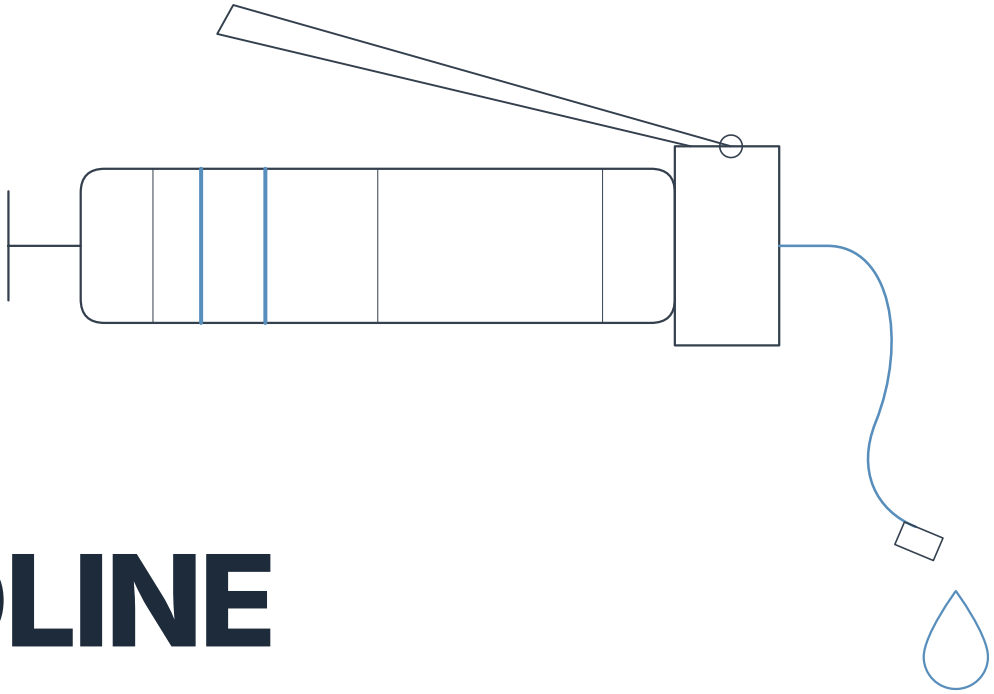


VALVOLINE

How to Choose a Perfect Grease

راهنمای انتخاب گریس Valvoline

استعلام قیمت و خرید گریس VALVOLINE ←

BRAND برند	ORIGIN کشور سازنده	PRODUCTS محصولات	PAGES تعداد صفحات	LANGUAGE زبان
VALVOLINE	USA	Greases	22	English

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تهران، خیابان امیرکبیر، کوچه ناظم‌الاطبا شمالی، پاساژ تهران، طبقه سوم، پلاک ۱۴۲

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HOW TO CHOOSE A PERFECT GREASE

- Learn what is grease in a nutshell - from a layman to an expert in an hour
- Find out how to read and understand specification sheet like a lube expert
- Explore the ideal greasing possibilities for the industrial, construction, and agriculture machinery

Brought to you by Valvoline experts on lubrication

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1. INTRODUCTION

Thank you for downloading our white paper on choosing a perfect grease!

Choosing the right type of grease for your machinery might sometimes look like rocket science. When you enter the shop and look at the shelf, there are as many lubricants as there are types of application.

Not to mention all those numbers and letters printed in the grease specification charts.
At times, trying to read them and truly comprehend what you're purchasing can be overwhelming.

The goal of this white paper is to provide you with a basic, yet extensive enough, education on grease selection, so you could

- confidently choose the best type of grease for your equipment;
- understand the specification charts and data in your machinery manuals;
- rarely second-guess your lubricant choice.

Although the white paper is aimed primarily towards companies in the industrial, agricultural, or construction market, we believe that any type of professional can use it as a quick educational guide.

Please note: This white paper should help you in making the right decision. However, it shouldn't replace the help of consultants and experts. Use it wisely, and in case of any doubt, we recommend contacting the **Valvoline Lubrication Experts.**



