy consumption, overheating, corrosion, and reduced service life of the machinery. Incompatible base oils or thickeners can cause separation, gumming, or a breakdown of the grease's lubricating film, leading to catastrophic failures and costly downtime.

Additional Resources

Here are 9 book titles and descriptions related to Kluber grease equivalent charts:

1. Lubricants and Their Applications: A Comprehensive Guide

This foundational text delves into the science behind various lubricants, including greases. It would likely cover the chemical compositions and physical properties that define lubricant performance, providing the underlying principles needed to understand how different greases function. The book would also explore the diverse industrial sectors where these lubricants are critical for machinery longevity and efficiency.

2. Tribology in Practice: Friction, Wear, and Lubrication

Tribology, the study of friction, wear, and lubrication, is central to understanding grease equivalents. This book would offer in-depth explanations of how greases mitigate friction and prevent wear in mechanical systems. Readers would gain insight into the mechanisms of lubrication and the factors that influence lubricant selection, which are essential for deciphering lubricant compatibility.

3. Industrial Lubrication Handbook: Selection, Application, and Troubleshooting

This handbook would be a practical resource for engineers and technicians dealing with lubrication challenges. It would likely contain extensive

sections on selecting the appropriate lubricant for specific applications, including detailed charts and guidelines. The troubleshooting aspect would be invaluable for understanding common lubrication failures and how to identify suitable alternatives.

4. The Chemistry of Lubricating Greases: Formulation and Performance

Focusing specifically on greases, this book would explore the intricate chemistry involved in their formulation. It would explain the roles of base oils, thickeners, and additives, and how these components determine a grease's properties and its potential as an equivalent to another. Understanding these chemical aspects is key to recognizing similarities and differences between greases.

5. Bearing Lubrication: Theory, Practice, and Technology

Given that Kluber greases are often used in bearings, this specialized book would be highly relevant. It would detail the lubrication requirements of various bearing types and the specific types of greases recommended for each. The book would likely offer guidance on how to ensure proper lubrication, which is crucial when considering substitutes.

6. Materials Science and Engineering of Lubricants

This advanced text would bridge the gap between material science and lubrication. It would discuss the interactions between lubricants and the materials they are in contact with, offering insights into compatibility issues. Understanding these material interactions is vital for ensuring a grease equivalent performs as expected without causing damage.

7. Lubricant Standards and Specifications: A Global Overview

This book would navigate the complex world of lubricant standards and specifications set by various international bodies. It would explain how these standards classify lubricants based on their properties and performance characteristics, which directly informs the creation and interpretation of equivalent charts. The focus on global aspects would help understand variations in testing and classification.

8. Maintenance Engineering and Asset Management: Lubrication Strategies

From a maintenance perspective, this book would emphasize the role of effective lubrication in extending the life of industrial assets. It would likely include discussions on developing robust lubrication programs, including the selection of lubricants and the management of inventory, which would naturally involve considerations for lubricant equivalents. The focus is on practical implementation and long-term reliability.

9. Specialty Lubricants: Performance and Selection for Demanding Applications

Kluber is renowned for its specialty greases. This book would delve into the unique properties and applications of lubricants designed for extreme temperatures, pressures, or specific environments. It would likely provide detailed case studies and selection guides, highlighting the intricacies of choosing a specialty grease equivalent for high-performance needs.

Kluber Grease Equivalent Chart

Kluber Grease Equivalent Chart: Finding the Right Lubricant for Your Needs

Ebook Title: The Ultimate Guide to Kluber Grease Equivalents

Ebook Outline:

Introduction: The importance of proper lubrication and the challenges of finding suitable replacements. Understanding grease specifications and classifications.

Chapter 1: Understanding Kluber Grease Product Lines: Overview of Kluber's major grease families and their typical applications. Focus on key performance characteristics.

Chapter 2: Deciphering Grease Specifications: A detailed explanation of NLGI grades, base oil types (mineral, synthetic, etc.), and key performance parameters (dropping point, oxidation resistance, etc.).

Chapter 3: The Kluber Grease Equivalent Chart: A comprehensive, searchable chart matching Kluber greases to equivalents from other major manufacturers (e.g., Mobil, Shell, Castrol, SKF). Explanation of the chart's structure and how to use it effectively.

