

grease equivalent chart pdf

Grease Equivalent Chart PDF: An Essential Resource for Foodservice Professionals

Grease equivalent chart PDF is an invaluable tool for chefs, restaurant owners, kitchen managers, and foodservice professionals. It provides critical information about the fat content and calorie equivalencies of various cooking fats, oils, and grease substitutes. This comprehensive chart simplifies decision-making processes related to menu planning, cost management, and nutritional labeling, ensuring compliance with health regulations and optimizing kitchen operations.

In the foodservice industry, managing grease and fat content is vital for maintaining equipment efficiency, ensuring food quality, and complying with safety standards. A grease equivalent chart PDF consolidates complex data into an easy-to-understand format, helping professionals make informed choices about ingredients and cooking methods. Whether you're preparing a detailed nutritional analysis, considering alternative fats, or ensuring regulatory compliance, having access to a reliable grease equivalent chart in PDF format is essential.

Understanding the Concept of Grease Equivalence

What Is a Grease Equivalent?

A grease equivalent refers to the amount of fat or oil that produces the same caloric or functional effect as a specific amount of another fat or oil. For example, substituting butter with margarine or vegetable oil may require understanding their respective grease equivalents to maintain consistency in cooking and nutrition.

Why Is Grease Equivalence Important?

- **Cost Management:** Helps in selecting cost-effective ingredients without compromising quality.
- **Nutritional Accuracy:** Ensures accurate calorie and fat content calculations for menu labeling and dietary planning.
- **Kitchen Efficiency:** Guides accurate substitutions, reducing waste and

improving workflow.

- **Regulatory Compliance:** Assists in meeting health and safety standards by maintaining consistent fat content in prepared foods.

Key Components of a Grease Equivalent Chart PDF

Common Fats and Oils Included

A comprehensive grease equivalent chart typically includes data for various fats and oils, such as:

- Butter and Margarine
- Vegetable Oils (Canola, Soybean, Corn, Olive, etc.)
- Lard and Tallow
- Shortening
- Nut butters and seed oils
- Specialty fats (palm oil, coconut oil)

Measurement Units and Conversion Factors

Effective charts specify measurements in units like grams, ounces, cups, and tablespoons, along with conversion factors for quick reference. These facilitate seamless substitutions and calculations during food preparation.

Caloric and Fat Content Data

Charts often provide caloric values per unit, along with fat content percentages. This data supports nutritional analysis and menu labeling compliance.

Functional Equivalents

Apart from caloric equivalence, some charts include functional equivalents, such as melting points, smoke points, and emulsification properties, which influence cooking techniques and outcomes.

How to Use a Grease Equivalent Chart PDF Effectively

Step-by-step Guide

1. **Identify the ingredient you want to substitute:** For example, replacing butter with oil.
2. **Locate the original ingredient on the chart:** Find its typical measurement and caloric content.
3. **Find the substitute:** Use the chart to determine the amount of alternative fat needed to match the original's grease or calorie content.
4. **Adjust recipe quantities:** Modify your recipe accordingly, considering flavor and cooking properties.
5. **Document and verify:** Record the changes for nutritional analysis and quality control.

Practical Applications

- **Menu Development:** Create healthier options by substituting high-fat ingredients with lower-fat alternatives while maintaining flavor and texture.
- **Cost Optimization:** Choose more economical fats that provide the same functional and caloric effect.
- **Nutrition Labeling:** Ensure accurate reporting of fat and calorie content on menus and packaging.
- **Equipment Maintenance:** Manage grease buildup by understanding the fat content of used oils, preventing clogging and fire hazards.

Benefits of Using a PDF Format for the Grease Equivalent Chart

Accessibility and Portability

PDF files are compatible across devices and platforms, making it easy for kitchen staff to access the chart on smartphones, tablets, or computers anywhere in the kitchen or office.

Ease of Sharing and Updating

Distributing updates or new versions of the chart is simple via email or cloud storage, ensuring everyone has the latest data.

High-Quality Presentation

PDFs retain formatting, graphics, and clarity, which enhances readability and reduces misinterpretation of data.

Where to Find or Create a Reliable Grease Equivalent Chart PDF

Sources for Pre-made Charts

- Industry Associations and Regulatory Agencies (FDA, USDA)
- Foodservice Equipment and Supply Companies
- Nutrition and Culinary Websites
- Professional Cookbooks and Foodservice Manuals

Creating a Custom Chart

If existing charts don't meet your specific needs, consider creating a custom grease equivalent chart using reputable nutritional databases and culinary resources. Use software like Adobe Acrobat, Microsoft Word, or Excel to compile data, then export as PDF for distribution.

Best Practices for Maintaining and Updating

Your Grease Equivalent Chart PDF

- **Regular Review:** Keep the chart updated with new fats, oils, or formulations available in the market.
- **Consult Experts:** Collaborate with dietitians or food scientists for accuracy.
- **Verify Data Sources:** Use reputable nutritional databases and scientific literature.
- **Incorporate Feedback:** Gather input from kitchen staff and adjust the chart for clarity and usability.

Conclusion

A **grease equivalent chart PDF** is more than just a reference document; it is a strategic tool that enhances efficiency, accuracy, and compliance within foodservice operations. By understanding the concept of grease equivalents and utilizing detailed charts, professionals can optimize recipes, control costs, and ensure nutritional transparency. Whether you are developing new menu items, managing kitchen waste, or adhering to regulatory standards, having a reliable, accessible, and up-to-date grease equivalent chart in PDF format is essential for success in the culinary industry.

Frequently Asked Questions

What is a grease equivalent chart PDF and how is it used?

A grease equivalent chart PDF is a digital document that provides conversion ratios between different types or brands of lubricating greases, helping engineers and technicians select suitable substitutes or equivalents in various applications.

Where can I find a reliable grease equivalent chart PDF online?

Reliable grease equivalent chart PDFs can be found on manufacturer websites, industry association resources, and engineering reference platforms. Always ensure the source is reputable to guarantee accurate information.

How do I interpret the data in a grease equivalent chart PDF?

The chart typically lists different grease types alongside their properties such as base oil type, consistency, drop point, and NLGI grade, along with equivalent values or substitution ratios to help identify suitable replacements.

Why is it important to use a grease equivalent chart PDF in maintenance?

Using a grease equivalent chart ensures compatibility and performance when replacing or mixing greases, preventing equipment failure, reducing downtime, and maintaining optimal lubrication conditions.

Can a grease equivalent chart PDF help in cross-referencing international grease standards?

Yes, many grease equivalent charts include international standards and classifications, making it easier to find equivalents across different regions and comply with local regulations.

Are there any limitations to relying solely on a grease equivalent chart PDF?

Yes, while helpful, grease equivalent charts should be used alongside manufacturer specifications and expert advice, as differences in formulation, additive packages, and operating conditions can affect performance despite similar classifications.

Additional Resources

Grease Equivalent Chart PDF: An In-Depth Analysis of Its Significance, Usage, and Reliability

In the realm of mechanical engineering, food service, and industrial maintenance, understanding the properties and compatibilities of various lubricants is paramount. One of the critical tools employed by professionals is the grease equivalent chart PDF, a digital resource that facilitates quick reference and comparison of different grease types, their properties, and their suitability for specific applications. This comprehensive review explores the origins, structure, applications, and reliability of grease equivalent charts in PDF format, providing insights into their significance for engineers, technicians, and industry practitioners.

Understanding the Concept of Grease Equivalence

What Is a Grease Equivalent Chart?

A grease equivalent chart is a visual or tabular representation designed to compare different types of greases based on key parameters such as consistency, dropping point, base oil type, soap type, and performance characteristics. These charts serve as quick-reference tools for selecting compatible or interchangeable greases, especially when the original product is unavailable or when assessing alternative lubricants for maintenance or repair.

When presented in PDF format, these charts become portable, easily shareable resources that can be integrated into technical documentation, training materials, or maintenance manuals.

