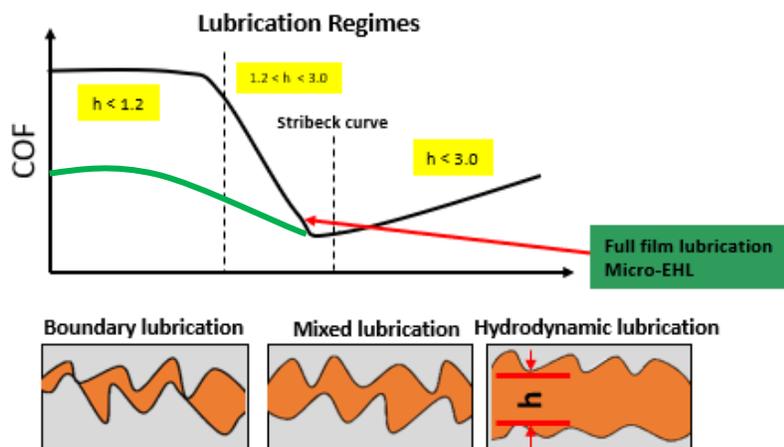


# Tribex™ ERD Additive



Tribex™ ERD Additive is a novel, solid-state lubricant designed and evaluated in accordance with the principles of Tribology whose friction reduction is generated through Elastohydrodynamic Lubrication (EHL), boundary, and mixed regimes of the Stribeck curve. Tribex™ ERD Additive is designed to overcome the performance limitations of commercial liquid lubricants and minimize material inconsistencies. Tribex™ ERD Additive is a multifunctional, multipurpose, solid-state lubricant that functions in both aqueous and non-aqueous formulations. Tribex™ ERD Additive exhibits stable suspension properties and creates a lubricating film that minimizes contact between the formation and drilling assembly in critical Extended Reach Drilling (ERD) applications.



## Mud Types

Aqueous and Non-Aqueous Fluids

## Mixing Requirements

Mix through a mud hopper

## Handling

For specific instruction on handling, refer to the SDS

## Packaging

50-pound, multiwall paper sacks, 40 sacks to the pallet.

## Concentration

2-3 pounds per barrel-OBM  
2-3 pounds per barrel-WBM  
6-7 pounds per barrel-Brine

## Advantages

- Compatible in Aqueous and Non-Aqueous Fluids
- Multifunctional product delivers Lubricity, HTHP FL, API FL, Extended Sealing Capacity
- Designed for Extended Reach Drilling or High Torque Conditions
- Minimizes surface asperities (irregularities) to contribute to friction reduction
- Temperature stable to 300°F
- pH tolerant to 10.5
- No adverse effect on low end rheology
- Dry material is ideal for use in hot and cold weather conditions

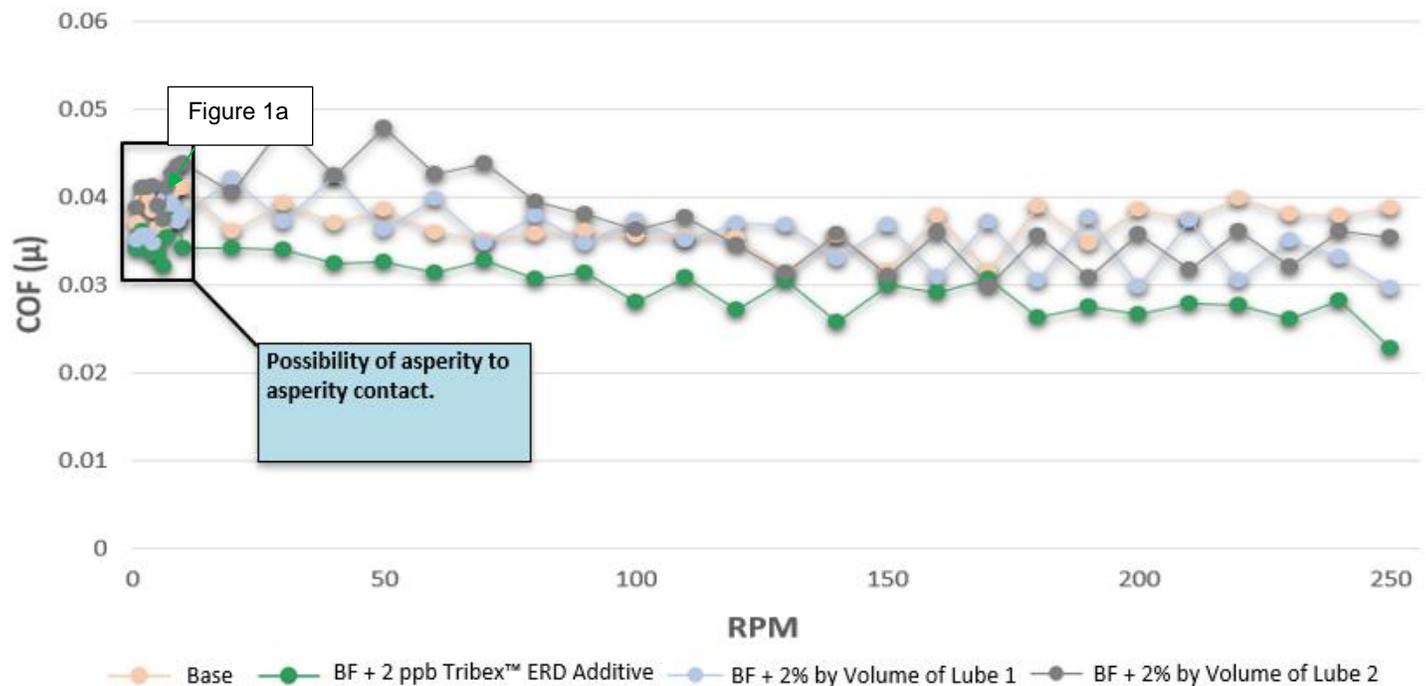
Before using this product, the user is advised and cautioned to make its own determination and assessment of the safety and suitability of the product for the specific use in question and is further advised against relying on the information contained herein as it may relate to any specific use or application. It is the ultimate responsibility of the user to ensure that the product is suitable, and the information is applicable to the user's specific application. Drilling Specialties Company does not make, and expressly disclaims, all warranties, including warranties of merchantability or fitness for a particular purpose, regardless of whether oral or written, express or implied, or allegedly arising from any usage of any trade or from any course of dealing in connection with the use of the information contained herein or the product itself. The user expressly assumes all risk and liability, whether based in contract, tort or otherwise, in connection with the use of the information contained herein or the product itself. Further, information contained herein is given without reference to any intellectual property issues, as well as federal, state or local laws which may be encountered in the use thereof. Such questions should be investigated by the user.