Chapter 4: Application-Specific Grease Selection: Practical examples of how to choose the right grease for various applications (high-temperature, food-grade, extreme pressure, etc.).

Chapter 5: Troubleshooting Lubrication Problems: Common lubrication issues and how to identify and resolve them using the equivalent chart.

Chapter 6: Safety and Handling of Greases: Important safety precautions and best practices for handling and disposing of lubricating greases.

Conclusion: Recap of key concepts and recommendations for future lubrication management.

The Ultimate Guide to Kluber Grease Equivalents

Introduction: The Crucial Role of Proper Lubrication

Proper lubrication is paramount for the efficient and reliable operation of machinery across various industries. From automotive components to industrial equipment, lubricants reduce friction, prevent wear, and extend the lifespan of critical parts. However, finding the right lubricant can be challenging, especially when dealing with specialized applications or needing to replace a specific brand. This guide focuses on Kluber lubricants, a renowned manufacturer of high-performance greases, and provides a comprehensive resource for finding suitable equivalents from other leading brands. Understanding grease specifications and classifications is crucial for making informed decisions. Improper lubrication can lead to premature component failure, costly downtime, and potential safety hazards. This ebook will equip you with the knowledge and tools to select the correct grease, ensuring optimal performance and longevity of your equipment.

Chapter 1: Understanding Kluber Grease Product Lines

Kluber Lubrication is known for its wide range of high-performance specialty greases tailored to diverse applications. Their product lines are often categorized based on base oil type (mineral, synthetic, or synthetic hydrocarbon), NLGI consistency grade, and performance characteristics. Understanding these categories is essential for navigating their extensive catalog and finding appropriate replacements.

Klüberplex: This line often features high-performance greases designed for demanding applications requiring excellent extreme pressure (EP) properties, high-temperature resistance, or resistance to water washout. They are frequently used in heavy-duty industrial machinery and automotive applications.

Klübersynth: This line focuses on synthetic greases offering superior performance compared to mineral oil-based counterparts. Synthetic base oils provide enhanced oxidation resistance, improved low-temperature performance, and extended service life. These are often preferred for applications with extreme operating conditions.

Klüberfood: This line consists of greases specifically formulated for use in food processing and pharmaceutical industries. These greases meet stringent regulatory requirements regarding food contact and ensure safety and hygiene.

Other Specialized Lines: Kluber offers numerous other specialized grease lines designed for specific applications, such as high-vacuum conditions, aerospace components, or rolling bearings operating at extremely high speeds.

Understanding the specific performance characteristics of each Kluber grease line – including operating temperature range, NLGI consistency, and chemical composition – is crucial for successful selection of an equivalent lubricant.

Chapter 2: Deciphering Grease Specifications

Before delving into the equivalent chart, it's critical to understand the technical specifications that define grease properties. This section will break down the key parameters:

NLGI Consistency Grade: This number (000, 00, 0, 1, 2, etc.) indicates the grease's hardness or consistency. Lower numbers represent softer, more fluid greases, while higher numbers represent stiffer, thicker greases. The choice depends on the application and bearing type.

Base Oil Type: This indicates the type of oil used in the grease formulation. Common types include mineral oil (refined from petroleum), synthetic oils (e.g., polyalphaolefins – PAOs, polyglycols – PGs), and synthetic hydrocarbon oils. Synthetic oils generally offer superior performance at extreme temperatures and longer service life.

Dropping Point: This is the temperature at which the grease starts to lose its consistency and drip. It's a crucial parameter for high-temperature applications.

Oxidation Resistance: This measures the grease's ability to resist degradation caused by exposure to oxygen and heat. Greases with high oxidation resistance have longer service lives.

Extreme Pressure (EP) Additives: These additives enhance the grease's ability to withstand high pressures and prevent wear in heavily loaded applications.

Water Resistance: This indicates the grease's resistance to washout or emulsification when exposed to water.

Chapter 3: The Kluber Grease Equivalent Chart

The core of this guide is the Kluber grease equivalent chart. This chart meticulously matches Kluber greases to comparable products from other major manufacturers. It's crucial to understand how to effectively use the chart:

Finding the Kluber Grease: Start by identifying the specific Kluber grease you need to replace. Note its full product code and specifications (NLGI grade, base oil type, etc.).

