



## marine lubricants information bulletin 12

# marine industry greases



Grease lubricants have many applications onboard marine vessels; they provide sealing and retention on lubricated parts. Unlike oil lubricants, grease does not require frequent replenishment and, in open systems, it is used to coat surfaces where it is impractical to use oil.

Grease is a semi-solid product consisting of a thickener dispersed in a liquid lubricant. The thickener forms a network structure that holds the lubricant stationary, comparable to a sponge holding water. The two most distinguishing properties of grease are its consistency and dropping point.

### Grease consistency

The consistency of grease is reflected by a penetration number. To determine the penetration number for a grease, a test amount is worked for 60 strokes to obtain a uniform sample. Then, a standard cone penetrates the sample under specified conditions of load, time, and temperature. Lastly, penetration depth is measured, and the depth is expressed in tenths of a millimeter.

Based on the penetration depth, the National Lubricating Grease Institute (NLGI) consistency grade is defined, as shown in Table 1. The NLGI in the United States defined a series of consistency grades ranging from 000 (very soft) to 6 (very hard). Each grade corresponds with a range of values for the penetration depth.

### Dropping point

As temperature increases, grease gradually softens until it starts to become "liquid." The dropping point is the temperature at which liquid starts to form. It is measured by heating a sample in a test cup, with a small orifice at the bottom, until the first drop of material falls from the lower end of the cup. The dropping point for a grease is largely

**Table 1: NLGI classification for greases**

| NLGI Grade | Worked Penetration Depth Range (mm/10) |
|------------|----------------------------------------|
| 000        | 445–475                                |
| 00         | 400–430                                |
| 0          | 355–385                                |
| 1          | 310–340                                |
| 2          | 265–295                                |
| 3          | 220–250                                |
| 4          | 175–205                                |
| 5          | 130–160                                |
| 6          | 85–115                                 |

determined by the thickener. Unlike calcium soaps, lithium soaps and, especially, lithium-complex soaps, result in high dropping points.

The dropping point determines the maximum usable temperature for a grease. In systems without frequent relubrication, we recommend staying at least 15°C to 30°C below the dropping point of the grease in service. However, with frequent or continuous relubrication, this service temperature limit can be raised.

### Key properties

The key properties of a grease must match its intended application and required performance criteria. These properties relate to the composition of the grease.

Thickener and oil phase play important roles in grease composition. The thickener is usually present at a concentration level between 5% and 30%, depending on the desired consistency or “hardness” of the grease.

Metal soaps, such as calcium and lithium, are widely used as a thickener in marine greases today. While metal soaps are produced by the reaction of a single organic acid to the metal hydroxide, complex soaps are synthesized by the co-crystallization of two or more organic compounds with the metal hydroxide. This creates a more complex soap structure and provides higher thermal stability.

Additional non-soap chemicals, urea or inorganic materials (bentonite clays), can be applied in certain cases.

Table 2 (on the next page) shows the general characteristics and applications of the main grease families used by the marine and general industries. Lubricants provide the lubrication qualities of a grease and consist of mineral paraffinic or synthetic-based oil and a combination of various additives. These additives are:

- Anti-oxidants to prevent oil degradation as a result of heat or oxidation
- Rust and corrosion inhibitors to protect lubricated metal surfaces against rust from saltwater contamination
- Anti-wear additives to strengthen the lubricating film and reduce adhesive wear
- Tackifiers, such as fibrous molecules, to enable the grease to cling to the metal surface and prevent it from being thrown off when the equipment is rotating
- Solid friction modifiers, such as graphite powder or Molybdenum Disulphide ( $\text{MoS}_2$ ), to allow the grease to tolerate very high loads or shock loads

#### **Chevron marine grease products**

As shown in Table 3 on the next page, our range of high-performing greases for specific marine applications meet the lubrication requirements of onboard marine vessels. These greases are formulated to meet the demands of extreme pressure, temperature, and corrosive environments — ideal properties for many marine applications.