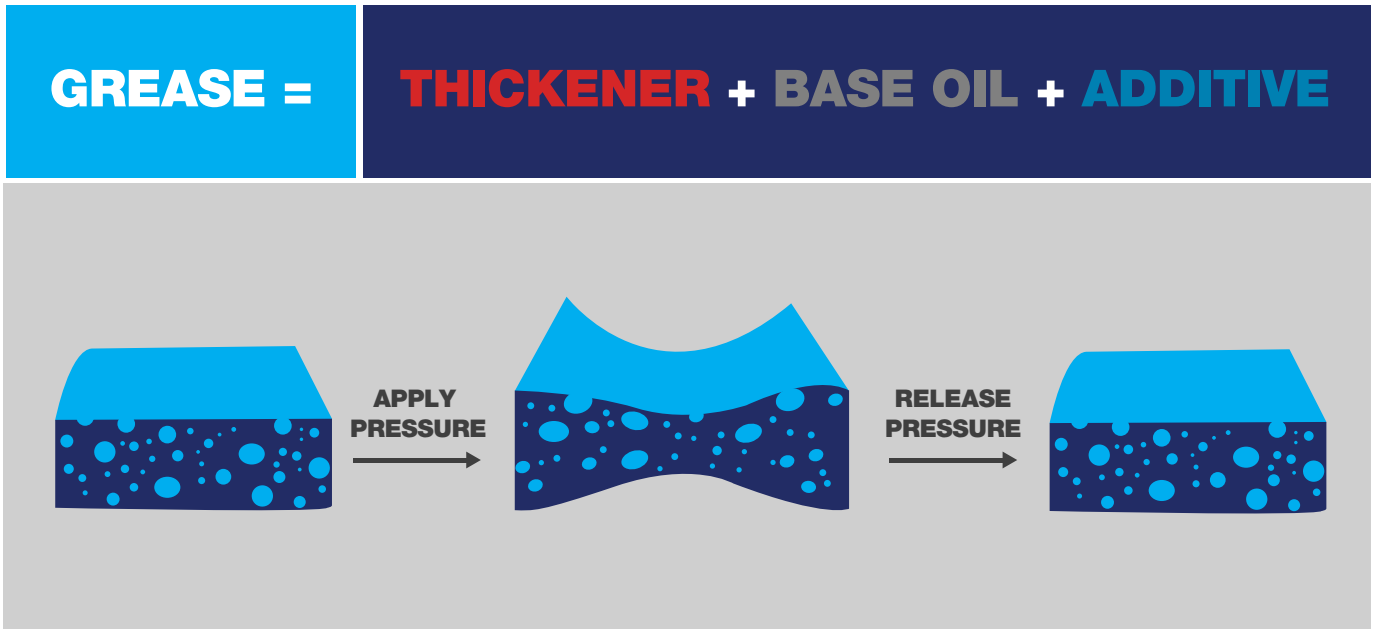
Best regards,

Department for Greases Valvoline Europe
Designed to Endure.



2. GREASE FUNDAMENTALS

Let's start with the essentials. Grease is a "sponge" that holds the oil and additives. Under pressure, temperature change, and load - the "sponge" releases oil that does the actual lubricating.



2.1. THICKENERS

Now, "a sponge" is the base or thickener.

There are two types of thickeners, depending on the chemical process used to produce grease:

- Soap thickeners - lithium (complex), sodium, calcium (complex), aluminium...
- Non-soap thickeners - silica gel, bentonite, clay, polyurea...

!

Using the right thickener is very important, as it can influence your grease's operating temperature, load, speed, and material compatibility. The table below will help you get a clear overview.

TICKENER	WATER RESISTANCE	MECHANICAL STABILITY	HIGH TEMPERATURES	CORROSION RESISTANCE
Lithium	* * *	* * * * *	* * *	* * * *
Lithium Calcium	* * * *	* * * * *	* * *	* * * *
Lithium Complex	* * *	* * * * *	* * * *	* * * *
Calcium	* * * *	* *	* *	*
Aluminium	* * *	*	* *	* * * *
Calcium complex	* * *	* * *	* * * *	* * * *
Aluminium complex	* * *	* * *	* * * *	* * * *
Calcium sulfonate complex	* * * * *	* * * * *	* * * * *	* * * * *
Clay	* *	* *	* * * *	* *

Poor * **Low** * * **Good** * * * **Very good** * * * * **Excellent** * * * * *

Source: valvolineeurope.com

The thickener determines which grease you should use in diverse conditions.

2.2. BASE OILS

The second component of grease is base oils, which are also quite important since they represent 80-95% of the weight of a typical grease.

CATEGORY	TYPE
Mineral Oils	Paraffinic & Naphthenic
Synthetic	PAO, Ester, PAG & Alkylbenzenes
Natural	Vegetable Oils
High Performance	Silicones & Fluorinated Fluids

Source: Efficient Plant Magazine

Mineral oils are by far the most used in industry grease manufacturing.
A crucial factor in the performance of grease is its **base oil viscosity.**

LOW VISCOSITY IS BEST FOR:

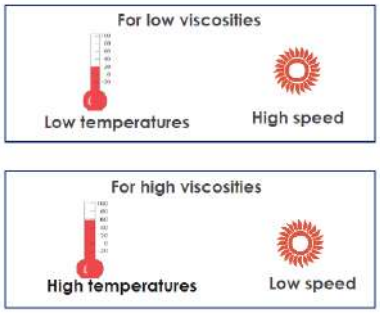
High speed, low load, and low temperatures

HIGH VISCOSITY IS BEST FOR:

Low speed, high load, and high temperatures

VISCOSITY SELECTION TOOL

GENERAL APPILCATION FOR VISCOSITY:



BASE OIL VISCOSITY	APPLICATION
ISO VG 100	Bearings of electric motor, speed bearings > 3600 rpm
ISO VG 150 & 220	Multipurpose grease, moderate speeds
ISO VG 460	High loads, water presence, higher temperatures, low speed
ISO VG > 1000	Very high loads, very low speed

2.3. ADDITIVES

Additives enhance the base abilities of grease and are the third key component in grease. The table below shows the most common additives and their function in greases.

