The Rights and Wrongs of Greasing : From Selection to Application

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When it comes to greasing, there are many ways to get it right and many ways to get it wrong. Sometimes people think of greasing as a simple task that doesn’t require any skill or dedication, and others believe it is more of an exact science and that adhering to proper regreasing practices will yield the biggest return on equipment availability.

Greasing is more of an exact science than not, stemming from weighing a shot of grease from your grease gun to calculating regrease volumes and frequencies. Greasing is one of the more simple lubrication tasks in execution, but it can be just as difficult as taking a proper oil sample without proper training, experience and tools. This article will explore the subject of greasing from the selection process to the application process and try to expand your perception of the dedication and precision required to get the most from each stroke of the grease gun.

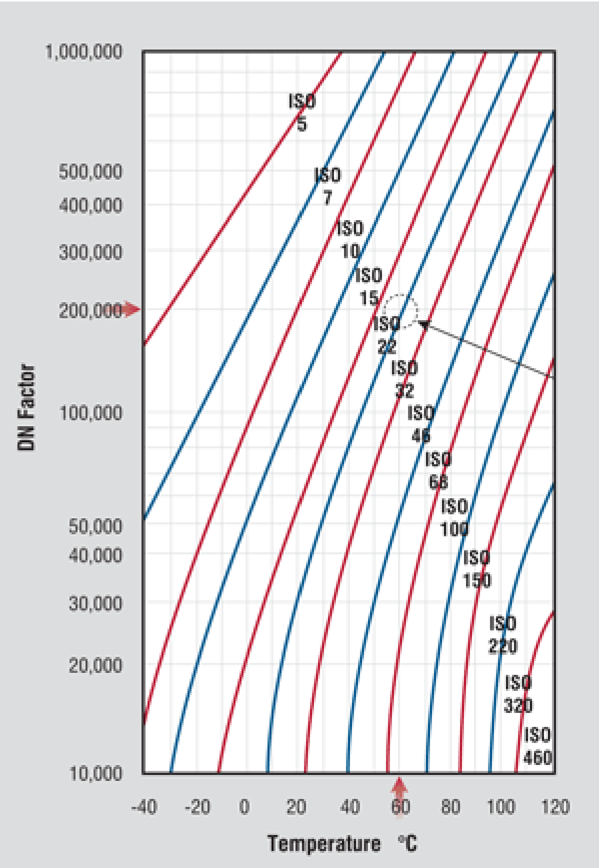

Figure 1. DN vs. Operating Temperature

Grease Selection

Precision greasing starts with the selection of the proper grease for the application. Grease selection utilizes the same concepts as oil selection, but with a few more variables to consider. When selecting the proper grease, many times the “best” product wins out simply because it is the most expensive and says it is a “do all” grease. This approach can be very costly, not just in the purchasing expenses but the possibility of equipment failures. Just because a particular grease says it is the best product on the market doesn’t mean it is the best product for your application.

Here is a short list of grease selection guidelines to aid in the selection process. These guidelines may need to be adjusted to fit your application needs.

1) Determine the proper base oil viscosity. There are many different ways to determine the viscosity requirement for a grease application. One method is to use speed factors such as NDm (NDm = rpm x [(bearing bore + outside diameter) ÷ 2]) or DN [DN = (rpm) x (bearing bore)] and the operating temperature to derive the minimum viscosity requirement.

Typically, the NDm method is more accurate since it relies on the bearing’s pitch diameter instead of just the bearing bore. Once you have properly selected the minimum viscosity, certain correction factors should be applied depending on operating conditions to arrive at the “optimum” required base oil viscosity. Figure 1 is a representation of the DN and operating temperature method.

2) Determine the proper grease thickener type and consistency. Grease thickener type is becoming a more predominant criterion in grease selection due to the increasing number of thickener types available. The thickener type is application dependent. Most general-purpose greases will use lithium or lithium-complex thickener. For high-temperature applications, bentone or clay thickener is preferred for its thermal stability against bleeding. For heavy water environments, aluminum complex thickener is preferred for its water washout stability. Also, be aware of thickener type when changing greases in the same application as not all types are compatible.

Grease consistency is controlled by thickener type, thickener concentration and base oil viscosity. It should be noted that a grease with a high base oil viscosity does not always have a high consistency, and vice versa. The National Lubrication Grease Institute (NLGI) developed a scale for determining thickener consistency which ranges from 000 (semi-fluid) to 6 (block grease). The most common NLGI number is 2. Figure 2 depicts the relationship of consistency, base oil viscosity, speed and loading.