Our marine grease product line includes:

**Multifak® EP**, an excellent multipurpose grease, is based on lithium soap. It has a smooth, buttery texture and is highly adhesive and water-resistant. This grease achieves high load-carrying capacity and low wear rates as a result of antiwear additives included in the formula. Multifak EP has two consistency grades, 0 and 2, that will satisfy the grease requirements for a majority of marine equipment. We especially recommend the 0 grade for use in central lubrication systems.

For protection against seizure under highly loaded service conditions, we recommend our **Molytex® EP 2** grease. This multipurpose, extreme-pressure lithium grease contains  $\text{MoS}_2$  as a solid filler. This grease is specifically developed for use in constant-velocity joints.

Molytex EP 2 can also be used for all types of anti-friction bearing arrangements, from plain sleeve-type to rolling element bearings and bushings and other sliding surface or pivot points.

We also recommend Molytex EP 2 for the lubrication of (deck) cranes. Compared with other products in the market, this product increases the service life of rudder shafts by up to 30 percent.

The presence of  $\text{MoS}_2$  in grease provides an extra measure of protection in shock-loading situations. During heavy shock-loading, the lubricant film between metal surfaces can temporarily squeeze out, which can result in equipment damage. The  $\text{MoS}_2$  in the lubricant prevents metal-to-metal contact and protects the equipment.

We recommend **Texclad® 2** for applications on deck where exceptional water resistance is desired during continuous wet operation and where temperatures remain relatively low. This water-stabilized calcium grease contains selected graphite and molybdenum disulphide fillers. The presence of these solid lubricants guarantees reliable lubrication even under extreme heavy-duty operating conditions, such as open gear operations. The high adhesiveness to metals in Texclad 2 resists displacement or run-off and prevents the metal-to-metal contact of gear teeth, chains, and wire ropes. Additionally, the product is bitumen-free, which provides a more environmentally acceptable lubricant solution. Extended use of mineral grease at temperatures above 130°C causes rapid oxidation and degradation of the grease in service.

As an extension to the range of mineral greases, we offer **Ulti-Plex® Synthetic Grease EP**. This grease is formulated with a lithium-complex thickener and a synthetic base stock. It is designed for use in extreme temperature environments and for applications requiring extended re-lubrication intervals. Ulti-Plex Synthetic Grease EP provides outstanding thermal stability up to 140°C in continuous service and up to 230°C in central lubrication systems.

This grease retains its pumpability in temperatures as low as -30°C and provides proper bearing lubrication at temperatures as low as -50°C. Its anti-corrosion properties make it a superior multipurpose marine lubricant for use in deck equipment, offshore drilling equipment, and lubricated shaft bearings, cranes, and winches.

**Table 2: Grease types — properties and applications**

| Thickener                             | Grease properties                   |                  |                        |                                               | Applications                                                                            |
|---------------------------------------|-------------------------------------|------------------|------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------------|
|                                       | Appearance                          | Water resistance | Temperature resistance | Specific properties                           |                                                                                         |
| <b>Soap thickened greases</b>         |                                     |                  |                        |                                               |                                                                                         |
| Sodium (Na)                           | Rough, fibrous                      | —                | +/-                    | Good metal adhesion                           | Older equipment with frequent relubrication; roller-element bearings.                   |
| Calcium (Ca)                          | Smooth, buttery                     | ++               | —                      |                                               | Bearings in wet conditions; rail lubricant.                                             |
| Lithium                               | Smooth, buttery to slightly stringy | +                | +                      | Resistant to softening and leakage            | Wheel bearings; multi-purpose grease.                                                   |
| <b>Complex soap thickened greases</b> |                                     |                  |                        |                                               |                                                                                         |
| Calcium complex                       | Smooth, buttery                     | ++               | ++                     | Inherent load carrying capacity               | High-temperature bearings.                                                              |
| Lithium complex                       | Smooth, buttery                     | +                | ++                     | Resistant to softening and leakage            | Wheel bearings; high-temperature service including various roller-element applications. |
| <b>Non-soap thickened greases</b>     |                                     |                  |                        |                                               |                                                                                         |
| Polyurea                              | Smooth, slightly opaque             | ++               | ++                     | Oxidation resistant less resistant to leakage | Roller-element bearings; Constant velocity joints.                                      |
| Organo-clay                           | Smooth, buttery                     | ++               | ++                     | Resistant to leakage                          | High temperature bearings with frequent relubrication; steel mill roll neck bearings.   |

