THE **EFFECTIVE** GREASING GUIDE

20 TIPS OF GOOD GREASING

PETRO-CANADA LUBRICANTS

A HOLLYFRONTIER BUSINESS

PAUL HETHERINGTON

CORE JOB ROLE –

Sr. Technical Services Advisor

- *Providing technical support to mining, forestry and general manufacturing in BC and AB.*

EMPLOYMENT HISTORY

Joined Petro-Canada in May 2011

- Primarily responsible for providing technical support to major forestry and mining customers in BC and Northern Saskatchewan

Fluid Life Corporation 2002 – 2011

- Developed and Managed Training & Consulting Services

Syncrude Canada Limited 1981 – 2002

- Corporate Advisor Lubes & Fuels (1993 – 2002)
- Previous roles included developing reliability initiatives (vibration analysis, oil analysis, thermography and various NDT techniques)

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INDUSTRY AFFILIATIONS

STLE (**Society of Tribologist & Lubrication Engineers**)

- CLS (Certified Lubrication Specialist) - since 1994
- STLE Member since 1990
- STLE Board of Directors (since 2007)
- **STLE PRESIDENT May 2020 – May 2021**

INDUSTRY EXPERIENCE

- Total Industry Experience – 40 Years
  - Petro-Canada Lubricants - 10 Years
  - Other – 30 Years
- **Direct Lubricant Specialist – 30+ Years**

INTRODUCTION

For maximum productivity and reliability, greasing is a vital part of a maintenance program for most mechanical equipment and electric motors. Around 90% of rolling element bearings are lubricated with grease, as are many other applications including plain bearings and open gears. Follow these tips to make your greasing regimes as effective as possible.

WHAT IS A GREASE?

Grease is a solid to semi-fluid substance composed of base oil, additives, and a thickening agent in various ratios*:

- Base oil: 50-95%
- Thickener: 3-40%
- Additives: 1-15%

Petro-Canada Lubricants starts with the HT purity process to produce water-white, 99.9% pure base oils. The result is a range of lubricants, specialty fluids and greases that deliver maximum performance for our customers.

*2015 NLGI Grease Lubricating Guide

WHAT IS A GREASE?

Base oils + Additive

Base oil is a refined product of crude oil used to formulate lubricants. Base oils can be mineral, synthetic, or natural based. Most greases use mineral oil as a base. However, greases designed to work in extreme temperatures may be formulated using synthetic base oil.

Mineral base oils

Mineral base oils are derived from heavy materials derived from the distillation of crude oil, and then subjected to further processing. They are classified as paraffinic or naphthenic, depending on their composition, which depends on the kind of crude oil that they are distilled from.

Paraffinic oils are mainly composed of straight chain saturated hydrocarbons, while naphthenic oils are primarily composed of ring-like cycloparaffins. Both types are widely used in greasemaking.

Synthetic base oils

Synthetic oils cost more and are usually used for low or high temperature grease applications. Synthetic oils include: Polyalphaolefins (PAO), Polyisobutenes (PIBs), Esters and Polyglycols.

Natural base oils

Vegetable base oils, Canola,

WHAT IS A GREASE?

Thickeners

Thickeners give grease its consistency, from solid to semi-solid or semi-fluid. The thickener forms a three dimensional network (similar to a sponge) to hold the oil (and additives) in place. The fluid component which contains most of the additives is mainly responsible for the lubricating action of the grease.

