Shell
GADUS

HIGH-PERFORMANCE GREASE DESIGNED TO MEET YOUR NEEDS

How to select the right grease for your application

SHELL LUBRICANTS
TOGETHER ANYTHING IS POSSIBLE

GREASE: IMPORTANT TO KEEP YOUR BUSINESS MOVING

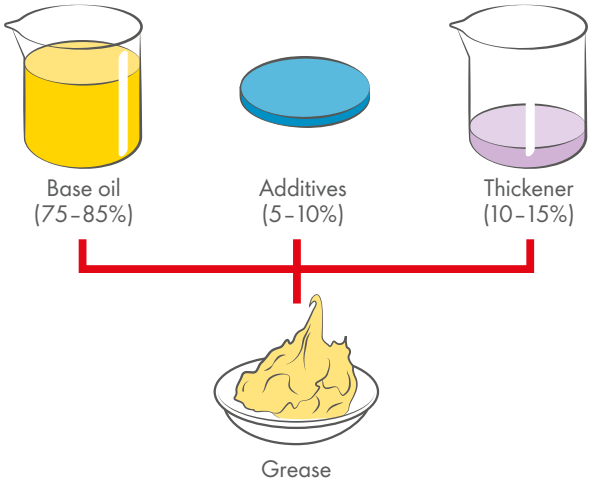
Greases may only be a small part of your maintenance budget, but they play a key role in keeping equipment up and running.

Selecting the right grease is the critical first step to realising total cost of ownership cost savings through helping to improve productivity and lowering maintenance spend and costs related to unplanned machine downtimes. A high-quality grease will enable you to run your machines for longer with less downtime.

This brochure provides some general information on greases and describes what elements you need to consider when selecting the most appropriate grease for your application.

WHAT IS A GREASE AND HOW DOES IT WORK?

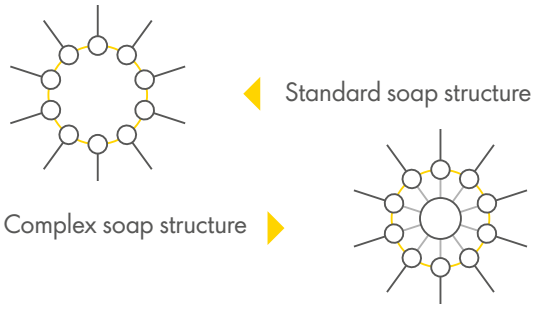
A grease is a lubricating base oil with performance enhancing additives that is kept within a thickening fibre matrix. The length, form and torsion of these fibres are determined by the production process and drive – besides the type and amount of the additives – the typical performance properties of the grease. Adjusting the proportions of the three basic components will alter the grease's consistency.



The thickening fibre matrix is commonly a soap produced from a fatty acid and a brine.

The brine usually is a metal hydroxide, e.g. Lithium hydroxide, Calcium hydroxide or Aluminium hydroxide which is why you will hear greases described as lithium grease, calcium grease and so on.

There are also complex soap structures, consisting of a metallic soap together with a complexing agent. Complex soap structures usually have a better high-temperature performance and show better load-carrying capability.



The thickener holds the oil and releases it under pressure or load to build up a protective lubrication layer keeping the metal surfaces in the application apart, e.g. between the housing and the rolling element in a bearing. This reduces friction and minimizes abrasive wear. When the pressure is released, the oil is re-absorbed into the thickener fibre matrix. You can think of this as acting in the same way as a sponge when pressure is applied and then released.

USING GREASE: APPLICATIONS AND ADVANTAGES

The main objective of grease is to lubricate the respective application by keeping the metal surfaces apart and seal out contaminants such as dirt, dust or water. Greases are usually the better lubricant choice for extreme operating conditions such as high operating temperatures, high pressures combined with low speeds or shock-loaded applications.

Typical applications:

- Bearings
- Pins and bushes
- Couplings
- Joints and linkages
- Open and enclosed gears
- Chains and cables
- Wheel flanges

Advantages:

- Convenience: needs replenishing less frequently, can be used in automated greasing devices for hard-to-reach spots
- Persistence: stays where it is put
- Protection and sealing: keeps contaminants out, protects against corrosion
- Noise reduction
- Clean: easy to apply, less likely to leak

KEY GREASE PERFORMANCE PROPERTIES

The choice of base oil, thickener and performance-enhancing additives mainly defines the performance properties of a grease, but also the grease production process significantly impacts some of the parameters.