**Table 3: Chevron's range of marine greases**

| Product Name                   | Thickener       | Base oil  | Consistency (NLGI-class) | Dropping Point (°C) | Application Range (°C) |
|--------------------------------|-----------------|-----------|--------------------------|---------------------|------------------------|
| Multifak® EP 0                 | Li-soap         | mineral   | 0                        | 200                 | -30 to 120             |
| Multifak EP 2                  | Li-soap         | mineral   | 2                        | 200                 | -30 to 120             |
| Molytex® EP 2                  | Li-soap         | mineral   | 2                        | 210                 | -30 to 120             |
| Texclad® 2                     | Ca-soap         | mineral   | 2                        | 106                 | -10 to 60              |
| Ulti-Plex® Synthetic Grease EP | Li-complex soap | synthetic | 1.5                      | 285                 | -50 to 230             |

### Grease compatibility

Before replacing your current grease, contact your Chevron marine representative for advice on the compatibility of using a new grease with the one in service. The compatibility diagram in Table 4 serves as a guideline and lists the main thickener systems used by the industry. Actual compatibility may, however, depend on the additive or base oil system of the specific products being mixed.

The Chevron Technology laboratory is one of the best-equipped grease testing facilities in the world. In addition to testing general physico-chemical characteristics, the lab conducts performance bench tests and continuously monitors the quality of grease batches produced and tests used greases arriving from the field. Our technical department personnel can always provide advice on grease compatibility issues. ■

**Table 4: Compatibility between different grease types**

|                  | Aluminum Complex                      | Barium Complex | Calcium      | Calcium Complex                       | Clay         | Lithium                               | Lithium Complex                       | Polyurea                              | Sodium       |
|------------------|---------------------------------------|----------------|--------------|---------------------------------------|--------------|---------------------------------------|---------------------------------------|---------------------------------------|--------------|
| Aluminum Complex | Compatible                            | Incompatible   | Incompatible | Incompatible                          | Incompatible | Borderline — sample should be checked | Borderline — sample should be checked | Incompatible                          | Incompatible |
| Barium Complex   | Incompatible                          | Compatible     | Incompatible | Incompatible                          | Incompatible | Incompatible                          | Incompatible                          | Incompatible                          | Incompatible |
| Calcium          | Incompatible                          | Incompatible   | Compatible   | Compatible                            | Incompatible | Compatible                            | Compatible                            | Incompatible                          | Incompatible |
| Calcium Complex  | Incompatible                          | Incompatible   | Compatible   | Compatible                            | Incompatible | Borderline — sample should be checked | Borderline — sample should be checked | Incompatible                          | Incompatible |
| Clay             | Incompatible                          | Incompatible   | Incompatible | Incompatible                          | Compatible   | Incompatible                          | Incompatible                          | Incompatible                          | Incompatible |
| Lithium          | Borderline — sample should be checked | Incompatible   | Compatible   | Borderline — sample should be checked | Incompatible | Compatible                            | Borderline — sample should be checked | Borderline — sample should be checked | Incompatible |
| Lithium Complex  | Borderline — sample should be checked | Incompatible   | Compatible   | Borderline — sample should be checked | Incompatible | Compatible                            | Compatible                            | Borderline — sample should be checked | Incompatible |
| Polyurea         | Borderline — sample should be checked | Incompatible   | Compatible   | Borderline — sample should be checked | Incompatible | Borderline — sample should be checked | Borderline — sample should be checked | Compatible                            | Incompatible |
| Sodium           | Incompatible                          | Incompatible   | Incompatible | Incompatible                          | Incompatible | Borderline — sample should be checked | Borderline — sample should be checked | Incompatible                          | Compatible   |