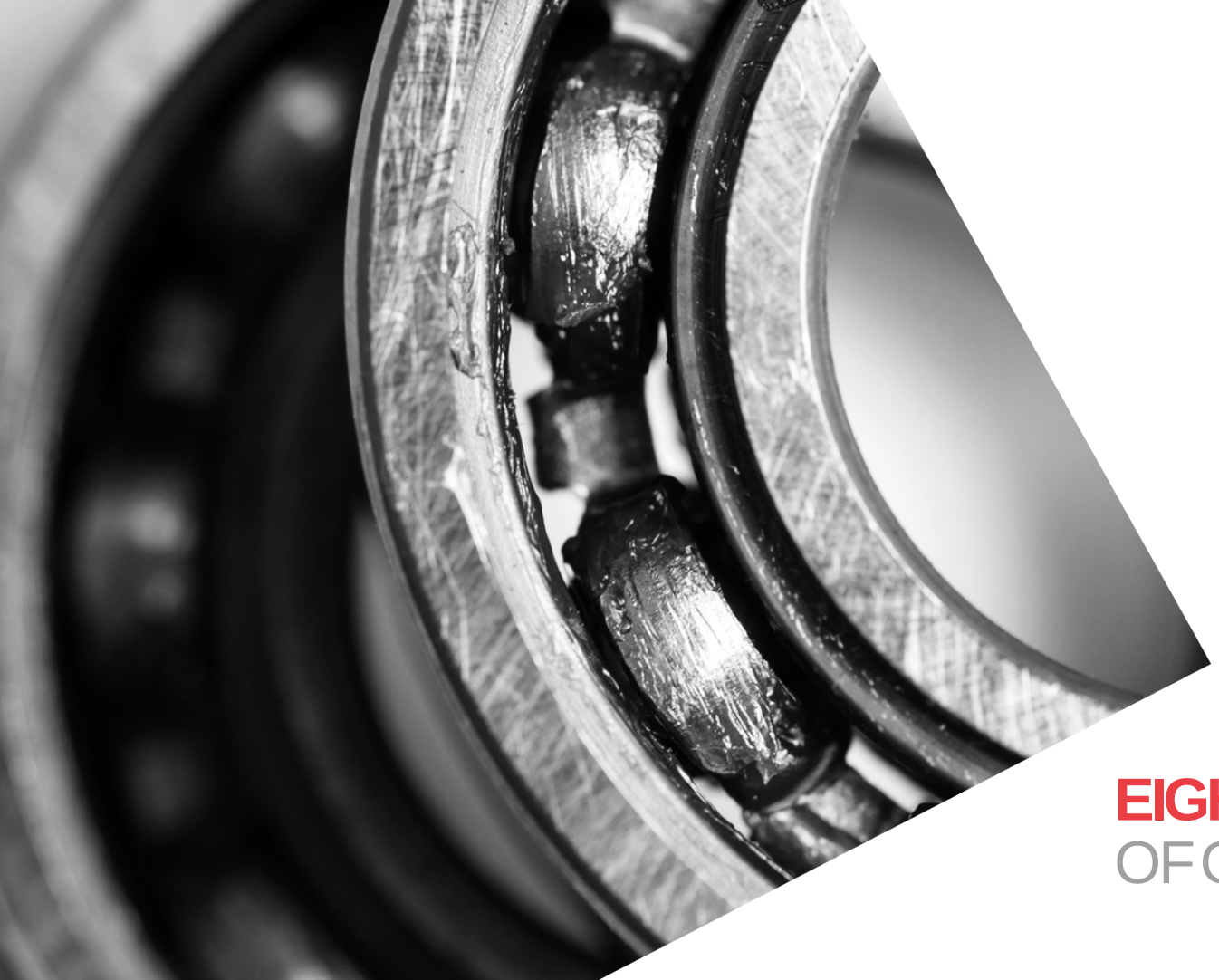
NLGI 000 to 6

Thickeners come in many different types and each provides slightly different properties to the finished grease:

- Soaps - Metal hydroxides are reacted with an organic acid to form a network of soap fibres. Complex greases use more than one different organic acid to improve their properties. Common types are lithium, lithium complex, aluminum complex, etc.
- Non-soaps – Thickeners formed by the reaction of chemicals in the base fluid, such as calcium sulphonate complex or polyurea greases
- Dispersions – polymers, silica or clays dispersed in oil
- Hybrids – combination of above thickener types

WHAT IS A GREASE?