ADDITIVE	FUNCTION
Antioxidant	Retard oxidation of base stock for longer lubricant life
Rust Inhibitor	Protect ferrous surfaces from rusting
Antiwear	Provide wear protection during boundary lubricaion
Extreme Pressure	Provide protection during high load and shock loading conditions
Tackifiers / Polymers	Enhance water resistance and metal adhesivness
Molybdenum Disulfide / Graphite	Solid lubricants providing protection and friction reduction under high load/sliding conditions at low speeds

Source: Efficient Plant Magazine

3. HOW TO READ SPECIFICATION CHARTS LIKE A LUBRICATION EXPERT

Now that we know the fundamentals, let's put that knowledge to good use. Theoretical knowledge is worthless without practice.

In this section, you'll learn just how every ingredient we've mentioned plays its vital role and **how you can read the spec chart like an expert to spot what grease composition you need for your specific case.**

Simply said, every grease has to fulfill 4 basic functions. As pointed out at our official Valvoline website on a topic what makes a good grease, those are:

1 LUBRICATION

The fundamental role of greases. Keeping equipment lubricated reduces friction and heat.

2 ISOLATION

Grease serves as a seal to prevent fluid and solid contaminants from entering a system.

3 LOADING

Greases must withstand great loads without reducing their lubrication performance.

4 CORROSION

Greases prevent corrosion by adhering to the metal surface.

MULTIPURPOSE LITHIUM EP 2	
NLGI grade	2
Soap type	Lithium
Color	Brown
Texture	Smooth
Density @ 20°C	0.905
Application temperature °C	-30 to +120 (max 130)
Dropping point, °C	> 180
Oil Viscosity mm^2/s @ 40°C	190
Oil Viscosity mm^2/s @ 100°C	15,0
4-Ball Weld Load, kg	285
SKF R2F B at 120°C	Pass
Water wash out @ 79°C	< 10%

The spec sheet for the Valvoline Multipurpose Lithium EP 2 grease

But when you look at the specification sheet, these 4 simple functions are presented in a variety of ways, through various properties.

If you're not a lubrication expert, but e.g. an operation manager looking for a good grease vendor, all the numbers and letters in the spec sheet mean almost nothing to you.

Hard to read? Don't worry. In the following sections, we'll go step-by-step through all of these grease properties so you could safely plan your grease procurement.

THE WHOLE SPEC SHEET IS DIVIDED INTO STANDARDS AND PROPERTIES.

3.1. NATIONAL LUBRICATION GREASE INSTITUTE (NLGI)

All greases have to undergo standardized tests and have proprietary specification sheets. Grease is graded by the **National Lubrication Grease Institute (NLGI).**

The NLGI grades designate the relative hardness of a grease - simply put, **consistency.**

Of course, consistency alone isn't enough for choosing the right type for the application. Other factors (like viscosity, mechanical stability, washout resistance...) play their roles as well.

But it's a good starting point.

NLGI	ASTM - Worked Penetration	FOOD ANALOGY
000	445 - 475	Ketchup
00	400 - 430	Applesauce
0	355 - 385	Brown Mustard
1	310 - 340	Tomato paste
2	265 - 295	Peanut butter
3	220 - 250	Vegetable shortening
4	175 - 208	Frozen yogurt
5	130 - 160	Smooth pate
6	85 - 115	Smooth cheddar cheese

Most of the greases are between **1 and 3**.

Those with an NLGI of **000 to 1** are used in cases where you need low viscosity, eg

- enclosed gear drives operating at low speeds
- open gearing

Grades **0, 1, and 2** are used in highly loaded gearing.

Grades **1 through 4** are often used in rolling contact bearings.

Greases with **a higher number** are firmer, tend to stay in place, and are a good choice when leakage is a concern.



3.2. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

Grease is validated by the **American Society for Testing and Materials (ASTM).** That's what those ASTM + numbers designations stand for.

Dropping Point:	ASTM D2265	>550°F (287°C)
Penetration, worked (60 strokes)	ASTM D217	265-295 mm/10
Four Ball Test **Load wear index:** **Weld point:**	ASTM 2596	 70.63 kgf 400 kg
Four ball EP Scar Diameter:	ASTM D2266	< 1.0 mm
Low Temperature Torque @ -54°C **Starting:** **10 minute running:** **1 hour running:**	 ASTM D1478 ASTM D1478 ASTM D1478	 0.27 N-m (0.37 in-lbs.) 0.08 N-m (0.11 in-lbs.) 0.006 N-m (0.09 in-lbs.)
Salt Spray Test (100 hrs.)	ASTM B117	Pass
Dielectric Loss:	ASTM D924	1.2×10^{12}
Dielectric Resistivity:	ASTM D1169	1.7×10^{14}
Dielectric Constant:	ASTM D924	2.5
Oil Separation:	ASTM D6184	< 2%
Evaporation Loss **22 hrs. @ 212°F (100°C):**	 ASTM D972	 <1%
Oxidation Stability - 100 hrs.	ASTM D942	0.5 psi drop
Timken OK Load:	ASTM 2509	40 lbs.
Flash Point:	ASTM D92	>428°F (220°C)
Fire Point:	ASTM D92	>572°F (300°C)
Wheel Bearing Leakage:	ASTM D1263	< 1.0 g
Water Washout (max.):	ASTM 1264	< 1%
Copper Corrosion - 24 hrs. @ 100°C	ASTM D4048	1B, shiny
Acid Number:	ASTM D664	.5 mg KOH/g
Biodegradability	CEC-L33-T82	50% degradability in 28-35 days 60+% degradability in 56 days

Source: Competitor's Spec Sheet

At astm.com, you can find all the possible standards for material testing. Just type in the one you wish to explore further.