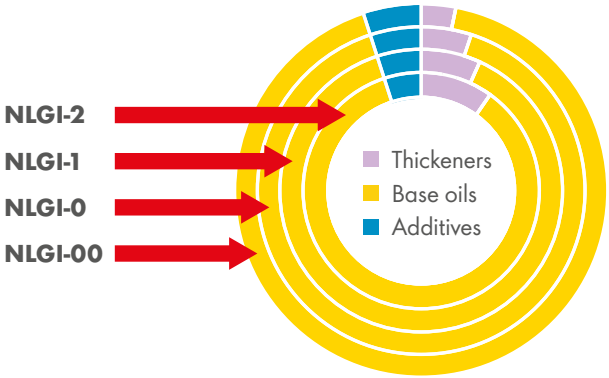
PERFORMANCE PROPERTY	BASE OIL	THICKENER	ADDITIVES	PRODUCTION PROCESS
Consistency	■	■■■		
Cold temperature behaviour	■■■	■■		
Oxidation stability	■		■■■	
Pumpability	■■■	■■		
Corrosion protection		■	■■■	
Mechanical/ shear stability	■	■■		■■■
Oil separation	■■■	■■		■■■
Seal compatibility	■■■	■	■	
Water wash-out and spray-off resistance	■	■■■		
Dropping point		■■■		

■ Minor impact ■■ Medium impact ■■■ Major impact

Consistency

The NLGI (National Lubricating Grease Institute) grade provides a measurement of a grease's consistency (how stiff or soft it is), ranging from 000 for fluid to 6 for block greases.

The key for the consistency is the ratio of thickener to oil: more thickener creates a stiffer grease (higher NLGI class), less thickener makes it softer (lower NLGI class).



NLGI GRADE	TYPE	DESCRIPTION
6	Journal bearings	Block
5	Journal bearings	Very stiff
4	High speed/ low load	Stiff
3	High–speed bearings	Medium
2	Ball/roller bearings	Medium soft
1	Centralized lubrication systems/ low temperature	Soft
0	Centralized lubrication systems	Very soft
00	Enclosed gears	Semi-fluid
000	Enclosed gears	Fluid

Mechanical stability

Mechanical or shear stability is the resistance of a grease against breakdown, softening and subsequent leakage under heavy and shock loads. It has a direct impact on grease life and grease consumption and is a key factor in reducing abrasive wear from metal-to-metal contact, helping to maximise equipment availability and reducing maintenance costs.

Good shear stability is especially important for bearings filled for life, for bearings operating at high speeds and with high loads, and for bearing housings with low replenishment rate.

Water wash-out and spray-off resistance

The ability of grease to stick to the surface and remain in the application in the presence of water without being washed out or sprayed off is another vital quality.

Good adhesion properties are key to keep the grease where it is needed to lubricate and to enable the best possible corrosion protection.

Oxidation stability, low-temperature behaviour and dropping point

Good oxidation stability is required to avoid grease drying out, hardening and forming deposits at high operating temperatures to increase the system efficiency.

Low-temperature behaviour defines the tendency of a grease to become thicker at low temperatures, negatively impacting its pumpability at low temperatures. A good low-temperature performance is critical for equipment operating in cold climates using centralised lubrication systems where the grease needs to be pumped over long distances.

The dropping point is the temperature at which a grease changes from being semi-solid to liquid. If grease is heated to its dropping point, its structure is irreversibly destroyed, therefore it is important to stay within the operational temperature range indicated.