The Importance of Accurate Comparisons

Choosing the right grease is crucial for ensuring machinery longevity, optimal performance, and safety. An incorrect lubricant choice can lead to increased wear, overheating, or failure. Therefore, establishing reliable equivalency between different grease formulations helps maintain operational integrity, especially in environments where specific lubricants are mandated by manufacturer specifications or regulatory standards.

The Structure and Content of a Typical Grease Equivalent Chart PDF

Key Parameters Included

Most grease equivalency charts in PDF format encompass the following core parameters:

- Performance Grade or Consistency (NLGI Grade): Indicates the hardness or softness of the grease.
- Base Oil Type: Mineral, synthetic, biodegradable, or specialty oils.
- Soap or Thickener Type: Lithium, calcium, aluminum, polyurea, etc.
- Dropping Point: Temperature at which the grease becomes fluid.
- Operational Temperature Range: Suitable temperature limits.

- Water Resistance and Corrosion Protection: Performance under wet conditions.
- Compatibility: Whether different greases can be mixed safely.

These parameters collectively inform users about the suitability and interchangeability of different grease products.

Organizational Formats

The charts may be organized in various formats, including:

- Tabular Layouts: Side-by-side comparison of properties.
- Flowcharts: Stepwise decision-making guides.
- Color-Coded Charts: Visual cues for quick identification.
- Annotated Diagrams: Illustrative aids showing grease structure or application zones.

The PDF format allows these various formats to be compiled into an accessible, portable document that can be printed or viewed digitally.

Sources and Reliability of Grease Equivalent Charts PDF

Official Manufacturer Resources

Major lubricant manufacturers often publish official equivalency charts to assist their customers and distributors. These charts are typically based on rigorous testing and industry standards, ensuring high reliability. Examples include brands like Mobil, Shell, Chevron, and Castrol, which provide downloadable PDFs aligned with their product lines.

Industry Standards and Regulatory Bodies

Organizations such as the National Lubricating Grease Institute (NLGI), ASTM International, and ISO develop standards that underpin the data in these charts. When a PDF chart references these standards, its validity is generally considered high.

Third-Party and Educational Resources

Various technical training providers, industry journals, and engineering universities produce their own grease equivalency charts. While these can be valuable, users should verify the data's source and cross-reference with official manufacturer or standards documentation for critical applications.

Potential Pitfalls and Limitations

Despite their usefulness, grease equivalent charts in PDF format can have limitations:

- Outdated Data: Lubricant formulations evolve; charts must be regularly updated.
- Generic Assumptions: They may not account for specific application nuances.
- Variability Between Brands: Similar NLGI grades or soap types may behave differently depending on additives.
- Lack of Context: Charts provide a snapshot but may omit operational considerations like load conditions or environmental factors.

Therefore, while a PDF chart is a handy reference, it should be used in conjunction with manufacturer data sheets and engineering judgment.

Applications of Grease Equivalent Charts PDF in Industry

Maintenance and Repair Operations

Technicians often rely on these charts when replacing or supplementing lubricants, especially in field conditions where the original product is unavailable. Quick access to an equivalency PDF can prevent delays and ensure machinery continues to operate within specified parameters.

Procurement and Inventory Management

Procurement teams utilize these charts to identify acceptable alternative products, optimize inventory, and reduce costs by substituting higher-priced greases with suitable equivalents without compromising performance.

Training and Education

Technical training programs incorporate grease equivalency charts in PDF form to educate new engineers and maintenance personnel about lubricant properties, compatibility, and selection criteria.

Design and Engineering

Engineers designing machinery or specifying lubricants for new systems consult these charts to determine the range of compatible greases, facilitating flexibility in sourcing and ensuring design robustness.

Best Practices for Using Grease Equivalent Chart PDFs

- Verify the Source: Always use charts from reputable manufacturers or standards organizations.
- Cross-Check Data: Confirm equivalency with official product datasheets.
- Consider Operating Conditions: Ensure the substitute grease meets temperature, load, and environmental requirements.
- Update Regularly: Use the latest version of the chart to incorporate recent formulations or standards.
- Perform Practical Testing: When in doubt, conduct trial runs to confirm compatibility and performance.

The Future of Grease Equivalence Resources

As technology advances, digital tools are increasingly integrating grease equivalency functionalities into maintenance management systems, mobile apps, and AI-driven diagnostics. PDF charts remain a foundational resource, often serving as the basis for more sophisticated tools.

Moreover, evolving standards and the emergence of new lubricant chemistries necessitate regularly updated PDFs and online repositories. The integration of these resources into digital asset management platforms can streamline lubricant selection processes, reduce errors, and enhance operational efficiency.

Conclusion

The grease equivalent chart PDF is an invaluable resource for ensuring the correct selection and substitution of lubricants across various industries. Its structured presentation of key parameters, portability, and ease of access make it an essential tool for maintenance personnel, engineers, and procurement specialists alike. However, users must exercise due diligence by verifying data sources, understanding the limitations, and considering operational conditions to maximize the benefits of these charts.

As the industry continues to innovate, the role of comprehensive, accurate, and up-to-date grease equivalency resources—whether in PDF format or integrated digital systems—will remain vital in maintaining machinery efficiency, safety, and longevity. Proper utilization of these resources not only reduces downtime and costs but also promotes best practices in lubrication management worldwide.

[Grease Equivalent Chart Pdf](#)

grease equivalent chart pdf: *Betty Crocker Cookbook* Betty Crocker, 2007-10-19 This special heart edition is packed with information to help you be good to your heart. It features over 1 000 classic and contemporary recipes, more than 300 colour photos, clear instructions and helpful tips. Achieve ultimate wellbeing by adopting a heart healthy lifestyle.

grease equivalent chart pdf: *California Cultivator* , 1911

grease equivalent chart pdf: *Practical Solar Tracking Automatic Solar Tracking Sun Tracking Автоматическое удержание Солнечная слежения ВС* Gerro Prinsloo, Robert Dobson, 2015-11-01 This book details Practical Solar Energy Harvesting, Automatic Solar-Tracking, Sun-Tracking-Systems, Solar-Trackers and Sun Tracker Systems using motorized automatic positioning concepts and control principles. An intelligent automatic solar tracker is a device that orients a payload toward the sun. Such programmable computer based solar tracking device includes principles of solar tracking, solar tracking systems, as well as microcontroller, microprocessor and/or PC based solar tracking control to orientate solar reflectors, solar lenses, photovoltaic panels or other optical configurations towards the sun. Motorized space frames and kinematic systems ensure motion dynamics and employ drive technology and gearing principles to steer optical configurations such as mangin, parabolic, conic, or cassegrain solar energy collectors to face the sun and follow the sun movement contour continuously. In general, the book may benefit solar research and solar energy applications in countries such as Africa, Mediterranean, Italy, Spain, Greece, USA, Mexico, South America, Brazilia, Argentina, Chili, India, Malaysia, Middle East, UAE, Russia, Japan and China. This book on practical automatic Solar-Tracking Sun-Tracking is in .PDF format and can easily be converted to the .EPUB .MOBI .AZW .ePub .FB2 .LIT .LRF .MOBI .PDB .PDF .TCR formats for smartphones and Kindle by using the ebook.online-convert.com facility. The content of the book is also applicable to communication antenna satellite tracking and moon tracking algorithm source code for which links to free download links are provided. In harnessing power from the sun through a solar tracker or practical solar tracking system, renewable energy control automation systems require automatic solar tracking software and solar position algorithms to accomplish dynamic motion control with control automation architecture, circuit boards and hardware. On-axis sun tracking system such as the altitude-azimuth dual axis or multi-axis solar