Locating the Equivalent: Use the chart's search function (if available in the digital version) or browse the table to find the corresponding Kluber grease. The chart will list several potential equivalent greases from different brands.

Comparing Specifications: Always verify the specifications of the proposed equivalent grease against the original Kluber grease to ensure compatibility. Minor discrepancies might be acceptable, but significant differences in NLGI grade, base oil type, or key performance parameters should raise concerns.

Considering Application: The final decision should always consider the specific application requirements. While the chart provides equivalents, the best choice may depend on the operating conditions, environmental factors, and load characteristics.

Chapter 4: Application-Specific Grease Selection

This chapter will provide practical examples of choosing the right grease for various applications:

High-Temperature Applications: For high-temperature applications (e.g., ovens, furnaces), greases with high dropping points and excellent oxidation resistance are essential. The chart can help identify equivalents with similar high-temperature performance characteristics.

Food-Grade Applications: For food processing equipment, only greases that meet stringent food safety regulations should be used. The chart will guide you to equivalent food-grade greases.

Extreme-Pressure Applications: Heavily loaded applications require greases with robust EP additives to prevent wear and scuffing. The chart can help find equivalents with sufficient EP properties.

Low-Temperature Applications: For low-temperature operation, greases with excellent low-temperature pumpability are required. Synthetic greases often provide superior performance in such conditions.

Chapter 5: Troubleshooting Lubrication Problems

This section addresses common lubrication issues and how to use the equivalent chart to resolve them:

Premature Bearing Failure: This might indicate insufficient lubrication or an improper grease selection. Consulting the chart can help identify a suitable replacement grease with better performance characteristics.

Excessive Wear: This can result from insufficient lubrication or the use of a grease not suitable for the load conditions. The equivalent chart aids in selecting a grease with appropriate EP properties.

Grease Leakage: This might be due to the use of an incompatible grease or incorrect application techniques. Selecting a grease with appropriate consistency (NLGI grade) and using appropriate application methods is critical.

Chapter 6: Safety and Handling of Greases

This chapter emphasizes the importance of safety precautions:

Personal Protective Equipment (PPE): Always wear appropriate PPE, including gloves, eye protection, and protective clothing when handling greases.

Proper Storage: Store greases in a cool, dry place away from direct sunlight and ignition sources.

Disposal: Dispose of used greases responsibly according to local regulations. Never pour used grease down drains or into the environment.

Conclusion: Optimizing Lubrication for Peak Performance

This guide provides a framework for selecting appropriate lubricating greases. Using the Klüber grease equivalent chart effectively and understanding grease specifications are crucial for optimizing equipment performance, extending service life, and minimizing downtime. Remember to always consult the manufacturer's recommendations and safety data sheets for detailed information on the specific greases used.

FAQs

1. What is an NLGI grade? The NLGI (National Lubricating Grease Institute) grade indicates the consistency or hardness of a grease.
2. What is the difference between mineral and synthetic greases? Synthetic greases generally offer superior performance at extreme temperatures and longer service life.
3. How do I find the right grease for high-temperature applications? Look for greases with high dropping points and excellent oxidation resistance.
4. What are EP additives? Extreme pressure (EP) additives enhance the grease's ability to withstand

high pressures and prevent wear.

5. How important is water resistance in a grease? Water resistance is critical in preventing grease washout and ensuring lubrication effectiveness in wet environments.

6. What should I do if I experience premature bearing failure? Review your lubrication practices, consider the suitability of the grease, and consult the equivalent chart for a potentially better alternative.

7. Can I use any grease equivalent I find? Always compare specifications carefully before using an equivalent to ensure compatibility.

8. Where can I find the safety data sheets (SDS) for greases? Safety data sheets are typically available on the manufacturer's website.

9. What are the environmental considerations for grease disposal? Dispose of used grease according to local regulations, often involving specialized waste disposal services.

Related Articles:

1. Selecting the Right Grease for Rolling Element Bearings: Discusses factors influencing grease selection for bearings, including load, speed, and temperature.

2. Understanding Grease Rheology and its Impact on Performance: Explores the flow characteristics of grease and their effect on lubrication effectiveness.

3. The Importance of Regular Lubrication Maintenance: Highlights the benefits of regular lubrication schedules and inspection for preventing equipment failures.