	REGULAR GREASES		COMPLEX					ORGANIC	INORGANIC
Properties	**Calcium**	**Lithium**	**Aluminum**	**Calcium**	**Barium**	**Lithium**	**Calcium Sulphonate**	**Polyurea**	**Clay**
Dropping Point °C	80-100	175-205	260+	260+	200+	260+	260+	250+	260+
*Max Temp °C	65	125	150	150	150	160	160	150	150
High Temp Use	V. Poor	Good	Excellent	Excellent	Good	Excellent	Excellent	Excellent	Excellent
Low Temp Mobility	Fair	Good	Good	Fair	Poor	Good	Fair	Good	Good
Mech. Stability	Fair	Good	Excellent	Good	Fair	Excellent	Excellent	Good	Fair
Water Resist.	Excellent	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Fair
Oxidation Stability	Poor	Good	Excellent	Excellent	Poor	Good	Good	Excellent	Good
Texture	Smooth	Smooth	Smooth	Smooth	Fibrous	Smooth	Smooth	Smooth	Smooth



EIGHT BENEFITS
OF GREASE OVER OIL

EIGHT BENEFITS
OF GREASE OVER OIL

While oil lubrication provides better heat and contamination removal, grease delivers a range of important protective benefits:

1. Stays in place without an oil circulation system

2. Can be used in applications that are not tightly sealed (where an oil could leak out)

3. Can help to seal out contaminants

4. Readily suspends solid additives, such as moly (Molybdenum Disulphide), which provide a benefit in shock loading situations

5. Simplifies equipment design: no filters, coolers, or often pumps are required

6. Allows some bearings to be pre-lubricated at factory and even “sealed for life”

7. Suitable for intermittent operations – stop and go

8. Helps reduce noise and vibrations – dampens the energy

SMART GREASE SELECTION; WHAT TO CONSIDER

You will need to consider a range of factors when selecting the most suitable grease for a specific application:

Thickener Type. Some thickener types work better in different applications. If switching thickener types, you will need to be aware of grease incompatibility. For more information about grease incompatibility, refer to Tip #5.

Oil Type and Viscosity. Since the oil is doing most of the lubrication, its viscosity is important. A synthetic base oil may be required for extreme temperatures.

Load. High loads require higher oil viscosity and the presence of EP agents.

Speed. At higher speeds, a lower viscosity base oil will be required, while at lower speeds a higher base oil is required.

Temperature. Higher temperature applications need higher oil viscosity and stiffer grease. At lower temperatures, lower oil viscosity and softer greases will perform better. Make sure the grease is pumpable at the expected ambient temperatures.

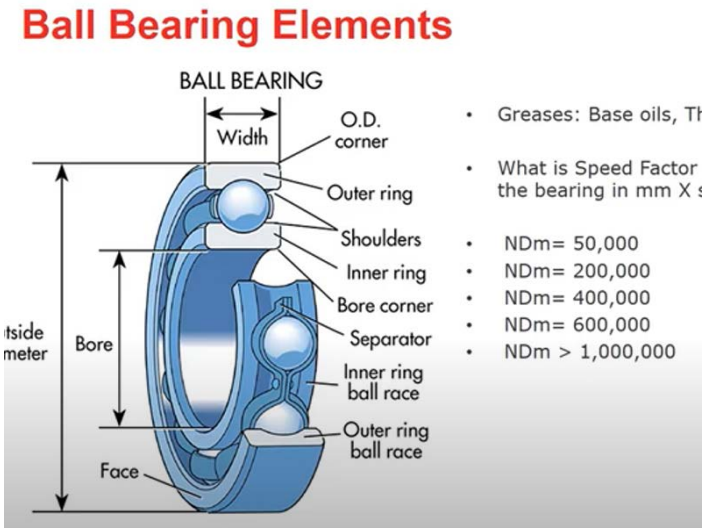
Environment. Grease choice must take into account the operating conditions, such as high moisture or water exposure.

OEM requirements. It is essential to ensure that OEM specifications are complied with.