tracker systems use a sun tracking algorithm or ray tracing sensors or software to ensure the sun's passage through the sky is traced with high precision in automated solar tracker applications, right through summer solstice, solar equinox and winter solstice. A high precision sun position calculator or sun position algorithm is this an important step in the design and construction of an automatic solar tracking system. From sun tracing software perspective, the sonnet Tracing The Sun has a literal meaning. Within the context of sun track and trace, this book explains that the sun's daily path across the sky is directed by relatively simple principles, and if grasped/understood, then it is relatively easy to trace the sun with sun following software. Sun position computer software for tracing the sun are available as open source code, sources that is listed in this book. Ironically there was even a system called sun chaser, said to have been a solar positioner system known for chasing the sun throughout the day. Using solar equations in an electronic circuit for automatic solar tracking is quite simple, even if you are a novice, but mathematical solar equations are over complicated by academic experts and professors in text-books, journal articles and internet websites. In terms of solar hobbies, scholars, students and Hobbyist's looking at solar tracking electronics or PC programs for solar tracking are usually overcome by the sheer volume of scientific material and internet resources, which leaves many developers in frustration when search for simple experimental solar tracking source-code for their on-axis sun-tracking systems. This booklet will simplify the search for the mystical sun tracking formulas for your sun tracker innovation and help you develop your own autonomous solar tracking controller. By directing the solar collector directly into the sun, a solar harvesting means or device can harness sunlight or thermal heat. This is achieved with the help of sun angle formulas, solar angle formulas or solar tracking procedures for the calculation of sun's position in the sky. Automatic sun tracking system software includes algorithms for solar altitude azimuth angle calculations required in following the sun across the sky. In using the longitude, latitude GPS coordinates of the solar tracker location, these sun tracking software tools supports precision solar tracking by determining the solar altitude-azimuth coordinates for the sun trajectory in altitude-azimuth tracking at the tracker location, using certain sun angle formulas in sun vector calculations. Instead of follow the sun software, a sun tracking sensor such as a sun sensor or webcam or video camera with vision based sun following image processing software can also be used to determine the position of the sun optically. Such optical feedback devices are often used in solar panel tracking systems and dish tracking systems. Dynamic sun tracing is also used in solar surveying, DNI analyser and sun surveying systems that build solar infographics maps with solar radiance, irradiance and DNI models for GIS (geographical information system). In this way geospatial methods on solar/environment interaction makes use use of geospatial technologies (GIS, Remote Sensing, and Cartography). Climatic data and weather station or weather center data, as well as queries from sky servers and solar resource database systems (i.e. on DB2, Sybase, Oracle, SQL, MySQL) may also be associated with solar GIS maps. In such solar resource modelling systems, a pyranometer or solarimeter is normally used in addition to measure direct and indirect, scattered, dispersed, reflective radiation for a particular geographical location. Sunlight analysis is important in flash photography where photographic lighting are important for photographers. GIS systems are used by architects who add sun shadow applets to study architectural shading or sun shadow analysis, solar flux calculations, optical modelling or to perform weather modelling. Such systems often employ a computer operated telescope type mechanism with ray tracing program software as a solar navigator or sun tracer that determines the solar position and intensity. The purpose of this booklet is to assist developers to track and trace suitable source-code and solar tracking algorithms for their application, whether a hobbyist, scientist, technician or engineer. Many open-source sun following and tracking algorithms and source-code for solar tracking programs and modules are freely available to download on the internet today. Certain proprietary solar tracker kits and solar tracking controllers include a software development kit SDK for its application programming interface API attributes (Pebble). Widget libraries, widget toolkits, GUI toolkit and UX libraries with graphical control elements are also available to construct the graphical user interface (GUI) for your solar tracking or solar power monitoring program. The solar

library used by solar position calculators, solar simulation software and solar contour calculators include machine program code for the solar hardware controller which are software programmed into Micro-controllers, Programmable Logic Controllers PLC, programmable gate arrays, Arduino processor or PIC processor. PC based solar tracking is also high in demand using C++, Visual Basic VB, as well as MS Windows, Linux and Apple Mac based operating systems for sun path tables on Matlab, Excel. Some books and internet webpages use other terms, such as: sun angle calculator, sun position calculator or solar angle calculator. As said, such software code calculate the solar azimuth angle, solar altitude angle, solar elevation angle or the solar Zenith angle (Zenith solar angle is simply referenced from vertical plane, the mirror of the elevation angle measured from the horizontal or ground plane level). Similar software code is also used in solar calculator apps or the solar power calculator apps for IOS and Android smartphone devices. Most of these smartphone solar mobile apps show the sun path and sun-angles for any location and date over a 24 hour period. Some smartphones include augmented reality features in which you can physically see and look at the solar path through your cell phone camera or mobile phone camera at your phone's specific GPS location. In the computer programming and digital signal processing (DSP) environment, (free/open source) program code are available for VB, .Net, Delphi, Python, C, C+, C++, PHP, Swift, ADM, F, Flash, Basic, QBasic, GBasic, KBasic, SIMPL language, Squirrel, Solaris, Assembly language on operating systems such as MS Windows, Apple Mac, DOS or Linux OS. Software algorithms predicting position of the sun in the sky are commonly available as graphical programming platforms such as Matlab (Mathworks), Simulink models, Java applets, TRNSYS simulations, Scada system apps, Labview module, Beckhoff TwinCAT (Visual Studio), Siemens SPA, mobile and iphone apps, Android or iOS tablet apps, and so forth. At the same time, PLC software code for a range of sun tracking automation technology can follow the profile of sun in sky for Siemens, HP, Panasonic, ABB, Allan Bradley, OMRON, SEW, Festo, Beckhoff, Rockwell, Schneider, Endress Hauser, Fuji electric, Honeywell, Fuchs, Yokonawa, or Muthibishi platforms. Sun path projection software are also available for a range of modular IPC embedded PC motherboards, Industrial PC, PLC (Programmable Logic Controller) and PAC (Programmable Automation Controller) such as the Siemens S7-1200 or Siemens Logo, Beckhoff IPC or CX series, OMRON PLC, Ercam PLC, AC500plc ABB, National Instruments NI PXI or NI cRIO, PIC processor, Intel 8051/8085, IBM (Cell, Power, Brain or Truenorth series), FPGA (Xilinx Altera Nios), Intel, Xeon, Atmel megaAVR, MPU, Maple, Teensy, MSP, XMOS, Xbee, ARM, Raspberry Pi, Eagle, Arduino or Arduino AtMega microcontroller, with servo motor, stepper motor, direct current DC pulse width modulation PWM (current driver) or alternating current AC SPS or IPC variable frequency drives VFD motor drives (also termed adjustable-frequency drive, variable-speed drive, AC drive, micro drive or inverter drive) for electrical, mechatronic, pneumatic, or hydraulic solar tracking actuators. The above motion control and robot control systems include analogue or digital interfacing ports on the processors to allow for tracker angle orientation feedback control through one or a combination of angle sensor or angle encoder, shaft encoder, precision encoder, optical encoder, magnetic encoder, direction encoder, rotational encoder, chip encoder, tilt sensor, inclination sensor, or pitch sensor. Note that the tracker's elevation or zenith axis angle may measured using an altitude angle-, declination angle-, inclination angle-, pitch angle-, or vertical angle-, zenith angle- sensor or inclinometer. Similarly the tracker's azimuth axis angle be measured with a azimuth angle-, horizontal angle-, or roll angle-sensor. Chip integrated accelerometer magnetometer gyroscope type angle sensors can also be used to calculate displacement. Other options include the use of thermal imaging systems such as a Fluke thermal imager, or robotic or vision based solar tracker systems that employ face tracking, head tracking, hand tracking, eye tracking and car tracking principles in solar tracking. With unattended decentralised rural, island, isolated, or autonomous off-grid power installations, remote control, monitoring, data acquisition, digital datalogging and online measurement and verification equipment becomes crucial. It assists the operator with supervisory control to monitor the efficiency of remote renewable energy resources and systems and provide valuable web-based feedback in terms of CO₂ and clean development mechanism (CDM) reporting. A power quality analyser for diagnostics