Why is this important?

Because these tests prove that the grease you're looking at is compatible with the conditions and applications you aim to use it for.

3.3. DIN AND ISO STANDARDS

DIN (Deutsches Institut für Normung) is a German Institute for Standardization. Every letter and number in a spec sheet has its meaning.

Here's an explanation table.
DIN example **K P 2 N -20**

- Place of application
- Type of base oil and additives
- NLGI
- Higher temperature application (°C)
- Lower temperature application (°C)

1. PLACE OF APPLICATION	
G	Closed gear gearbox
CG	Open gear gearbox
K	Rolling and sliding bearings and sliding surfaces
M	Sliding bearings and gears (lower requirements then K)

2. BASE OIL TYPE AND ADDITIVES	
E	Organic esters
FK	Perfluoric compounds
HC	Synthetic hydrocarbons
PG	Polyglycols
PH	Phosphoric acid esters
SI	Silicone oils
X	Other types
P	EP / AW additives
F	Solids (MoS_2, graphit etc.)

3. HIGHER TEMPERATURE APPLICATION AND RELATION TO WATER		
	Higher temperature	Relation to water
C	60	0 or 1
D		2 or 3
E	80	0 or 1
F		2 or 3
G	100	0 or 1
H		2 or 3
K	120	0 or 1
M		2 or 3
N	140 - 160	
P		

ISO (International Standardization Organisation) standardized the technical specifications worldwide, simplifies the system, and aids the flow of trade via a universally recognized standard.

ISO	L	X	LABEL 1	LABEL 2	LABEL 3	LABEL 4	LABEL 5
Standard	Lubricants	Greases	Lowest application temperature	Highest application temperature	The level of corrosion protection	Pressure conditions	Grease consistency

LABEL 1	Lowest application temperature	LABEL 2	Highest application temperature
A	0	A	60
B	-20	B	90
C	-30	C	120
D	-40	D	140
E	< -40	E	160
		F	180
		G	>180

LABEL	Protection level - environmental conditions	Corrosion protection
A	Dry	Without protection
B	Dry	Protection in presence of water
C	Dry	Protection in presence of water
D	Wet	Without protection
E	Wet	Protection in presence of water
F	Wet	Protection in presence of water
G	Rinsing with water	Without protection
H	Rinsing with water	Protection in presence of water
I	Rinsing with water	Protection in presence of water

ISO EXPLANATION TOOL

LABEL	The ability of lubricating grease to perform lubrication at high or low loads
A	Without EP
B	With EP

NLGI gradation	Penetration 0,1 mm	Grease consistency	Usuall application
000	445 - 475	Semi-fluid	For gear drives and central systems
00	400 - 430	Semi-fluid	For gear drives and central systems
0	355 - 385	Very soft	For gear drives and central systems
1	310 - 340	Soft	For gear drives and central systems
2	265 - 295	Medium soft	For roller bearings
3	220 - 250	Medium	For general application

3.4. GREASE PROPERTIES THAT YOU SHOULD KNOW TO MAKE A GOOD CHOICE

Now that we've covered standards, let's talk about important properties that you'll encounter on almost all of the specification sheets. This will allow you to understand what most grease types are used for.

Viscosity
A fluid's resistance to flow. It's a measure of stickiness. Higher viscosity = lower speed and vice versa.

Application Temperature
A temperature range in which grease can perform as intended.

Ball Weld Load
The purpose of this test is to determine the load-carrying capabilities of grease under high load applications like bearings. This method has become an industry-standard in comparing EP, wear, and frictional functionality.

Dropping Point
This is the temperature of grease where the first drop of oil separates from the thickener. It is the point when the thickener breaks down.

Water Washout
The water washout test measures the ability of a thickener to remain in the bearing when submerged in water or sprayed with it. Good water resistance prevents corrosion.

3.5. ADDITIONAL PROPERTIES YOU MAY SEE ON A SPEC SHEET

Oxidation
Oxidation shortens lubricant's life. That's where antioxidants as additives come into play.

Shear stability
The shear stability measures the softening of grease when sheared for 10,000 or 100,000 double strokes with a grease worker. Loss of less than one NLGI grease grade means that a thickener will remain stable under high shear conditions.

Compatibility
When you mix incompatible thickeners, grease usually becomes soft and runs out of the bearing. When mixing different thickener types, consult the supplier and your machinery manuals.