SELECTING THE CORRECT GREASE

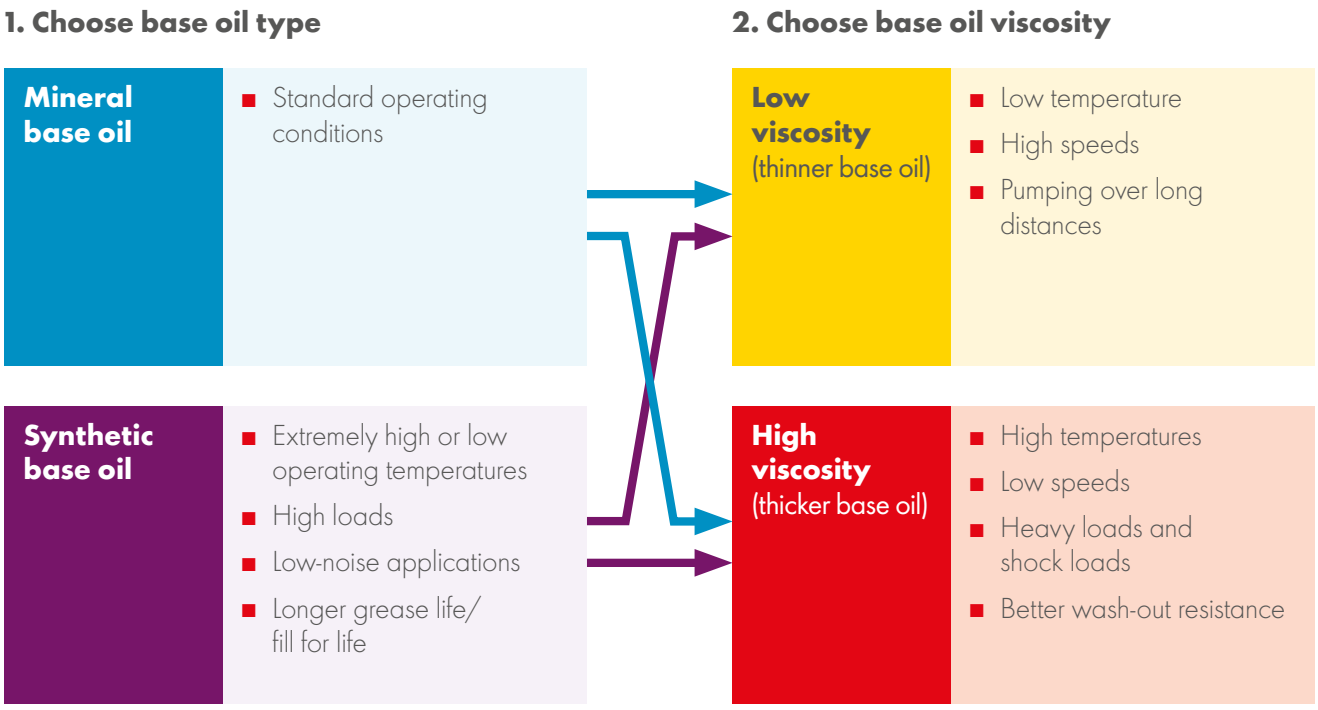
Step 1: Consider the operating conditions

This is **the** crucial first step and the key factor for the grease selection, as the operating conditions determine what base oil viscosity, thickener and additives are best suited for the task. Operating conditions to consider include:

- **Operating temperatures:** do extreme hot or cold operating conditions occur, does the grease need to cope with a wide operating temperature range or seasonal differences?
- **Loads:** Does the grease need to have EP (Extreme Pressure) additives, do shock loads occur that require solids?
- **Speeds:** Will the grease be subject to high-speed working conditions (key for the selection of the correct base oil viscosity and NLGI class)?
- **Environmental conditions:** Does the operating environment involve the presence of water, ice, snow, chemically active fluids and other potential contaminants, including dirt, rock, grit and wood fibres

Step 2: Choice of base oil type and viscosity

Choosing the right base oil type and viscosity is the second important step in the grease selection process and should be done in accordance with the operating conditions, mainly in terms of temperature, speed and load. It ultimately impacts the durability of your equipment and also the grease life.



Step 3: Thickener choice

The choice of thickener and thickener content determines the temperature range, load-carrying ability, shear stability and pumpability, especially at low temperatures.