through internet, WiFi and cellular mobile links is most valuable in frontline troubleshooting and predictive maintenance, where quick diagnostic analysis is required to detect and prevent power quality issues. Solar tracker applications cover a wide spectrum of solar applications and solar assisted application, including concentrated solar power generation, solar desalination, solar water purification, solar steam generation, solar electricity generation, solar industrial process heat, solar thermal heat storage, solar food dryers, solar water pumping, hydrogen production from methane or producing hydrogen and oxygen from water (HHO) through electrolysis. Many patented or non-patented solar apparatus include tracking in solar apparatus for solar electric generator, solar desalinator, solar steam engine, solar ice maker, solar water purifier, solar cooling, solar refrigeration, USB solar charger, solar phone charging, portable solar charging tracker, solar coffee brewing, solar cooking or solar drying means. Your project may be the next breakthrough or patent, but your invention is held back by frustration in search for the sun tracker you require for your solar powered appliance, solar generator, solar tracker robot, solar freezer, solar cooker, solar drier, solar pump, solar freezer, or solar dryer project. Whether your solar electronic circuit diagram include a simplified solar controller design in a solar electricity project, solar power kit, solar hobby kit, solar steam generator, solar hot water system, solar ice maker, solar desalinator, hobbyist solar panels, hobby robot, or if you are developing professional or hobby electronics for a solar utility or micro scale solar powerplant for your own solar farm or solar farming, this publication may help accelerate the development of your solar tracking innovation. Lately, solar polygeneration, solar trigeneration (solar triple generation), and solar quad generation (adding delivery of steam, liquid/gaseous fuel, or capture food-grade CO₂) systems have need for automatic solar tracking. These systems are known for significant efficiency increases in energy yield as a result of the integration and re-use of waste or residual heat and are suitable for compact packaged micro solar powerplants that could be manufactured and transported in kit-form and operate on a plug-and play basis. Typical hybrid solar power systems include compact or packaged solar micro combined heat and power (CHP or mCHP) or solar micro combined, cooling, heating and power (CCHP, CHPC, mCCHP, or mCHPC) systems used in distributed power generation. These systems are often combined in concentrated solar CSP and CPV smart microgrid configurations for off-grid rural, island or isolated microgrid, minigrid and distributed power renewable energy systems. Solar tracking algorithms are also used in modelling of trigeneration systems using Matlab Simulink (Modelica or TRNSYS) platform as well as in automation and control of renewable energy systems through intelligent parsing, multi-objective, adaptive learning control and control optimization strategies. Solar tracking algorithms also find application in developing solar models for country or location specific solar studies, for example in terms of measuring or analysis of the fluctuations of the solar radiation (i.e. direct and diffuse radiation) in a particular area. Solar DNI, solar irradiance and atmospheric information and models can thus be integrated into a solar map, solar atlas or geographical information systems (GIS). Such models allows for defining local parameters for specific regions that may be valuable in terms of the evaluation of different solar in photovoltaic or CSP systems on simulation and synthesis platforms such as Matlab and Simulink or in linear or multi-objective optimization algorithm platforms such as COMPOSE, EnergyPLAN or DER-CAM. A dual-axis solar tracker and single-axis solar tracker may use a sun tracker program or sun tracker algorithm to position a solar dish, solar panel array, heliostat array, PV panel, solar antenna or infrared solar nan antenna. A self-tracking solar concentrator performs automatic solar tracking by computing the solar vector. Solar position algorithms (TwinCAT, SPA, or PSA Algorithms) use an astronomical algorithm to calculate the position of the sun. It uses astronomical software algorithms and equations for solar tracking in the calculation of sun's position in the sky for each location on the earth at any time of day. Like an optical solar telescope, the solar position algorithm pin-points the solar reflector at the sun and locks onto the sun's position to track the sun across the sky as the sun progresses throughout the day. Optical sensors such as photodiodes, light-dependant-resistors (LDR) or photoresistors are used as optical accuracy feedback devices. Lately we also included a section in the book (with links to microprocessor code) on how the PixArt Wii infrared camera in the Wii remote or Wiimote may be

used in infrared solar tracking applications. In order to harvest free energy from the sun, some automatic solar positioning systems use an optical means to direct the solar tracking device. These solar tracking strategies use optical tracking techniques, such as a sun sensor means, to direct sun rays onto a silicon or CMOS substrate to determine the X and Y coordinates of the sun's position. In a solar mems sun-sensor device, incident sunlight enters the sun sensor through a small pin-hole in a mask plate where light is exposed to a silicon substrate. In a web-camera or camera image processing sun tracking and sun following means, object tracking software performs multi object tracking or moving object tracking methods. In an solar object tracking technique, image processing software performs mathematical processing to box the outline of the apparent solar disc or sun blob within the captured image frame, while sun-localization is performed with an edge detection algorithm to determine the solar vector coordinates. An automated positioning system help maximize the yields of solar power plants through solar tracking control to harness sun's energy. In such renewable energy systems, the solar panel positioning system uses a sun tracking techniques and a solar angle calculator in positioning PV panels in photovoltaic systems and concentrated photovoltaic CPV systems. Automatic on-axis solar tracking in a PV solar tracking system can be dual-axis sun tracking or single-axis sun solar tracking. It is known that a motorized positioning system in a photovoltaic panel tracker increase energy yield and ensures increased power output, even in a single axis solar tracking configuration. Other applications such as robotic solar tracker or robotic solar tracking system uses robotica with artificial intelligence in the control optimization of energy yield in solar harvesting through a robotic tracking system. Automatic positioning systems in solar tracking designs are also used in other free energy generators, such as concentrated solar thermal power CSP and dish Stirling systems. The sun tracking device in a solar collector in a solar concentrator or solar collector Such a performs on-axis solar tracking, a dual axis solar tracker assists to harness energy from the sun through an optical solar collector, which can be a parabolic mirror, parabolic reflector, Fresnel lens or mirror array/matrix. A parabolic dish or reflector is dynamically steered using a transmission system or solar tracking slew drive mean. In steering the dish to face the sun, the power dish actuator and actuation means in a parabolic dish system optically focusses the sun's energy on the focal point of a parabolic dish or solar concentrating means. A Stirling engine, solar heat pipe, thermosyphin, solar phase change material PCM receiver, or a fibre optic sunlight receiver means is located at the focal point of the solar concentrator. The dish Stirling engine configuration is referred to as a dish Stirling system or Stirling power generation system. Hybrid solar power systems (used in combination with biogas, biofuel, petrol, ethanol, diesel, natural gas or PNG) use a combination of power sources to harness and store solar energy in a storage medium. Any multitude of energy sources can be combined through the use of controllers and the energy stored in batteries, phase change material, thermal heat storage, and in cogeneration form converted to the required power using thermodynamic cycles (organic Rankin, Brayton cycle, micro turbine, Stirling) with an inverter and charge controller. В этой книге подробно Автоматическая Solar-Tracking, BC-Tracking-Systems, Solar-трекеры и BC Tracker Systems. Интеллектуальный автоматический солнечной слежения является устройством, которое ориентирует полезную нагрузку к солнцу. Такое программируемый компьютер на основе солнечной устройство слежения включает принципы солнечной слежения, солнечных систем слежения, а также микроконтроллер, микропроцессор и / или ПК на базе управления солнечной отслеживания ориентироваться солнечных отражателей, солнечные линзы, фотоэлектрические панели или другие оптические конфигурации к BC Моторизованные космические кадры и кинематические системы обеспечения динамики движения и использовать приводной техники и готовится принципы, чтобы направить оптические конфигурации, такие как Манжен, параболических, конических или Кассегрена солнечных коллекторов энергии, чтобы лицом к солнцу и следовать за солнцем контур движения непрерывно. В обуздывать силу от солнца через солнечный трекер или практической солнечной системы слежения, системы возобновляемых контроля энергии автоматизации требуют автоматического солнечной отслеживания программного обеспечения и алгоритмов