How to select a grease for a bearing

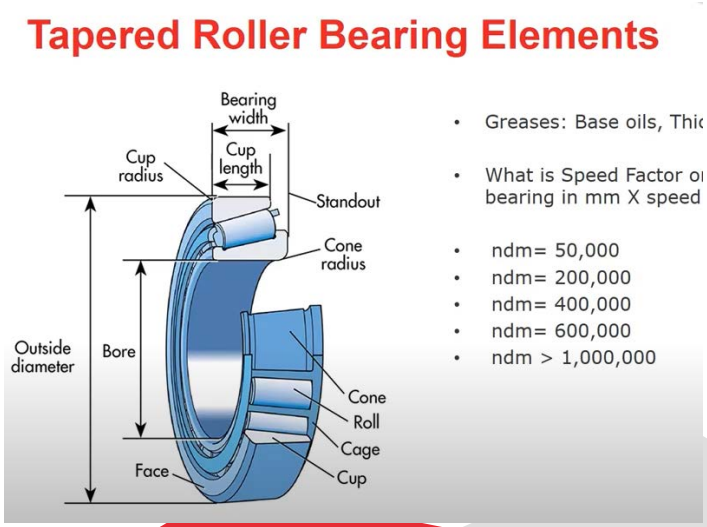
Ball Bearing Grease selection

https://www.youtube.com/watch?v=6ekZiOaWGkg&feature=youtu.be



Tapered Bearing Grease selection

https://www.youtube.com/watch?v=44dtBLT44nM&feature=youtu.be



PETRO-CANADA LUBRICANTS

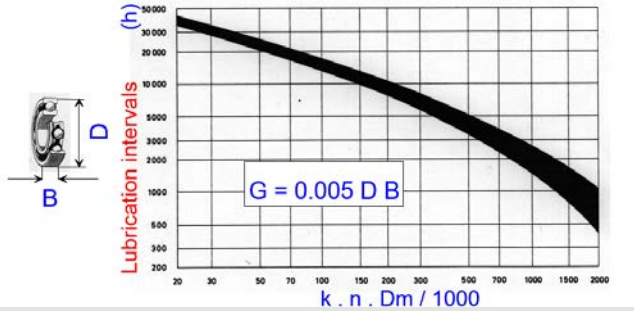
20 TIPS OF GOOD GREASING

FOLLOW THESE TOP TIPS TO MAKE YOUR GREASING AS EFFECTIVE AS POSSIBLE, AND TO ENSURE YOU ARE MAXIMIZING YOUR EQUIPMENT LIFE AND RELIABILITY.

1. More is not always better

Not enough grease can lead to bearing damage – but too much grease can be harmful too, leading to excessive heat and potential damage to seals.

Antifriction bearings should be packed only 1/3 full. Applying a small amount of grease more often is better than a large amount of grease less frequently. Pumping grease slowly into the bearing also helps avoid over-heating.



2. Keep it clean

It is much harder to remove contamination from grease than from oil, since grease can't pass through a fine filter as oil can. It is important to keep grease clean before applying to avoid pushing contaminants into the bearing. Once the bearing is contaminated, it is very difficult to completely clean the system.

Keep all grease containers tightly closed, clean, and well identified. Before applying grease, purge a small amount of grease from the end of the grease gun and wipe it clean, then clean the grease nipple. Consider protective caps to keep grease nipples clean, which can be color-coded to help avoid using the wrong grease.

Alternatively, leave a small amount of grease on the nipple after greasing to protect it from contamination and corrosion. Make sure this grease is cleaned off before any more grease is applied to the bearing.

3. Adapt for tough conditions

Bearings that are exposed to humidity, water, steam, high heat, vibration, and excessive contamination from dirt or chemicals, need to be re-greased more frequently. Bearings on vertical shafts should have their re-greasing interval halved.

The condition and type of seals also effect grease life. Keep these factors in mind when planning your greasing routes and re-greasing intervals. Consider specialty greases with enhanced properties to resist high heat and water exposure.