3) Determine the proper base oil type. Base oil type selection always has been a fundamental argument. Many argue that mineral oil is the way to go, while others argue for synthetic oil. Actually, both of these arguments can be true or false at any given time. Base oil type is another variable determined by operational conditions. For most conditions, a mineral oil will suffice; but for those conditions that are on the extreme ends of the temperature spectrum, a synthetic will more than likely be the base oil type of choice. Synthetic base oil selection also can be justified if extended lubricant life is required and costs can be justified.

4) Determine the proper additive package. Additive packages also are determined by operational conditions and requirements. Most additives found in lubricating oils are also found in greases, such as anti-wear (AW), extreme pressure (EP), rust and oxidation inhibitors (RO), and so on. The additive package selected solely depends on the application requirements. For example, a slow-moving, standard-temperature conveyor bearing may use either an EP or AW additive package, but a high-speed, high-temperature electric motor will require only AW, not EP. The reason EP isn't used in electric motors is due to its high chemical corrosiveness at high temperatures. For this reason, additives are just as important in the grease selection process as base oil viscosity/type and thickener type. Additives are included in the formulation to help with the performance and durability of the grease, but selecting the wrong additive package for the application can have a reverse effect.

5) Determine the required performance properties. As with lubricating oils, greases have their own specific performance properties, such as dropping point, mechanical stability, water washout, bleed characteristics and pumpability. Based on these properties, a grease selection method should contain testing on greases chosen to perform under adverse conditions. This means that if a grease is being used in a very slow-speed, highly loaded application, you should perform a test for the grease's ability to withstand this loading; but for a standard application, where operational and performance conditions aren't subjected to the extremes, choosing a standard-performing grease should suffice as long as all other selection steps have been followed.