солнечные позиции для достижения динамического контроля движения с архитектуры автоматизации управления, печатных плат и аппаратных средств. На оси системы слежения ВС, таких как высота-азимут двойной оси или многоосевые солнечные системы трекер использовать алгоритм отслеживания солнца или трассировки лучей датчиков или программное обеспечение, чтобы обеспечить прохождение солнца по небу прослеживается с высокой точностью в автоматизированных приложений Солнечная Tracker , прямо через летнего солнцестояния, солнечного равноденствия и зимнего солнцестояния. Высокая точность позиции ВС калькулятор или положение солнца алгоритм это важный шаг в проектировании и строительстве автоматической системой солнечной слежения. /PC

grease equivalent chart pdf: Sun Tracking and Solar Renewable Energy Harvesting Gerro Prinsloo, Robert Dobson, 2015-11-02 Free to download eBook on Practical Solar Tracking Design, Solar Tracking, Sun Tracking, Sun Tracker, Solar Tracker, Follow Sun, Sun Position calculation (Azimuth, Elevation, Zenith), Sun following, Sunrise, Sunset, Moon-phase, Moonrise, Moonset calculators. In harnessing power from the sun through a solar tracker or solar tracking system, renewable energy system developers require automatic solar tracking software and solar position algorithms. On-axis sun tracking system such as the altitude-azimuth dual axis or multi-axis solar tracker systems use a sun tracking algorithm or ray tracing sensors or software to ensure the sun's passage through the sky is traced with high precision in automated solar tracker applications, right through summer solstice, solar equinox and winter solstice. Eco Friendly and Environmentally Sustainable Micro Combined Solar Heat and Power (m-CHP, m-CCHP, m-CHCP) with Microgrid Storage and Layered Smartgrid Control towards Supplying Off-Grid Rural Villages in developing BRICS countries such as Africa, India, China and Brazil. Off-grid rural villages and isolated islands areas require mCHP and trigeneration solar power plants and associated isolated smart microgrid solutions to serve the community energy needs. This article describes the development progress for such a system, also referred to as solar polygeneration. The system includes a sun tracker mechanism wherein a parabolic dish or lenses are guided by a light sensitive mechanic in a way that the solar receiver is always at right angle to the solar radiation. Solar thermal energy is then either converted into electrical energy through a free piston Stirling, or stored in a thermal storage container. The project includes the thermodynamic modeling of the plant in Matlab Simulink as well as the development of an intelligent control approach that includes smart microgrid distribution and optimization. The book includes aspects in the simulation and optimization of stand-alone hybrid renewable energy systems and co-generation in isolated or islanded microgrids. It focusses on the stepwise development of a hybrid solar driven micro combined cooling heating and power (mCCHP) compact trigeneration polygeneration and thermal energy storage (TES) system with intelligent weather prediction, weak-ahead scheduling (time horizon), and look-ahead dispatch on integrated smart microgrid distribution principles. The solar harvesting and solar thermodynamic system includes an automatic sun tracking platform based on a PLC controlled mechatronic sun tracking system that follows the sun progressing across the sky. An intelligent energy management and adaptive learning control optimization approach is proposed for autonomous off-grid remote power applications, both for thermodynamic optimization and smart micro-grid optimization for distributed energy resources (DER). The correct resolution of this load-following multi objective optimization problem is a complex task because of the high number and multi-dimensional variables, the cross-correlation and interdependency between the energy streams as well as the non-linearity in the performance of some of the system components. Exergy-based control approaches for smartgrid topologies are considered in terms of the intelligence behind the safe and reliable operation of a

microgrid in an automated system that can manage energy flow in electrical as well as thermal energy systems. The standalone micro-grid solution would be suitable for a rural village, intelligent building, district energy system, campus power, shopping mall centre, isolated network, eco estate or remote island application setting where self-generation and decentralized energy system concepts play a role. Discrete digital simulation models for the thermodynamic and active demand side management systems with digital smartgrid control unit to optimize the system energy management is currently under development. Parametric simulation models for this trigeneration system (polygeneration, poligeneration, quadgeneration) are developed on the Matlab Simulink and TrnSys platforms. In terms of model predictive coding strategies, the automation controller will perform multi-objective cost optimization for energy management on a microgrid level by managing the generation and storage of electrical, heat and cooling energies in layers. Each layer has its own set of smart microgrid priorities associated with user demand side cycle predictions. Mixed Integer Linear Programming and Neural network algorithms are being modeled to perform Multi Objective Control optimization as potential optimization and adaptive learning techniques.

grease equivalent chart pdf: [Automatic Solar Tracking Sun Tracking Satellite Tracking rastreador solar seguimiento solar seguidor solar automático de seguimiento solar](#) Gerro Prinsloo, Robert Dobson, 2015-11-01 Automatic Solar Tracking Sun Tracking : This book details Automatic Solar-Tracking, Sun-Tracking-Systems, Solar-Trackers and Sun Tracker Systems. An intelligent automatic solar tracker is a device that orients a payload toward the sun. Such programmable computer based solar tracking device includes principles of solar tracking, solar tracking systems, as well as microcontroller, microprocessor and/or PC based solar tracking control to orientate solar reflectors, solar lenses, photovoltaic panels or other optical configurations towards the sun. Motorized space frames and kinematic systems ensure motion dynamics and employ drive technology and gearing principles to steer optical configurations such as mangin, parabolic, conic, or cassegrain solar energy collectors to face the sun and follow the sun movement contour continuously (seguimiento solar y automatización, automatización seguidor solar, tracking solar e automação, automação seguidor solar, inseguimento solare, inseguitore solare, energia termica, sole seguito, posizionatore motorizzato) In harnessing power from the sun through a solar tracker or practical solar tracking system, renewable energy control automation systems require automatic solar tracking software and solar position algorithms to accomplish dynamic motion control with control automation architecture, circuit boards and hardware. On-axis sun tracking system such as the altitude-azimuth dual axis or multi-axis solar tracker systems use a sun tracking algorithm or ray tracing sensors or software to ensure the sun's passage through the sky is traced with high precision in automated solar tracker applications, right through summer solstice, solar equinox and winter solstice. A high precision sun position calculator or sun position algorithm is this an important step in the design and construction of an automatic solar tracking system. The content of the book is also applicable to communication antenna satellite tracking and moon tracking algorithm source code for which links to free download links are provided. From sun tracing software perspective, the sonnet Tracing The Sun has a literal meaning. Within the context of sun track and trace, this book explains that the sun's daily path across the sky is directed by relatively simple principles, and if grasped/understood, then it is relatively easy to trace the sun with sun following software. Sun position computer software for tracing the sun are available as open source code, sources that is listed in this book. The book also describes the use of satellite tracking software and mechanisms in solar tracking applications. Ironically there was even a system called sun chaser, said to have been a solar positioner system known for chasing the sun throughout the day. Using solar equations in an electronic circuit for automatic solar tracking is quite simple, even if you are a novice, but mathematical solar equations are over complicated by academic experts and professors in text-books, journal articles and internet websites. In terms of solar hobbies, scholars, students and Hobbyist's looking at solar tracking electronics or PC programs for solar tracking are usually overcome by the sheer volume of scientific material and internet resources, which leaves many developers in frustration when search for simple experimental solar tracking source-code for their