Pumpability
This is an important property when pumping grease in centralized systems at low temperatures.

Please note: Always check your machinery manuals and consult experts besides reading this guide to ensure you're getting the right grease.

FAQ

Is color somehow relevant to choosing a type of grease?

No, color is not the way to tell if the grease is good or suitable for your particular use case.

We, as manufacturers, use colors for two reasons:

1. For a clear designation and differentiation between greases, as some grease aren't compatible and you don't want to mix them up

2. For marketing purposes, because some colors are important branding-wise

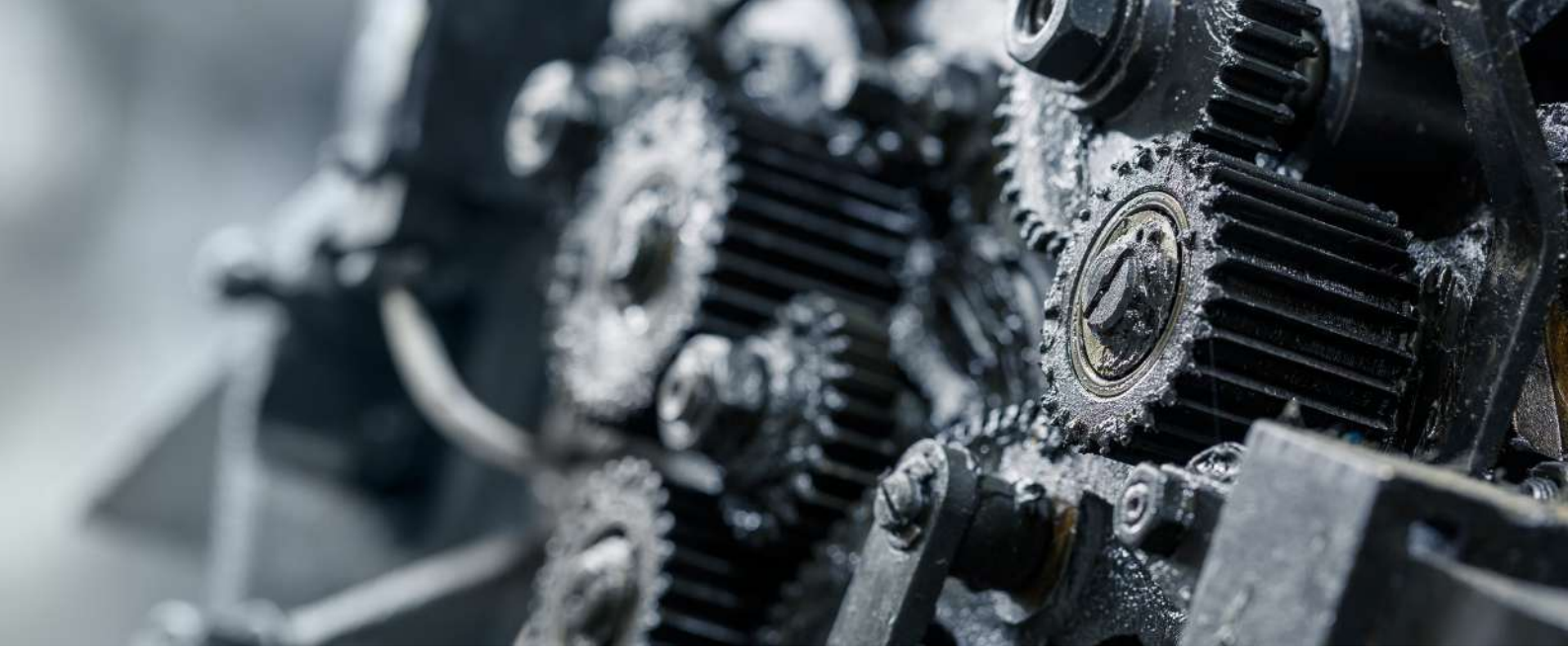
How to decide whether I need oil or grease?

This is somewhat of an old debate. Both oil and grease have their (dis)advantages.
Greases are better for sealing leakages. Grease can remain in equipment longer and tolerate a variety of conditions.

On the other hand, oil is easier to drain. You can more easily control the amount you are using and oil is much cleaner than grease. It also provides better cooling and extends the life of bearings, **as oiled bearings can last twice as long as greased ones.**



In case you're still not sure whether you need oil or grease, contact our lubrication experts to get a personalized recommendation.



4. BENEFITS OF CHOOSING GREASE SMARTLY

Some would say that greasing may be the least important part of your whole budget.

But let's imagine a scenario.

- Paying no attention to regular greasing turns into small leaks.
- Small, invisible leaks leach out your budget.
- The next thing you know, you're hiring mechanics for the third time in a short period to prevent downtime, or even worse, to put machines back into commission.

That's something you wouldn't allow, right?

There's a golden rule of thumb in the grease industry. Grease, and grease often. Machinery that's greased regularly, lasts longer.

- Machinery that lasts longer brings revenue.
- Your total cost of ownership sinks, which allows you to squeeze every dollar from the whole production process.