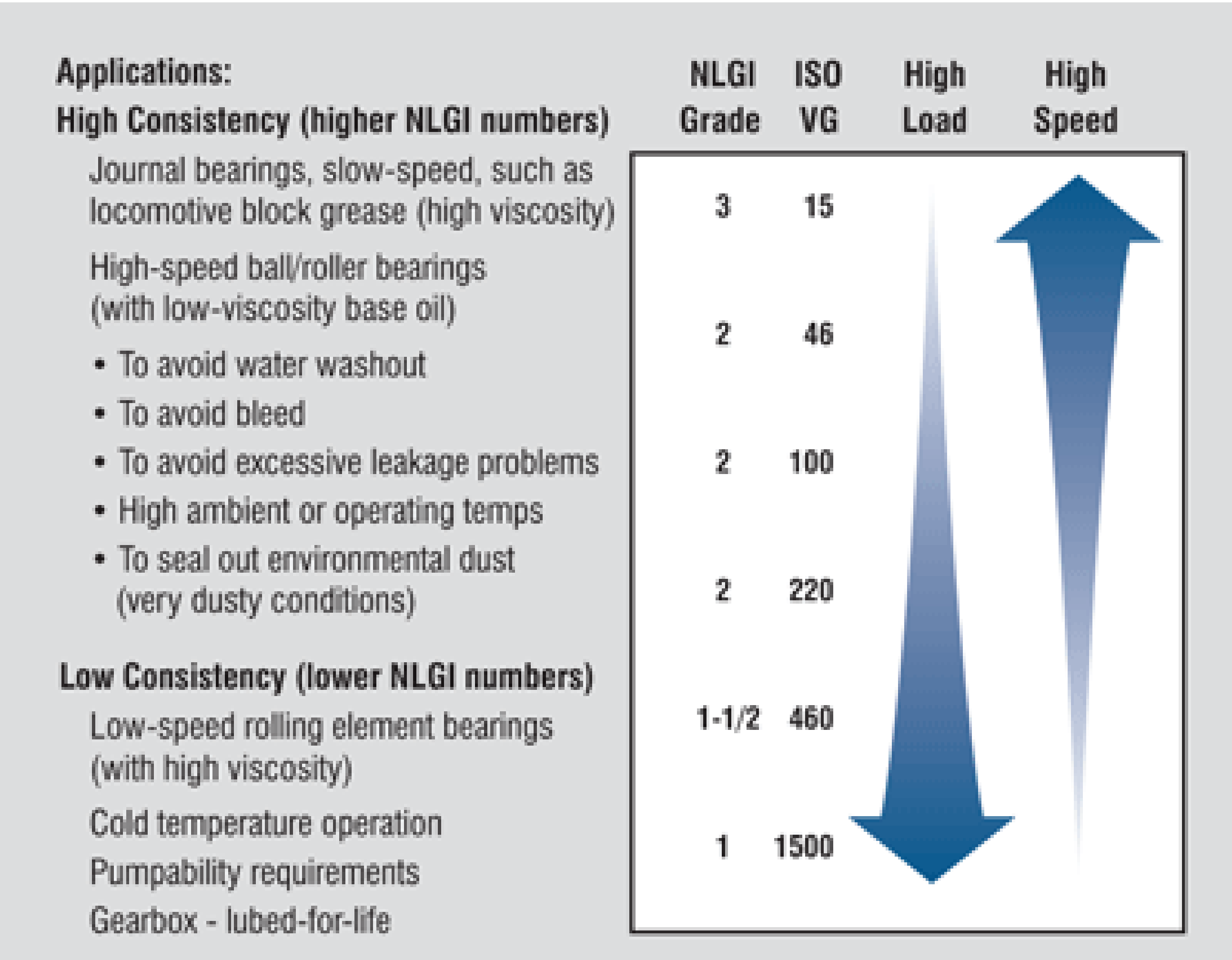

Figure 2. Grease Consistency

Relubrication Volume

Once you select the proper grease, it is time to determine the proper relubrication volume. There are many methods used to derive the relubrication volume. These can range from a general calculation to using ultrasonic technology. To build a world-class lubrication program (not just for greasing), employ multiple technological disciplines to ensure that you have accounted for all of the variables. Two of the many methods used to determine the relubrication volume of a grease-lubricated bearing is the calculated volume and ultrasonic-assisted greasing.

The calculation is:

Gq = 0.114 x D x B

Where ...

Gq = Relubrication volume (ounces)

D = Bearing outside diameter (inches)

B = Bearing total width (inches)

Both of these methods are acceptably accurate when used by themselves, but when they are used in conjunction, the accuracy of the relubrication volume increases substantially. Figure 3 is a representation of adjusting the relubrication volume with the help of ultrasonic technology. As shown here, the calculated relubrication volume can be increased or decreased depending upon the ultrasonic signal.

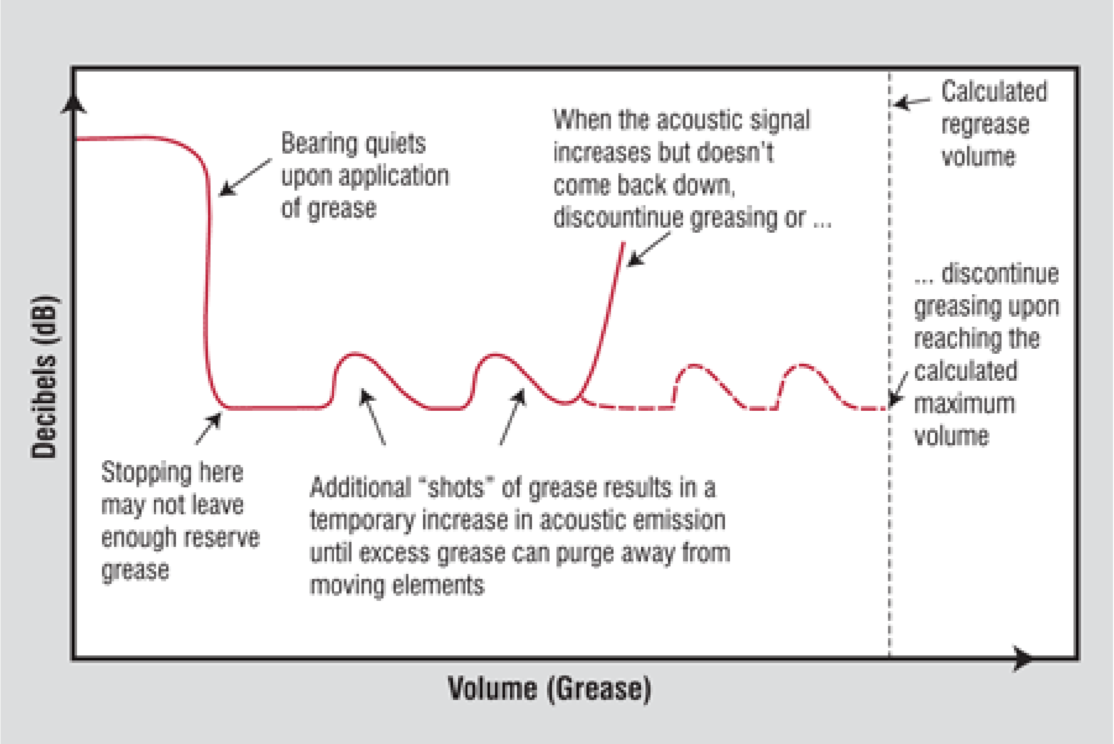

Figure 3. Ultrasonic-assisted Relubrication Volume

Relubrication Frequency

As with determining the relubrication volume, there are many methods for determining the appropriate relubrication interval. This is a variable that depends on a host of outside factors, including contamination, operating time, temperature, etc. For the sake of consistency, a calculated and an ultrasonic approach will be discussed. The most accurate but most subjective method, due to determining certain correction factors, is the calculated frequency.

$$T = K \times \left[\left(\frac{14{,}000{,}000}{n \times (d^{0.5})} \right) - (4 \times d) \right]$$

Where ...