4. Common Lubrication Mistakes and How to Avoid Them: Identifies frequent errors in lubrication practices and suggests best practices.

5. A Guide to Synthetic Grease Technology: Explores the benefits of synthetic base oils in grease formulations and their applications.

6. Food-Grade Lubricants: Regulations and Compliance: Details the regulatory requirements for greases used in food processing.

7. High-Temperature Grease Selection for Industrial Applications: Focuses on choosing greases capable of withstanding extreme heat.

8. Extreme Pressure (EP) Greases: Understanding Their Role in Heavy-Duty Applications: Explains the functions and advantages of EP greases in demanding applications.

9. Environmental Considerations in Lubricant Selection and Disposal: Focuses on environmentally responsible choices in lubrication practices.

kluber grease equivalent chart: A User's Guide to Vacuum Technology John F. O'Hanlon, 2005-02-18 In the decade and a half since the publication of the Second Edition of A User's Guide to Vacuum Technology there have been many important advances in the field, including spinning rotor gauges, dry mechanical pumps, magnetically levitated turbo pumps, and ultraclean system designs. These, along with improved cleaning and assembly techniques have made contamination-free manufacturing a reality. Designed to bridge the gap in both knowledge and training between designers and end users of vacuum equipment, the Third Edition offers a practical perspective on today's vacuum technology. With a focus on the operation, understanding, and selection of equipment for industrial processes used in semiconductor, optics, packaging, and related coating technologies, A User's Guide to Vacuum Technology, Third Edition provides a detailed treatment of this important field. While emphasizing the fundamentals and touching on significant topics not adequately covered elsewhere, the text avoids topics not relevant to the typical user.

kluber grease equivalent chart: Bearing Design in Machinery Avraham Harnoy, 2002-09-25 Covering the fundamental principles of bearing selection, design, and tribology, this book discusses basic physical principles of bearing selection, lubrication, design computations, advanced bearings materials, arrangement, housing, and seals, as well as recent developments in bearings for high-speed aircraft engines. The author explores unique solutions to challenging design problems and presents rare case studies, such as hydrodynamic and rolling-element bearings in series and adjustable hydrostatic pads for large bearings. He focuses on the design considerations and calculations specific to hydrodynamic journal bearings, hydrostatic bearings, and rolling element bearings.

kluber grease equivalent chart: Encyclopedia of Lubricants and Lubrication Theo Mang, 2014-01-22 The importance of lubricants in virtually all fields of the engineering industry is reflected by an increasing scientific research of the basic principles. Energy efficiency and material saving are just two core objectives of the employment of high-tech lubricants. The encyclopedia presents a comprehensive overview of the current state of knowledge in the realm of lubrication. All the aspects of fundamental data, underlying concepts and use cases, as well as theoretical research and last but not least terminology are covered in hundreds of essays and definitions, authored by experts in their respective fields, from industry and academic institutes.

kluber grease equivalent chart: Scientific Foundations of Vacuum Technique Saul Dushman, 1966

kluber grease equivalent chart: Grease Lubrication in Rolling Bearings Piet M. Lugt, 2013-02-18 The definitive book on the science of grease lubrication for roller and needle bearings in industrial and vehicle engineering. Grease Lubrication in Rolling Bearings provides an overview of the existing knowledge on the various aspects of grease lubrication (including lubrication systems) and the state of the art models that exist today. The book reviews the physical and chemical aspects of grease lubrication, primarily directed towards lubrication of rolling bearings. The first part of the book covers grease composition, properties and rheology, including thermal and dynamics properties. Later chapters cover the dynamics of greased bearings, including grease life, bearing life, reliability and testing. The final chapter covers lubrications systems – the systems that deliver grease to the components requiring lubrication. Grease Lubrication in Rolling Bearings: Describes the underlying physical and chemical properties of grease. Discusses the effect of load, speed, temperature, bearing geometry, bearing materials and grease type on bearing wear. Covers both bearing and grease performance, including thermo-mechanical ageing and testing methodologies. It is intended for researchers and engineers in the petro-chemical and bearing industry, industries related to this (e.g. wind turbine industry, automotive industry) and for application engineers. It will also be of interest for teaching in post-graduate courses.