There are costs in regards to getting new parts because the old ones are already worn out.

By choosing a suitable grease, you're not only saving your company a lot of money, but you're also:

- Increasing uptime and performance, thus ensuring smooth operation
- Reducing wear and tear of parts
- Reducing total cost of ownership (**TCO)**

E.g. For example, a client of ours in the steel industry saved **~103.847 EUR** in a year by using suitable Valvoline lubricants. After replacing the product he was already using and by applying a piece of advice he got from Valvoline consultants, **he was spending 7x less grease.**

We assume that's the kind of investment you could use more productively.

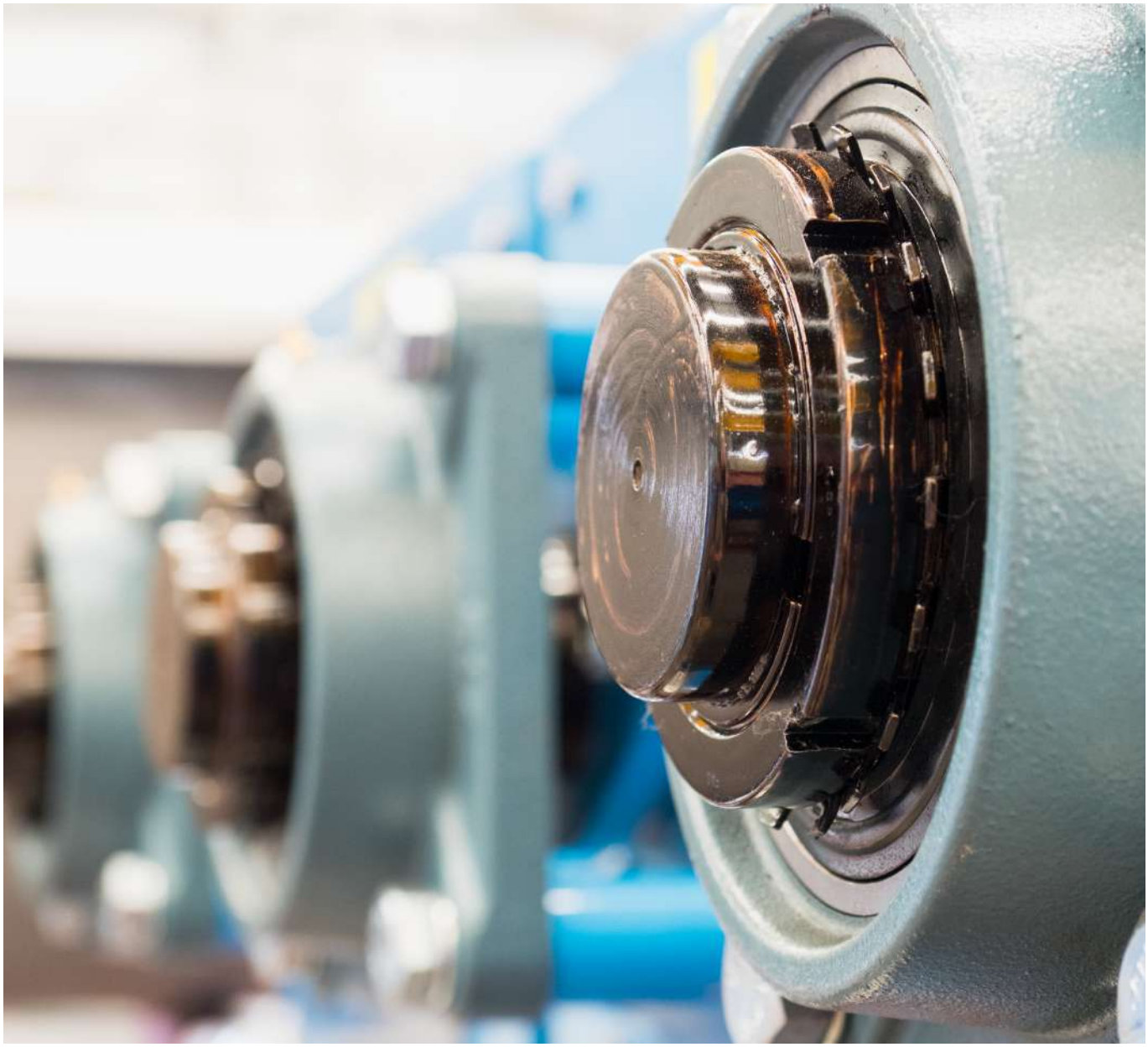
5. CHOOSING THE RIGHT GREASE FOR AGRICULTURE, CONSTRUCTION, OR HEAVY-DUTY INDUSTRIAL MACHINERY

No matter the industry, the three crucial things to remember when choosing the lubricants are

- Conditions you're working in
- Type (and quality) of equipment
- The data in your machinery manuals

These are the golden rules of thumb to follow. You've learned how to read data, you know the conditions, and you're familiar with the type of equipment.