T = Time (hours)

K = Product of correction factors

n = RPM

d = Bore diameter (inches)

Using ultrasonic technology here will help you hone in on the most accurate relubrication interval achievable. It will take time, dedication and data, but it can show big savings in manpower and cost if implemented correctly. Figure 4 shows the correlation between the calculated relubrication frequency and ultrasonic technology.

As shown in this figure, the alarm limit for relubrication frequency either can be triggered by the calculated interval or the ultrasonic threshold being surpassed. This technology will help ensure that over- or under-greasing is kept to a minimum.

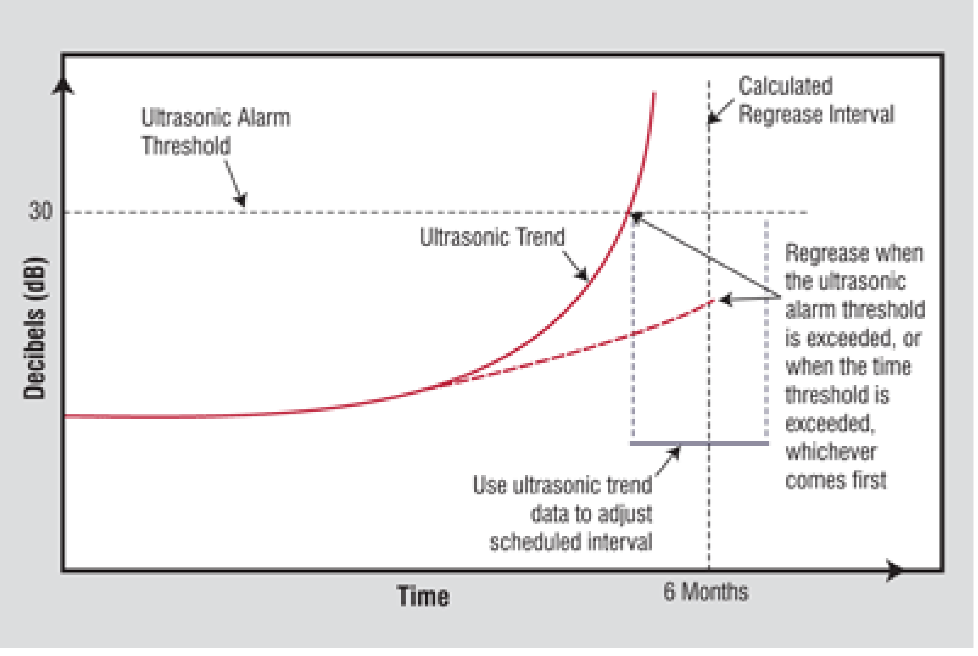

Figure 4. Calculated and Ultrasonic Re-lubrication Frequency

Relube Application Method

There are many application methods available to choose from depending on the application's requirements, available manpower and allowable budgets. There are two typical methods for applying grease: manual grease gun and central grease system or single-point lubricator (SPL). Each of these methods has benefits and drawbacks.

Some benefits of using a manual grease gun are: the lubrication engineer gets to see how the equipment is performing and if any important maintenance items need to be addressed before a catastrophic failure occurs. Some of the drawbacks are: it is more labor intensive and can be less accurate depending on the lubrication engineer's knowledge and experience levels.

Some benefits of using a central grease system or SPL are: less manpower is needed and it can be used in remote locations for easier and safer relubrication. Some of the drawbacks are: the lubrication engineer is less aware of the operating conditions and maintenance needs of the equipment due to the length of time between reservoir refills, and over- or under-lubrication can easily happen depending on the calibration of the lubricating unit.

When using the manual grease gun application, it is important for the lubrication engineer to know the exact amount of grease expelled from the grease gun with one stroke. To know this, simply use a digital scale and dispense one stroke's worth of grease and weigh it.

Summary

Having an increased knowledge of the factors that are needed to employ proper greasing, it is easy to see why this fundamentally easy task can lead to ill-advised decisions and inaccurate results. A proper regreasing strategy should include fundamental methods along with some new technologies, such as ultrasonic-assisted functions, and a lubrication engineer with proper training and knowledge.

References

"Step-by-Step Grease Selection". Machinery Lubrication magazine, September 2005.

Figures 1 and 2 are courtesy of ExxonMobil.

Machinery Lubrication (3/2010)

About the Author

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