on-axis sun-tracking systems. This booklet will simplify the search for the mystical sun tracking formulas for your sun tracker innovation and help you develop your own autonomous solar tracking controller. By directing the solar collector directly into the sun, a solar harvesting means or device can harness sunlight or thermal heat. This is achieved with the help of sun angle formulas, solar angle formulas or solar tracking procedures for the calculation of sun's position in the sky. Automatic sun tracking system software includes algorithms for solar altitude azimuth angle calculations required in following the sun across the sky. In using the longitude, latitude GPS coordinates of the solar tracker location, these sun tracking software tools supports precision solar tracking by determining the solar altitude-azimuth coordinates for the sun trajectory in altitude-azimuth tracking at the tracker location, using certain sun angle formulas in sun vector calculations. Instead of follow the sun software, a sun tracking sensor such as a sun sensor or webcam or video camera with vision based sun following image processing software can also be used to determine the position of the sun optically. Such optical feedback devices are often used in solar panel tracking systems and dish tracking systems. Dynamic sun tracing is also used in solar surveying, DNI analyser and sun surveying systems that build solar infographics maps with solar radiance, irradiance and DNI models for GIS (geographical information system). In this way geospatial methods on solar/environment interaction makes use use of geospatial technologies (GIS, Remote Sensing, and Cartography). Climatic data and weather station or weather center data, as well as queries from sky servers and solar resource database systems (i.e. on DB2, Sybase, Oracle, SQL, MySQL) may also be associated with solar GIS maps. In such solar resource modelling systems, a pyranometer or solarimeter is normally used in addition to measure direct and indirect, scattered, dispersed, reflective radiation for a particular geographical location. Sunlight analysis is important in flash photography where photographic lighting are important for photographers. GIS systems are used by architects who add sun shadow applets to study architectural shading or sun shadow analysis, solar flux calculations, optical modelling or to perform weather modelling. Such systems often employ a computer operated telescope type mechanism with ray tracing program software as a solar navigator or sun tracer that determines the solar position and intensity. The purpose of this booklet is to assist developers to track and trace suitable source-code and solar tracking algorithms for their application, whether a hobbyist, scientist, technician or engineer. Many open-source sun following and tracking algorithms and source-code for solar tracking programs and modules are freely available to download on the internet today. Certain proprietary solar tracker kits and solar tracking controllers include a software development kit SDK for its application programming interface API attributes (Pebble). Widget libraries, widget toolkits, GUI toolkit and UX libraries with graphical control elements are also available to construct the graphical user interface (GUI) for your solar tracking or solar power monitoring program. The solar library used by solar position calculators, solar simulation software and solar contour calculators include machine program code for the solar hardware controller which are software programmed into Micro-controllers, Programmable Logic Controllers PLC, programmable gate arrays, Arduino processor or PIC processor. PC based solar tracking is also high in demand using C++, Visual Basic VB, as well as MS Windows, Linux and Apple Mac based operating systems for sun path tables on Matlab, Excel. Some books and internet webpages use other terms, such as: sun angle calculator, sun position calculator or solar angle calculator. As said, such software code calculate the solar azimuth angle, solar altitude angle, solar elevation angle or the solar Zenith angle (Zenith solar angle is simply referenced from vertical plane, the mirror of the elevation angle measured from the horizontal or ground plane level). Similar software code is also used in solar calculator apps or the solar power calculator apps for IOS and Android smartphone devices. Most of these smartphone solar mobile apps show the sun path and sun-angles for any location and date over a 24 hour period. Some smartphones include augmented reality features in which you can physically see and look at the solar path through your cell phone camera or mobile phone camera at your phone's specific GPS location. In the computer programming and digital signal processing (DSP) environment, (free/open source) program code are available for VB, .Net, Delphi, Python, C, C+, C++, PHP, Swift, ADM, F,

Flash, Basic, QBasic, GBasic, KBasic, SIMPL language, Squirrel, Solaris, Assembly language on operating systems such as MS Windows, Apple Mac, DOS or Linux OS. Software algorithms predicting position of the sun in the sky are commonly available as graphical programming platforms such as Matlab (Mathworks), Simulink models, Java applets, TRNSYS simulations, Scada system apps, Labview module, Beckhoff TwinCAT (Visual Studio), Siemens SPA, mobile and iphone apps, Android or iOS tablet apps, and so forth. At the same time, PLC software code for a range of sun tracking automation technology can follow the profile of sun in sky for Siemens, HP, Panasonic, ABB, Allan Bradley, OMRON, SEW, Festo, Beckhoff, Rockwell, Schneider, Endress Hauser, Fudji electric. Honeywell, Fuchs, Yokonawa, or Muthibishi platforms. Sun path projection software are also available for a range of modular IPC embedded PC motherboards, Industrial PC, PLC (Programmable Logic Controller) and PAC (Programmable Automation Controller) such as the Siemens S7-1200 or Siemens Logo, Beckhoff IPC or CX series, OMRON PLC, Ercam PLC, AC500plc ABB, National Instruments NI PXI or NI cRIO, PIC processor, Intel 8051/8085, IBM (Cell, Power, Brain or Truenorth series), FPGA (Xilinx Altera Nios), Intel, Xeon, Atmel megaAVR, MPU, Maple, Teensy, MSP, XMOS, Xbee, ARM, Raspberry Pi, Eagle, Arduino or Arduino AtMega microcontroller, with servo motor, stepper motor, direct current DC pulse width modulation PWM (current driver) or alternating current AC SPS or IPC variable frequency drives VFD motor drives (also termed adjustable-frequency drive, variable-speed drive, AC drive, micro drive or inverter drive) for electrical, mechatronic, pneumatic, or hydraulic solar tracking actuators. The above motion control and robot control systems include analogue or digital interfacing ports on the processors to allow for tracker angle orientation feedback control through one or a combination of angle sensor or angle encoder, shaft encoder, precision encoder, optical encoder, magnetic encoder, direction encoder, rotational encoder, chip encoder, tilt sensor, inclination sensor, or pitch sensor. Note that the tracker's elevation or zenith axis angle may measured using an altitude angle-, declination angle-, inclination angle-, pitch angle-, or vertical angle-, zenith angle- sensor or inclinometer. Similarly the tracker's azimuth axis angle be measured with a azimuth angle-, horizontal angle-, or roll angle-sensor. Chip integrated accelerometer magnetometer gyroscope type angle sensors can also be used to calculate displacement. Other options include the use of thermal imaging systems such as a Fluke thermal imager, or robotic or vision based solar tracker systems that employ face tracking, head tracking, hand tracking, eye tracking and car tracking principles in solar tracking. With unattended decentralised rural, island, isolated, or autonomous off-grid power installations, remote control, monitoring, data acquisition, digital datalogging and online measurement and verification equipment becomes crucial. It assists the operator with supervisory control to monitor the efficiency of remote renewable energy resources and systems and provide valuable web-based feedback in terms of CO₂ and clean development mechanism (CDM) reporting. A power quality analyser for diagnostics through internet, WiFi and cellular mobile links is most valuable in frontline troubleshooting and predictive maintenance, where quick diagnostic analysis is required to detect and prevent power quality issues. Solar tracker applications cover a wide spectrum of solar applications and solar assisted application, including concentrated solar power generation, solar desalination, solar water purification, solar steam generation, solar electricity generation, solar industrial process heat, solar thermal heat storage, solar food dryers, solar water pumping, hydrogen production from methane or producing hydrogen and oxygen from water (HHO) through electrolysis. Many patented or non-patented solar apparatus include tracking in solar apparatus for solar electric generator, solar desalinators, solar steam engine, solar ice maker, solar water purifier, solar cooling, solar refrigeration, USB solar charger, solar phone charging, portable solar charging tracker, solar coffee brewing, solar cooking or solar drying means. Your project may be the next breakthrough or patent, but your invention is held back by frustration in search for the sun tracker you require for your solar powered appliance, solar generator, solar tracker robot, solar freezer, solar cooker, solar drier, solar pump, solar freezer, or solar dryer project. Whether your solar electronic circuit diagram include a simplified solar controller design in a solar electricity project, solar power kit, solar hobby kit, solar steam generator, solar hot water system, solar ice maker, solar desalinators, hobbyist solar panels,