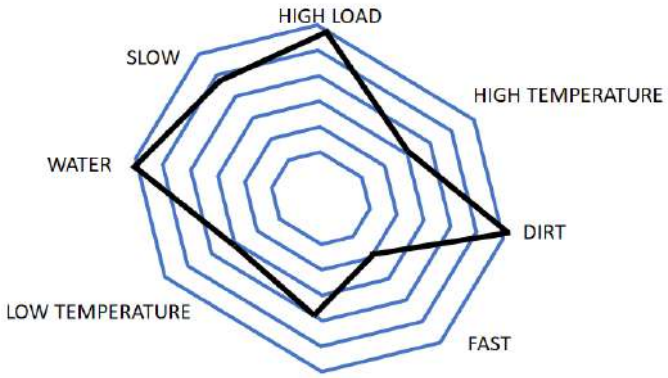
However, every industrial segment has its own needs. In the next 3 chapters, we'll share our direct experience from the field.





5.1. AGRICULTURE APPLICATION

This is the area where Valvoline has a lot of experience. Our on-field analysis found that the most usual conditions are:



When looking for good grease, pay attention to water washout and sealing properties, as well as EP additives.

Grease recommendation from our portfolio:

APPLICATION	PRODUCTS
PINS & BUSHES Atachments, Pivots, Bearings and Pins	VALVOLINE MULTIPURPOSE COMPLEX RED 2 VALVOLINE MULTIPURPOSE LICAL 2/3 VALVOLINE MULTIPURPOSE LITHIUM EP 2 VALVOLINE MULTIPURPOSE MOLY 2 VALVOLINE MULTIPURPOSE LITHIUM 2
CHASSIS OR GENERAL APPLICATION Steering Cardan driveshaft	VALVOLINE MULTIPURPOSE LICAL 2/3 VALVOLINE MULTIPURPOSE CALCIUM 2 VALVOLINE MULTIPURPOSE MOLY 2 VALVOLINE MULTIPURPOSE LITHIUM 2

- Lithium 2, lithium 2 EP, Lithium complex, and Calcium based greases are used for **lubricating bearings in wet conditions** since they show great washout resistance.

- For **Cardan shafts and bushes**, we recommend using multipurpose Valvoline greases with Moly additives.

Before choosing any product, **check the recommendations of the equipment manufacturer.**

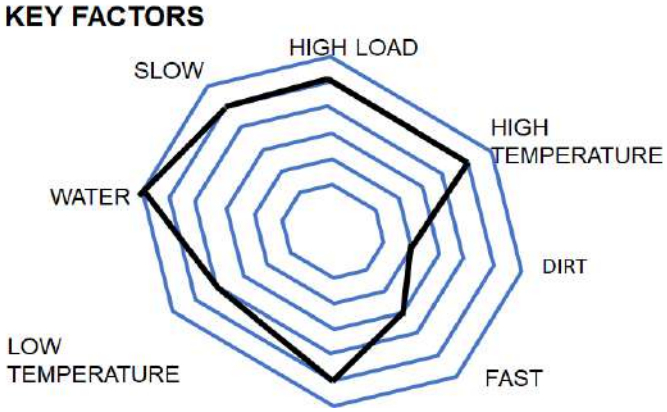




5.2. CONSTRUCTION APPLICATION

The working conditions in the construction industry are usually high loads, a great quantity of water, high temperatures, and slow operating machinery. There's also a lot of dirt.

A grease you choose should be able to keep its performance while enabling smooth operation of all parts, preventing unnecessary downtime, and providing good sealing characteristics.



Those are usually:

- Lithium-Calcium Multipurpose greases/Lithium with Moly/Lithium Complex
- Calcium-sulfonate greases

APPLICATION	PRODUCTS
EARTHMOVING EQUIPMENTS	VALVOLINE MULTIPURPOSE LICAL 2/3 VALVOLINE MULTIPURPOSE MOLY 2 VALVOLINE MULTIPURPOSE COMPLEX RED 2 VALVOLINE MULTIPURPOSE LITHIUM EP-X 2
CRUSHER Bearings	VALVOLINE MULTIPURPOSE LICAL 2/3 VALVOLINE MULTIPURPOSE COMPLEX RED 2 VALVOLINE MULTIPURPOSE CALSUL 2
VERTICAL RAW MILL Bearings	VALVOLINE MULTIPURPOSE LICAL 2/3 VALVOLINE MULTIPURPOSE COMPLEX RED 2
ROTARY KILN Open gears	VALVOLINE OPEN GEAR NLGI 0
CEMENT HORIZONTAL MILL Open gears	VALVOLINE OPEN GEAR NLGI 0

The products we recommend to our clients, that have shown to increase savings and the lifetime of the equipment.

FAQ

Should I choose a lithium multi-purpose/complex grease or calcium-sulfonate?

As shown above, it depends on the part of the machinery.

Some professional magazines for construction experts state that, when lithium greases emerged in the marketplace, they were found to be superior to calcium, and soon became the most popular multi-purpose greases in industry, but they also state that...

"A careful comparison between lithium-complex and calcium-sulfonate greases reveals that calcium-sulfonate greases hold an advantage because calcium-sulfonate greases do not typically need additives to meet certain performance requirements as lithium-complex greases do."