THICKENER	WATER RESISTANCE	MECHANICAL STABILITY	DROPPING POINT	CORROSION RESISTANCE
Calcium	■■■■	■■	■	■■
Aluminium	■■■	■	■	■■■■
Lithium	■■■	■■■■	■■	■■■
Lithium calcium	■■■■	■■■■■	■■	■■■■
Calcium complex	■■■	■■■	■■■	■■■
Aluminium complex	■■■■	■■■■■	■■■	■■■■
Lithium complex	■■■	■■■■■	■■■	■■■■
Calcium sulfonate complex	■■■■■	■■■■■	■■■	■■■
Clay	■■	■■	■■■	■■
Microgel	■■■	■■■	■■■	■■■
Polyurea	■■■■	■■■■■	■■■	■■■■

■ Poor ■■ Fair ■■■ Good ■■■■ Very Good ■■■■■ Excellent ■ Low ■■ High ■■■ Very High

There isn't one perfect grease that suits all applications, but some thickeners are particularly suited for some applications. The grease you choose will depend on which are the most important characteristics you need for your application.

DESIRED CHARACTERISTIC	THICKENER TYPE
Adhesiveness (stickiness)	Calcium, lithium calcium, calcium sulfonate complex, calcium complex
Multi-purpose, versatile applications	Lithium, aluminium complex, lithium complex, polyurea
High temperature	Clay, microgel, polyurea, calcium sulfonate complex

It is also important to check the compatibility with thickeners of other greases already used. If incompatible grease thickeners are mixed, the grease may break down completely.

THICKENER	ALUMINIUM COMPLEX	CALCIUM	CALCIUM COMPLEX	CLAY	LITHIUM	LITHIUM COMPLEX	POLYUREA
Aluminium complex		🟥	🟥	🟥	🟧	🟧	🟧
Calcium	🟥		🟩	🟥	🟩	🟩	🟩
Calcium complex	🟥	🟩		🟥	🟧		🟧
Clay	🟥	🟥	🟥		🟥	🟥	🟥
Lithium	🟧	🟩	🟧	🟥		🟩	🟧
Lithium complex	🟧	🟩	🟧	🟥	🟩		🟧
Polyurea	🟧	🟩	🟧	🟥	🟧	🟧	

🟩 Compatible 🟧 Borderline 🟥 Incompatible

This chart is a guide, testing may be required to assess compatibility.

Step 4: Determine needed additivation

Additives provide extra qualities that cannot be provided simply by the choice of thickener and base fluids. Greases use similar types of additive to those used in lubricating oils:

- Anti-oxidants: Help protect the base oil from oxidation for longer grease life.
- Anti-wear/EP additives: Reduce abrasive wear for longer equipment life.
- Corrosion inhibitors: Ensure that the grease effectively protects the metal surface it lubricates, especially in the presence of water.
- Solids: Particles, added to lubricating greases, minimize wear from metal-to-metal contact at extreme or shock load conditions where it is hard to achieve a surface-separating film just through the lubricating oil.
- Special compounds: Polymers increase cohesion and adhesion properties, enhancing the water wash-out and water-spray-off capabilities of the grease to ensure proper equipment lubrication and protection.

Step 5: Choosing the right NLGI class

Once the appropriate base oil type and viscosity, the thickener and additive requirements have been determined, the remaining criterion to consider in the last step is the grease consistency described by the NLGI class.