4. Measure your gun shots

All grease guns are not the same. The amount of grease in “1 shot” or pulse varies between grease guns. Measure the output of each grease gun to know how much “1 shot” of grease is to ensure you are applying the correct amount of grease to the equipment. It is always best to determine the correct volume of grease to add to a bearing and then calculate the number of shots based on the specific grease gun you want to use.

Use new Ultrasound technology to add right amount of grease, listen to the bearing sound

5. Don’t mix your greases

Many types of greases are incompatible. Mixing different thickener types and different types of base oil can both lead to incompatibility. Additives can have incompatibilities too.

Compatibility testing can be used to determine if two greases are compatible. Even when two greases are considered generally compatible, there will often be some decrease in performance if greases are mixed.

It is always best to avoid mixing greases if possible.

		Aluminium Complex	Lithium	Polyurea	Lithium Complex	Barium Complex	Silica	Clay
		VULTREX™ MPG	PRECISION™ General Purpose EP2	Chevron SRI 2	PRECISION™ XL EP2		THERMEX™	
Lithium	PRECISION™ General Purpose EP2	Yes 140						
Polyurea	CHEVRON SRI2	Yes 130	Yes 145					
Lithium Complex	PRECISION™ XLEP2	Yes 159	Yes 170	Yes 158				
Barium Complex		Yes 168	Yes 153	Yes 173	Yes 160			
Silica	THERMEX™	Yes 115	No (*)	No 80	No (*)	Yes 173		
Clay		No 58	No 95	No (*)	Yes 183	Yes 173	No 75	
Calcium Sulphonate Complex	PEERLESS™ OG 2	No 98	Yes 125	No 95	Yes 125	Yes 140	No (*)	No 95

Notes:
1. The number quoted indicates the temperature, in degrees Celsius, at which incompatibility sets in.
2. (*) indicates the mixture is incompatible at all temperatures.

6. Check every identification

Identify every grease gun with the grease inside to avoid accidentally using the wrong grease or mixing incompatible greases. Dedicate a grease gun to a specific grease and clearly label it with the grease name. Clear or color-coded grease guns can help with grease identification.

7. #2 doesn’t always equal #2

NLGI #2 grade greases may have a similar consistency but they can have very different lubricating properties. For example, one “#2 grease” could have an ISO 68 viscosity grade base oil, while another could have an ISO 460 viscosity grade. When selecting a grease, consider if the thickener type, base oil of the grease, and additives in the grease are suitable for the application.

8. Multi-purpose not all-purpose

There is no such thing as an all-purpose grease. Many applications require special greases. Electric motor bearings for example typically use a grease designed without the EP additives found in most other greases. Couplings often require greases designed to avoid separation of the thickener and base oil due to the high centrifugal forces present.

9. No color code is not color-coding

The colors of greases are simply dyes chosen by the manufacturer. They have no standardized meaning. For example, red does not signify high temperature performance, and blue does not mean electric motor bearing grease.

10. Make sure you know Moly.

Greases with Molybdenum disulphide (a.k.a. “moly”) additives provide excellent protection against shock load loads at lower speeds. However, at high speeds, generally above 1600 rpm, avoid using greases with moly as it does not provide much benefit and there can be issues with the solid moly particles in the grease.

11. Don’t forget the oil

Grease is comprised mostly of oil, so you need to select the correct viscosity oil in the grease for the application. Viscosity selection depends on many factors including speed, load, base oil viscosity index, and operating temperature (as viscosity changes with temperature). For guidelines see table opposite.

Viscosity Grade	General Application Guidelines
ISO 100 and lower	Used at high speeds (e.g. > 3600 rpm), low loads, or low temperatures.
ISO 150 / 220	Moderate speeds up to 3600 rpm, good load carrying, typical multi-purpose grease’s oil.
ISO 460	Higher loads and lower speeds than ISO 150 / 220. Often improved water resistance.
ISO 1500	Typical speeds usually < 100 rpm, excellent load carrying, good water resistance, often high temperatures.