kluber grease equivalent chart: High Power Impulse Magnetron Sputtering Daniel Lundin, Tiberiu Minea, Jon Tomas Gudmundsson, 2019-08-30 High Power Impulse Magnetron Sputtering: Fundamentals, Technologies, Challenges and Applications is an in-depth introduction to HiPIMS that emphasizes how this novel sputtering technique differs from conventional magnetron processes in terms of both discharge physics and the resulting thin film characteristics. Ionization of sputtered atoms is discussed in detail for various target materials. In addition, the role of self-sputtering, secondary electron emission and the importance of controlling the process gas dynamics, both inert and reactive gases, are examined in detail with an aim to generate stable HiPIMS processes. Lastly, the book also looks at how to characterize the HiPIMS discharge, including essential diagnostic equipment. Experimental results and simulations based on industrially relevant material systems are used to illustrate mechanisms controlling nucleation kinetics, column formation and microstructure evolution.

kluber grease equivalent chart: Lightweight Electric/Hybrid Vehicle Design John Fenton, Ron Hodkinson, 2001-07-04 Lightweight Electric/Hybrid Vehicle Design covers the particular automotive design approach required for hybrid/electrical drive vehicles. There is currently huge investment world-wide in electric vehicle propulsion, driven by concern for pollution control and depleting oil

resources. The radically different design demands of these new vehicles requires a completely new approach that is covered comprehensively in this book. The book explores the rather dramatic departures in structural configuration necessary for purpose-designed electric vehicle including weight removal in the mechanical systems. It also provides a comprehensive review of the design process in the electric hybrid drive and energy storage systems. Ideal for automotive engineering students and professionals **Lightweight Electric/Hybrid Vehicle Design** provides a complete introduction to this important new sector of the industry. - Comprehensive coverage of all design aspects of electric/hybrid cars in a single volume - Packed with case studies and applications - In-depth treatment written in a text book style (rather than a theoretical specialist text style)

kluber grease equivalent chart: Fluorinated Polymers Bruno Ameduri, Hideo Sawada, 2016-11-04 Fluoropolymers display a wide range of remarkable properties and are used in a number of applications including high performance elastomers, thermoplastics, coatings for optical fibers, and hydrophobic and lipophobic surfaces. **Fluorinated Polymers: Applications** covers the recent developments in the uses of fluoropolymers. Examples include materials for energy applications such as fuel cell membranes, lithium ion batteries and photovoltaics, as well as high-tech areas such as aerospace and aeronautics, automotives, building industries, textile finishings and electronics. Written by internationally recognized academic and industrial contributors, the book will be of interest to those in industry and academia working in the fields of materials science, polymer chemistry and energy applications of polymers. Together with **Fluorinated Polymers: Synthesis, Properties, Processing and Simulation**, these books provide a complete overview of different fluorinated polymer materials and their uses.

kluber grease equivalent chart: Ball Bearing Lubrication Bernard J. Hamrock, D. Dowson, 1981

kluber grease equivalent chart: Total Pressure Measurements in Vacuum Technology A. Berman, 2014-06-28 **Total Pressure Measurements in Vacuum Technology** focuses on the measurement of low total pressure in hostile environments or in the presence of magnetic fields. This book emphasizes the general processes and problems involved in measurement techniques and physical principles on which vacuum gauges operate, rather than on the detailed description of the gauges. The design and techniques involved in the use of special instruments that determine pressure or gas density, such as pressure converters or radioactive gauges, are also described. This publication is mainly intended for graduate students and research scientists who have a good general background in physics and engineering.

kluber grease equivalent chart: Design for Environmental Sustainability Carlo Arnaldo Vezzoli, Ezio Manzini, 2008-06-17 This volume is a technical and operative contribution to the United Nations Decade on Education for Sustainable Development (2005-2014), aiding the development of a new generation of designers, responsible and able in the task of designing environmentally sustainable products. The book provides a comprehensive framework and a practical tool to support the design process. This is an important text for those interested in the product development processes.