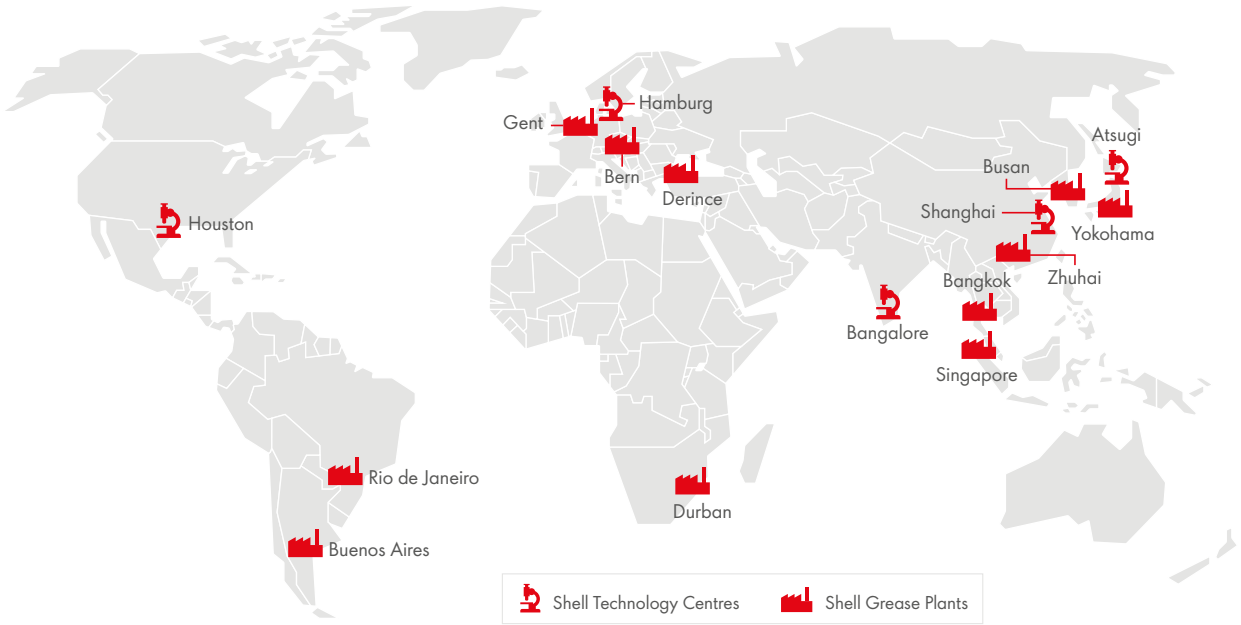
- Low NLGI class (0–000): best for low speeds. Typical applications include gears or centralised lubrication systems.
- High NLGI class: best for high speeds. Suitable for applications such as electric motors or pumps.

The most common grease grade is NLGI 2, which has a smooth, buttery consistency and is appropriate for a wide range of industrial and automotive applications.

SHELL GREASES – LEADING THROUGH TECHNOLOGY

With technical leadership and long-standing expertise in providing the highest-quality lubricants, Shell greases are designed to create sustainable value for our customers.

- The majority of Shell greases are produced in Shell grease manufacturing plants across the world, with a global quality control system that is best in class. This means that every batch you receive provides the same high performance levels.
- Shell technology centres around the world work in close co-operation with customers and equipment makers to create the latest advanced-technology greases.
- Shell owns more than 300 lubricant and grease patents globally. 70 years ago, Shell pioneered and patented the lithium thickener technology, which today is the world's most popular grease thickener.
- Shell Lubricants has been the Global #1 Lubricants supplier for 12 years in a row.
- Shell has on-the-ground grease specialists, supported by a global network of technicians, who can help to solve a specific lubricant problem or design a complete lubrication solution for our customers.

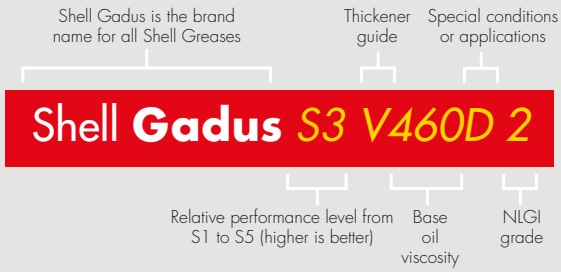


GADUS NAMING CONVENTION

Shell´s Gadus grease naming convention reflects the four main selection criteria, making it easy for you to select the right grease:

Shell Gadus greases have names based on four key properties that are critical when selecting the right grease for your application:

- Thickener type
- Base oil viscosity
- Operating conditions and application
- NLGI class (consistency)



KEY LETTERS USED:

A = Wet (aqueous) conditions
C = Coloured grease
D = Contains solids, suitable for shock load conditions
OG = Open Gear
Q = Noise-dampening (quiet) applications
T = Extreme-temperature applications, polyurea thickener
V = Versatile, lithium, lithium calcium or lithium complex thickener

To find out how we can help you, go to **shell.com/lubricants**

SHELL LUBRICANTS
TOGETHER ANYTHING IS POSSIBLE