12. Obey the speed limit

At high operating speeds, a stiffer grease such as an NLGI #2 or #3 with lower base oil viscosity is more suitable. The limiting speed factor for a grease, often expressed as a DN or nD value, is also an important consideration.

DN = RPM X (OD+ID/2)

DN= 50,000	BOV= 1000-1500 cSt @ 40 C
DN= 200,000	BOV=400-500 cSt @ 40 C
DN= 400,000	BOV=100-150 cSt @ 40 C
DN= 600,000	BOV < 70 cSt @ 40 C
DN > 1,000,000	BOV 15-32 cSt @40 C

13. Grease on the move

If possible, keep bearings moving while greasing so as to evenly distribute the grease within the bearing. If it is not safe to access the grease point while the equipment is not running, turn the equipment by hand if possible, or consider adding a line from a safe location to the grease point.

14. Choose the rightline

When using grease lines, keep the line as short as possible. Long grease lines can be harder to pump and if the grease sits in the lines for long periods, it may age or even separate.

Do not use copper tubing; use tubing designed for grease so it does not react negatively with the grease or additives.

Match the pressure of distribution system with the diameter and length of the grease lines.

15. Don’t freeze up

Cold temperature pumpability is a real concern if grease is exposed to cold ambient temperatures. You may need to switch between a thinner grease in the winter (e.g. NLGI #0 or #1) and a harder grease #2 in the summer, or select an appropriate multi-season grease for year-round use.

16. If it's inaccessible, make it automatic

For locations that are hard to access or not safe to reach, such as fans near the ceiling of a large building, consider automated lubricators. Choose the right one for the environment and the grease. Remember to check all automatic lubricators periodically to ensure they are still working properly and have not run out of grease.

17. Know when ‘sealed’ doesn’t mean sealed

Many applications in extremely dirty, wet, and/or extreme heat environments use shielded or purgeable labyrinth sealed bearings. These are not “sealed” bearings, so a regular complete purge of these bearings while running is recommended to void the bearing of most entrapped contaminants. Shielded and purgeable bearings will set their own level of grease after the purging routine is complete.

18. Know when to purge

As well as re-greasing, it is important to purge out old grease periodically. If the bearing has a drain port, remove the drain plug and clean out any hardened grease to allow the spent grease to be easily purged from the bearing.

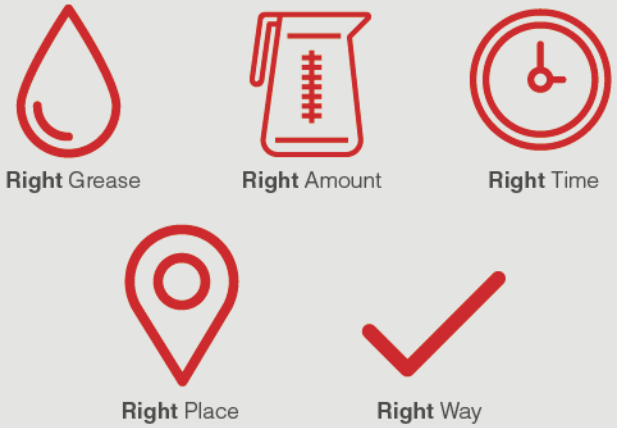
After purging, leave the drain plug out for about 20 minutes of operation to let excess grease be purged out. Bearings can also be cleaned manually, but take extreme care not to damage the bearing or introduce any contaminants.

19. Plan, record, adjust, repeat

Having a lubrication schedule is essential but it is also important to record what was actually done. Adjusting and optimizing the schedule is an essential part of ensuring that all grease points are being properly lubricated.

20. Know your Rights

Putting extra effort into designing a proper greasing program and educating everyone involved will pay off with increased equipment life and reliability. Make sure you are following the five rights of greasing:



THANK YOU

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