kluber grease equivalent chart: Plastics for Corrosion Inhibition V.A. Goldade, L.S. Pinchuk, A.V. Makarevich, V.N. Kestelman, 2006-03-30 One of the key problems of failure-free operation of machinery is prevention of corrosion. The global scale of modern production makes this problem even more critical. At the beginning of the 21st century industrial contamination and the corrosion-active nature of the environment reached a level such that corrosive damage of materials became commensurate with their production volume and expenditure on anticorrosion protection of machines became comparable with investments in basic production. Anticorrosion techniques changed from being an auxiliary service to industrial enterprises into a developing, scientifically intensive and generously financed branch of production. Polymers occupy a very specific place amongst anticorrosion techniques. Polymers combine good chemical resistance with impermeability to different media and unusual deformation characteristics. The main principle of their application as anticorrosion means is the creation of a tight barrier that insulates metal machine parts or

constructions from corrosion agents. The advantages of polymers allow the creation of such a barrier at minimal cost, providing protection of the working machines from corrosion, combining their manufacture with preservation and decreasing the cost of anticorrosion. This is one of the main reasons why world production of polymer materials increased by almost 50% in the past decade.

kluber grease equivalent chart: Developing Social Equity in Australian Adult Education

Pamela Osmond, 2021-03-07 *Developing Social Equity in Australian Adult Education: Lessons from the Past* presents a case study of the trajectory of an Australian adult basic education program in New South Wales from its humanist, social justice beginnings, through forty years of destabilising change. It identifies the influences and influencers that have directed this change; those that were responsible for the creation of the field in its foundation years, and that were displaced by other, more powerful actors representing the global influence of the neoliberal ideology. The story is told largely through archival evidence and the voices of those practitioners who helped shape the discourse and practice of the foundation years, and who were required to respond to constantly changing policies and socio-economic contexts. It discusses some lessons that might be learnt from the past in order that a new set of actors might be mobilised to promote an alternate discourse. This book will appeal to students and scholars of social justice and adult education, and practitioners involved in adult education.

kluber grease equivalent chart: Ionized Physical Vapor Deposition, 1999-10-14

This volume provides the first comprehensive look at a pivotal new technology in integrated circuit fabrication. For some time researchers have sought alternate processes for interconnecting the millions of transistors on each chip because conventional physical vapor deposition can no longer meet the specifications of today's complex integrated circuits. Out of this research, ionized physical vapor deposition has emerged as a premier technology for the deposition of thin metal films that form the dense interconnect wiring on state-of-the-art microprocessors and memory chips. For the first time, the most recent developments in thin film deposition using ionized physical vapor deposition (I-PVD) are presented in a single coherent source. Readers will find detailed descriptions of relevant plasma source technology, specific deposition systems, and process recipes. The tools and processes covered include DC hollow cathode magnetrons, RF inductively coupled plasmas, and microwave plasmas that are used for depositing technologically important materials such as copper, tantalum, titanium, TiN, and aluminum. In addition, this volume describes the important physical processes that occur in I-PVD in a simple and concise way. The physical descriptions are followed by experimentally-verified numerical models that provide in-depth insight into the design and operation of I-PVD tools. Practicing process engineers, research and development scientists, and students will find that this book's integration of tool design, process development, and fundamental physical models make it an indispensable reference. **Key Features:** The first comprehensive volume on ionized physical vapor deposition. Combines tool design, process development, and fundamental physical understanding to form a complete picture of I-PVD. Emphasizes practical applications in the area of IC fabrication and interconnect technology. Serves as a guide to select the most appropriate technology for any deposition application. *This single source saves time and effort by including comprehensive information at one's finger tips. *The integration of tool design, process development, and fundamental physics allows the reader to quickly understand all of the issues important to I-PVD. *The numerous practical applications assist the working engineer to select and refine thin film processes.

kluber grease equivalent chart: Refractory Technology Ritwik Sarkar, 2023-08-11

This book explains the refractories from different fundamental aspects, even with the support of phase diagrams, and also details the prominent applications of these industrial materials. The initial chapters cover fundamentals of refractories, classifications, properties, and testing, while later chapters describe different common shaped and unshaped refractories in detail and special refractories in a concise manner. The second edition includes new classifications, microstructures, the effect of impurities with binary and ternary phase diagrams, and recent trends in refractories including homework problems and an updated bibliography. **Features:** Provides exclusive material

on refractories Discusses detailed descriptions of different shaped and unshaped refractories Covers concepts like environmental issues, recycling, and nanotechnology Explores details on testing and specifications including thermochemical and corrosion behavior Includes a separate chapter on trends of refractories and other issues This book is aimed at junior/senior undergraduate students and researchers of ceramics, metallurgical engineering, and refractories.

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