hobby robot, or if you are developing professional or hobby electronics for a solar utility or micro scale solar powerplant for your own solar farm or solar farming, this publication may help accelerate the development of your solar tracking innovation. Lately, solar polygeneration, solar trigeneration (solar triple generation), and solar quad generation (adding delivery of steam, liquid/gaseous fuel, or capture food-grade CO₂) systems have need for automatic solar tracking. These systems are known for significant efficiency increases in energy yield as a result of the integration and re-use of waste or residual heat and are suitable for compact packaged micro solar powerplants that could be manufactured and transported in kit-form and operate on a plug-and play basis. Typical hybrid solar power systems include compact or packaged solar micro combined heat and power (CHP or mCHP) or solar micro combined, cooling, heating and power (CCHP, CHPC, mCCHP, or mCHPC) systems used in distributed power generation. These systems are often combined in concentrated solar CSP and CPV smart microgrid configurations for off-grid rural, island or isolated microgrid, minigrid and distributed power renewable energy systems. Solar tracking algorithms are also used in modelling of trigeneration systems using Matlab Simulink (Modelica or TRNSYS) platform as well as in automation and control of renewable energy systems through intelligent parsing, multi-objective, adaptive learning control and control optimization strategies. Solar tracking algorithms also find application in developing solar models for country or location specific solar studies, for example in terms of measuring or analysis of the fluctuations of the solar radiation (i.e. direct and diffuse radiation) in a particular area. Solar DNI, solar irradiance and atmospheric information and models can thus be integrated into a solar map, solar atlas or geographical information systems (GIS). Such models allows for defining local parameters for specific regions that may be valuable in terms of the evaluation of different solar in photovoltaic of CSP systems on simulation and synthesis platforms such as Matlab and Simulink or in linear or multi-objective optimization algorithm platforms such as COMPOSE, EnergyPLAN or DER-CAM. A dual-axis solar tracker and single-axis solar tracker may use a sun tracker program or sun tracker algorithm to position a solar dish, solar panel array, heliostat array, PV panel, solar antenna or infrared solar nantenna. A self-tracking solar concentrator performs automatic solar tracking by computing the solar vector. Solar position algorithms (TwinCAT, SPA, or PSA Algorithms) use an astronomical algorithm to calculate the position of the sun. It uses astronomical software algorithms and equations for solar tracking in the calculation of sun's position in the sky for each location on the earth at any time of day. Like an optical solar telescope, the solar position algorithm pin-points the solar reflector at the sun and locks onto the sun's position to track the sun across the sky as the sun progresses throughout the day. Optical sensors such as photodiodes, light-dependant-resistors (LDR) or photoresistors are used as optical accuracy feedback devices. Lately we also included a section in the book (with links to microprocessor code) on how the PixArt Wii infrared camera in the Wii remote or Wiimote may be used in infrared solar tracking applications. In order to harvest free energy from the sun, some automatic solar positioning systems use an optical means to direct the solar tracking device. These solar tracking strategies use optical tracking techniques, such as a sun sensor means, to direct sun rays onto a silicon or CMOS substrate to determine the X and Y coordinates of the sun's position. In a solar mems sun-sensor device, incident sunlight enters the sun sensor through a small pin-hole in a mask plate where light is exposed to a silicon substrate. In a web-camera or camera image processing sun tracking and sun following means, object tracking software performs multi object tracking or moving object tracking methods. In an solar object tracking technique, image processing software performs mathematical processing to box the outline of the apparent solar disc or sun blob within the captured image frame, while sun-localization is performed with an edge detection algorithm to determine the solar vector coordinates. An automated positioning system help maximize the yields of solar power plants through solar tracking control to harness sun's energy. In such renewable energy systems, the solar panel positioning system uses a sun tracking techniques and a solar angle calculator in positioning PV panels in photovoltaic systems and concentrated photovoltaic CPV systems. Automatic on-axis solar tracking in a PV solar tracking system can be dual-axis sun tracking or single-axis sun solar tracking. It is known that a motorized positioning

system in a photovoltaic panel tracker increase energy yield and ensures increased power output, even in a single axis solar tracking configuration. Other applications such as robotic solar tracker or robotic solar tracking system uses robotics with artificial intelligence in the control optimization of energy yield in solar harvesting through a robotic tracking system. Automatic positioning systems in solar tracking designs are also used in other free energy generators, such as concentrated solar thermal power CSP and dish Stirling systems. The sun tracking device in a solar collector in a solar concentrator or solar collector Such a performs on-axis solar tracking, a dual axis solar tracker assists to harness energy from the sun through an optical solar collector, which can be a parabolic mirror, parabolic reflector, Fresnel lens or mirror array/matrix. A parabolic dish or reflector is dynamically steered using a transmission system or solar tracking slew drive mean. In steering the dish to face the sun, the power dish actuator and actuation means in a parabolic dish system optically focusses the sun's energy on the focal point of a parabolic dish or solar concentrating means. A Stirling engine, solar heat pipe, thermosyphon, solar phase change material PCM receiver, or a fibre optic sunlight receiver means is located at the focal point of the solar concentrator. The dish Stirling engine configuration is referred to as a dish Stirling system or Stirling power generation system. Hybrid solar power systems (used in combination with biogas, biofuel, petrol, ethanol, diesel, natural gas or PNG) use a combination of power sources to harness and store solar energy in a storage medium. Any multitude of energy sources can be combined through the use of controllers and the energy stored in batteries, phase change material, thermal heat storage, and in cogeneration form converted to the required power using thermodynamic cycles (organic Rankin, Brayton cycle, micro turbine, Stirling) with an inverter and charge controller.

grease equivalent chart pdf: Crop Protection Reference , 2007

grease equivalent chart pdf: *Engine Oil Performance and Engine Service Classification (Other Than "Energy Conserving")* Fuels and Lubricants TC 1 Engine Lubrication, 2016 This SAE Standard outlines the engine oil performance categories and classifications developed through the efforts of the Alliance of Automobile Manufacturers (Alliance), American Petroleum Institute (API), the American Society for Testing and Materials (ASTM), the Engine Manufacturers Association (EMA), International Lubricant Specification Advisory Committee (ILSAC) and SAE. The verbal descriptions by API and ASTM, along with prescribed test methods and limits are shown for active categories in Table 1 and obsolete categories in Table A1. Appendix A is a historical documentation of the obsolete categories. For purposes of this document, active categories are defined as those (a) for which the required test equipment and test support materials, including reference engine oils and reference fuels, are readily available, (b) for which ASTM or the test developer monitors precision for all tests, and (c) which are currently available for licensing by API EOLCS. The current processes for initiating new classifications were developed through the cooperative efforts of the Alliance, API, ASTM, EMA, ILSAC, and SAE. New ILSAC classifications are developed using the procedure defined in API 1509 Annex C. New API C categories are added using the procedure defined in API 1509 Annex D. New API S categories are added by the API Lubricants Group. This revision of SAE J183 incorporates the latest changes to the API Engine Oil Licensing and Certification System (EOLCS) for gasoline and diesel engine oils, and the International Lubricant Specification Advisory Committee (ILSAC) (formerly International Lubricant Standardization and Approval Committee) Standards for Passenger Car Engine Oils. Additionally, the latest ASTM methods have been included, and the Appendix has been expanded to include those oil performance categories that have since become obsolete. The information contained within this revision is very important to those interested in the identification and comparison of the critical factors important to each classification as well as for their eventual utilization.

Related to grease equivalent chart pdf

Grease (film) - Wikipedia Grease is a 1978 American musical romantic comedy film directed by Randal Kleiser (in his feature directorial debut) from a screenplay by Bronté Woodard and an adaptation by co

Grease (1978) - IMDb Grease: Directed by Randal Kleiser. With John Travolta, Olivia Newton-John, Stockard Channing, Jeff Conaway. Good girl Sandy Olsson and greaser Danny Zuko fell in
Grease streaming: where to watch movie online? - JustWatch Find out how and where to watch "Grease" online on Netflix, Prime Video, and Disney+ today - including 4K and free options
Watch Grease | Prime Video - Australian good girl Sandy (Olivia Newton-John) and greaser Danny (John Travolta) fell in love over the summer. But when they discover they're now in the same high school, will they be

Grease Movie Official Website - Paramount Pictures Grease is the one that you want! Go back to high school with Pink Lady Sandy (Olivia Newton-John), leader of the bad-boy T-Birds, Danny (John Travolta), and a rockin' and rollin' all-star cast

Grease (1978) — The Movie Database (TMDb) Australian good girl Sandy and greaser Danny fell in love over the summer. But when they unexpectedly discover they're now in the same high school, will they be able to rekindle their

Grease | Musical, Olivia Newton-John, John Travolta, & Cast Grease, American musical film released in 1978 starring Olivia Newton-John and John Travolta that follows the adventures of a group of high-school students in the late 1950s

Grease | Rotten Tomatoes Discover reviews, ratings, and trailers for Grease on Rotten Tomatoes. Stay updated with critic and audience scores today!