Source: ForConstructionPros



Calcium-sulfonate greases have low **pumpability properties and higher costs**.

New technology has improved CalSul greases and they are now up to par with Lithium-complex greases.

A Calcium-Sulfonate grease can also be applied in more types of industries compared to Lithium-Complex greases, thus making it the preferred choice for a high-performance multi-purpose grease.

If you seek savings, **Lithium complex and LiCal greases may be the best choice.** If you need a huge range of applications, **CalSul** may be the option.

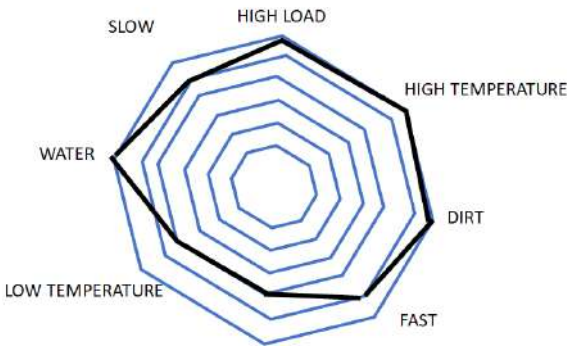
Therefore, our advice is to follow the table and explanations above, your machinery manuals, and **expert advice**, as there is no simple answer.



5.3. INDUSTRY APPLICATION

Heavy-duty Industrial Machinery - a case of a hot steel mill

The usual working conditions in a heavy-duty industrial environment are:



Since every branch of heavy-duty industry has its challenges, we decided to show you a case study instead of giving direct recommendations.

Our goal was to show you **how careful analysis can make huge savings** and why lubrication is an important part of your budget.

Here's an example of a steel mill we cooperated with.

WORKING ROLLERS - OPERATING CONDITIONS

- ☐ **Place of application-finishing liner rolling mill**
- ☐ **Working rollers-horizontal**
- ☐ **Bearing-cylindrical roller bearing SKF**
- ☐ **Rolling speed (m/sec)-4,8-12**
- ☐ **Operating temperatures (t°) - 80°C**
- ☐ **Presence of water-roller bearings business are exposed to constant water flus**





Instead of the **Lithium EP grease** that was used at the moment (and which seemed like a logical choice), we applied **Valvoline Industry CalSul 2, Multipurpose Lithium EP 2,** and **Multipurpose LICAL 2/3.**

APPLICATION	PRODUCTS
CONTINIUS CASTING Roller bearing grease	VALVOLINE INDUSTRY CALSUL 2
HOT/COLD ROLLING MILL	
Work roll bearing grease	VALVOLINE INDUSTRY CALSUL 2
Conveyors rool grease	VALVOLINE INDUSTRY CALSUL 2 VALVOLINE MULTIPURPOSE LITHIUM EP 2 VALVOLINE MULTIPURPOSE LICAL 2/3
EFFICIENT PRODUCTS FOR AN OPTIMIZED MAINTENANCE	
Multipurpose EP greases	VALVOLINE MULTIPURPOSE LITHIUM EP 2 VALVOLINE MULTIPURPOSE LICAL 2/3
FINISHING LINES Roller greases	VALVOLINE INDUSTRY CALSUL 2 VALVOLINE MULTIPURPOSE LITHIUM EP 2

These were the results:

Grease	Initial charge (kg)	Additional lubrication to 8 hours	Consumption of grease daily/bearing (kg)	Consumption of grease daily/hot mill (kg)	Montly consumption in hot rolling mill (kg)	Annual grease consumption in hot rolling mill with first filling (kg)
Current product	6	6	18	432	12.960	156.093
Industry CALSUL 2	6	0.8	2.4	57.6	1.728	21.312

Grease	Annual grease consumption on hot rolling mill (kg)	Product price (€/kg)	Costs (€)
Current product	156.096	1.5	234.144
Industry CALSUL 2	21.312	6	127.872
Current savings			Savings **(€) 106.272**

A change in preferred grease and precise application of various grease types saved 106.272 EUR to this steel mill.



6. FINAL THOUGHTS

Thank you for reading through this white paper. We hope that our **more than 150 years** old expertise and experience, which has been keeping the world moving every day, has improved your knowledge and led you to make better decisions in the future.

What you've learned so far is:

- What's grease
- How to read spec charts
- How to choose grease based on a sector and application

In case of any questions and recommendations for further guides, don't hesitate to contact our team via valvolineeuropemarketing@valvoline.com.

Also, make sure to visit our official website valvolineeurope.com for more resources and high-quality information on lubrication.

Best regards,
Valvoline Europe



محرک چرخش

تأمین‌کننده تخصصی بلبرینگ و رولبرینگ

BEARINGS · SEALS · BELTS · POWER TRANSMISSION

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ساعت کاری	شنبه تا پنج‌شنبه، ۹:۰۰ تا ۱۸:۰۰

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برای استعلام قیمت، اعلام موجودی و ثبت سفارش تکی و عمده گریس VALVOLINE با کارشناسان محرک چرخش تماس بگیرید.

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