Grease | Grease Wiki | Fandom Grease (also known as Grease 1) is a 1978 American musical film directed by Randal Kleiser and produced by Paramount Pictures. It is based on Warren Casey's and Jim Jacobs's 1971

Where to Watch, Stream "Grease" for Free, the Olivia Newton-John Grease is the word and an all-time classic. The musical starring John Travolta and Olivia Newton-John as high school lovebirds Danny Zuko and Sandy Olsson was released

Grease (film) - Wikipedia Grease is a 1978 American musical romantic comedy film directed by Randal Kleiser (in his feature directorial debut) from a screenplay by Bronté Woodard and an adaptation by co

Grease (1978) - IMDb Grease: Directed by Randal Kleiser. With John Travolta, Olivia Newton-John, Stockard Channing, Jeff Conaway. Good girl Sandy Olsson and greaser Danny Zuko fell in
Grease streaming: where to watch movie online? - JustWatch Find out how and where to watch "Grease" online on Netflix, Prime Video, and Disney+ today - including 4K and free options

Watch Grease | Prime Video - Australian good girl Sandy (Olivia Newton-John) and greaser Danny (John Travolta) fell in love over the summer. But when they discover they're now in the same high school, will they be

Grease Movie Official Website - Paramount Pictures Grease is the one that you want! Go back to high school with Pink Lady Sandy (Olivia Newton-John), leader of the bad-boy T-Birds, Danny (John Travolta), and a rockin' and rollin' all-star cast

Grease (1978) — The Movie Database (TMDb) Australian good girl Sandy and greaser Danny fell in love over the summer. But when they unexpectedly discover they're now in the same high school, will they be able to rekindle their

Grease | Musical, Olivia Newton-John, John Travolta, & Cast Grease, American musical film released in 1978 starring Olivia Newton-John and John Travolta that follows the adventures of a group of high-school students in the late 1950s

Grease | Rotten Tomatoes Discover reviews, ratings, and trailers for Grease on Rotten Tomatoes. Stay updated with critic and audience scores today!

Grease | Grease Wiki | Fandom Grease (also known as Grease 1) is a 1978 American musical film directed by Randal Kleiser and produced by Paramount Pictures. It is based on Warren Casey's and Jim Jacobs's 1971

Where to Watch, Stream "Grease" for Free, the Olivia Newton-John Grease is the word and an all-time classic. The musical starring John Travolta and Olivia Newton-John as high school lovebirds Danny Zuko and Sandy Olsson was released

Grease (film) - Wikipedia Grease is a 1978 American musical romantic comedy film directed by Randal Kleiser (in his feature directorial debut) from a screenplay by Bronté Woodard and an adaptation by co

Grease (1978) - IMDb Grease: Directed by Randal Kleiser. With John Travolta, Olivia Newton-John, Stockard Channing, Jeff Conaway. Good girl Sandy Olsson and greaser Danny Zuko fell in

Grease streaming: where to watch movie online? - JustWatch Find out how and where to watch "Grease" online on Netflix, Prime Video, and Disney+ today - including 4K and free options

Watch Grease | Prime Video - Australian good girl Sandy (Olivia Newton-John) and greaser Danny (John Travolta) fell in love over the summer. But when they discover they're now in the same high school, will they be

Grease Movie Official Website - Paramount Pictures Grease is the one that you want! Go back to high school with Pink Lady Sandy (Olivia Newton-John), leader of the bad-boy T-Birds, Danny (John Travolta), and a rockin' and rollin' all-star cast

Grease (1978) — The Movie Database (TMDB) Australian good girl Sandy and greaser Danny fell in love over the summer. But when they unexpectedly discover they're now in the same high school, will they be able to rekindle their

Grease | Musical, Olivia Newton-John, John Travolta, & Cast Grease, American musical film released in 1978 starring Olivia Newton-John and John Travolta that follows the adventures of a group of high-school students in the late 1950s

Grease | Rotten Tomatoes Discover reviews, ratings, and trailers for Grease on Rotten Tomatoes. Stay updated with critic and audience scores today!

Grease | Grease Wiki | Fandom Grease (also known as Grease 1) is a 1978 American musical film directed by Randal Kleiser and produced by Paramount Pictures. It is based on Warren Casey's and Jim Jacobs's 1971

Where to Watch, Stream "Grease" for Free, the Olivia Newton Grease is the word and an all-time classic. The musical starring John Travolta and Olivia Newton-John as high school lovebirds Danny Zuko and Sandy Olsson was released

Grease (film) - Wikipedia Grease is a 1978 American musical romantic comedy film directed by Randal Kleiser (in his feature directorial debut) from a screenplay by Bronté Woodard and an adaptation by co

Grease (1978) - IMDb Grease: Directed by Randal Kleiser. With John Travolta, Olivia Newton-John, Stockard Channing, Jeff Conaway. Good girl Sandy Olsson and greaser Danny Zuko fell in

Grease streaming: where to watch movie online? - JustWatch Find out how and where to watch "Grease" online on Netflix, Prime Video, and Disney+ today - including 4K and free options

Watch Grease | Prime Video - Australian good girl Sandy (Olivia Newton-John) and greaser Danny (John Travolta) fell in love over the summer. But when they discover they're now in the same high school, will they be

Grease Movie Official Website - Paramount Pictures Grease is the one that you want! Go back to high school with Pink Lady Sandy (Olivia Newton-John), leader of the bad-boy T-Birds, Danny (John Travolta), and a rockin' and rollin' all-star cast

Grease (1978) — The Movie Database (TMDB) Australian good girl Sandy and greaser Danny fell in love over the summer. But when they unexpectedly discover they're now in the same high school, will they be able to rekindle their

Grease | Musical, Olivia Newton-John, John Travolta, & Cast Grease, American musical film released in 1978 starring Olivia Newton-John and John Travolta that follows the adventures of a group of high-school students in the late 1950s

Grease | Rotten Tomatoes Discover reviews, ratings, and trailers for Grease on Rotten Tomatoes. Stay updated with critic and audience scores today!

Grease | Grease Wiki | Fandom Grease (also known as Grease 1) is a 1978 American musical film directed by Randal Kleiser and produced by Paramount Pictures. It is based on Warren Casey's and Jim Jacobs's 1971

Where to Watch, Stream "Grease" for Free, the Olivia Newton-John Grease is the word and an all-time classic. The musical starring John Travolta and Olivia Newton-John as high school lovebirds Danny Zuko and Sandy Olsson was released

Grease (film) - Wikipedia Grease is a 1978 American musical romantic comedy film directed by Randal Kleiser (in his feature directorial debut) from a screenplay by Bronté Woodard and an adaptation by co

Grease (1978) - IMDb Grease: Directed by Randal Kleiser. With John Travolta, Olivia Newton-John, Stockard Channing, Jeff Conaway. Good girl Sandy Olsson and greaser Danny Zuko fell in

Grease streaming: where to watch movie online? - JustWatch Find out how and where to watch "Grease" online on Netflix, Prime Video, and Disney+ today - including 4K and free options

Watch Grease | Prime Video - Australian good girl Sandy (Olivia Newton-John) and greaser Danny (John Travolta) fell in love over the summer. But when they discover they're now in the same high school, will they be

Grease Movie Official Website - Paramount Pictures Grease is the one that you want! Go back to high school with Pink Lady Sandy (Olivia Newton-John), leader of the bad-boy T-Birds, Danny (John Travolta), and a rockin' and rollin' all-star cast

Grease (1978) — The Movie Database (TMDB) Australian good girl Sandy and greaser Danny fell in love over the summer. But when they unexpectedly discover they're now in the same high school, will they be able to rekindle their

Grease | Musical, Olivia Newton-John, John Travolta, & Cast Grease, American musical film released in 1978 starring Olivia Newton-John and John Travolta that follows the adventures of a group of high-school students in the late 1950s

Grease | Rotten Tomatoes Discover reviews, ratings, and trailers for Grease on Rotten Tomatoes. Stay updated with critic and audience scores today!

Grease | Grease Wiki | Fandom Grease (also known as Grease 1) is a 1978 American musical film directed by Randal Kleiser and produced by Paramount Pictures. It is based on Warren Casey's and Jim Jacobs's 1971

Where to Watch, Stream "Grease" for Free, the Olivia Newton-John Grease is the word and an all-time classic. The musical starring John Travolta and Olivia Newton-John as high school lovebirds Danny Zuko and Sandy Olsson was released

Related Articles

- [free rv flat rate manual](#)
- [kamaloga kathaigal](#)
- [mendelian genetics worksheet answers](#)

[Back to Home](#)