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The Stribeck curve of the base fluid (BF) and the BF with 2 ppb of Tribex™ ERD Additive were built by using a tribometer. A tribometer performs repeatable friction/wear testing that can be done in rotative and linear modes that are compliant to ISO and ASTM standards. The tribometer provides a range of rotational speeds from 0.01 to 15,000 rpm. Data can be accurately recorded at any specific interval of time or position. This is a unique lubricity test because it provides a full and continuous spectrum of the Coefficient of Friction (COF).

**Figure 1. Stribeck Curve: Tribex™ ERD Additive**



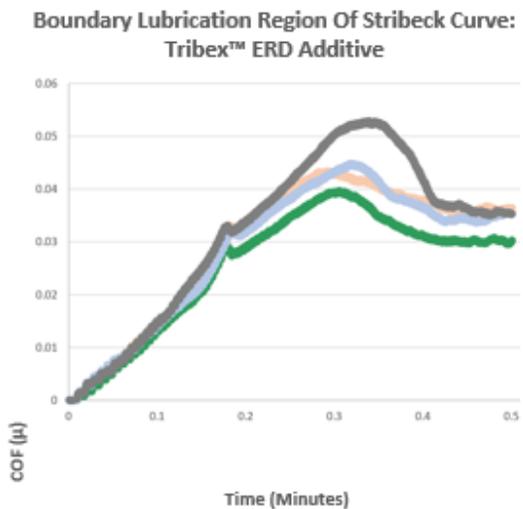
A comparison of the following samples is illustrated in **Figure 1 above**: BF, BF + 2 ppb of Tribex™ ERD Additive, BF + 2% by volume of liquid lubricant 1 and BF + 2% by volume of liquid lubricant 2. The curve was built by extracting values from the data within the RPM range of 1 - 250. Notice the lower COF of Tribex™ ERD Additive when compared with the two liquid lubricants. The Stribeck curve for Tribex™ ERD decreases continuously while increasing the RPM. The liquid lubricants remain relatively stable. **Figure 1a. Boundary Condition:** Asperity to Asperity contact shows the initial response in the boxed region above.

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# Tribex™ ERD Additive



**Figure 1a. Boundary Condition: Asperity to Asperity Contact**



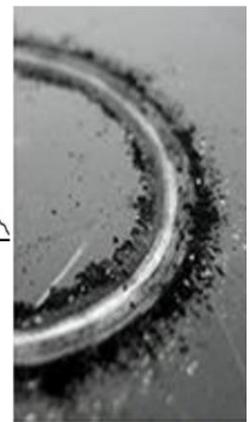
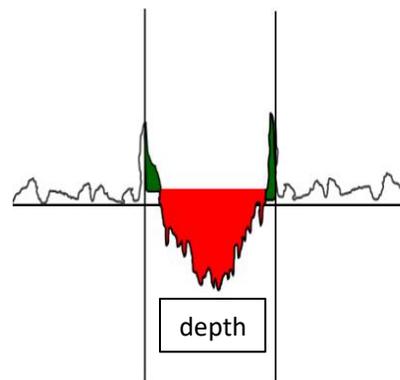
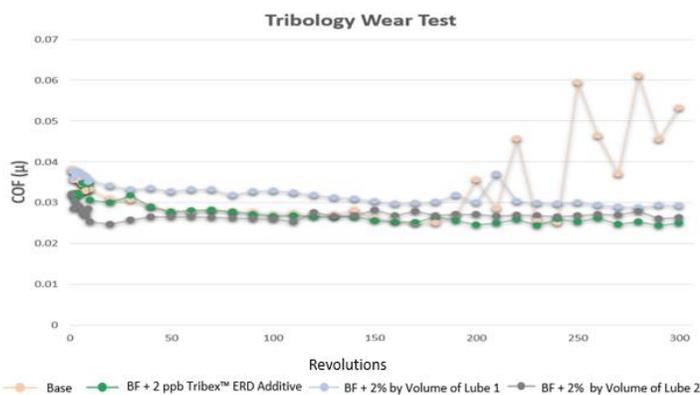
## Boundary Lubrication

Boundary lubrication is a lubrication regime defined by a film under constraints where the asperities are extremely close together that reasonable contact between opposing asperities is possible. Friction regimes are governed primarily by:

- $f(x)$  = rotation
- $f(x)$  = thickness of film as compared to surface asperities
- $f(x)$  = viscosity of film between surfaces

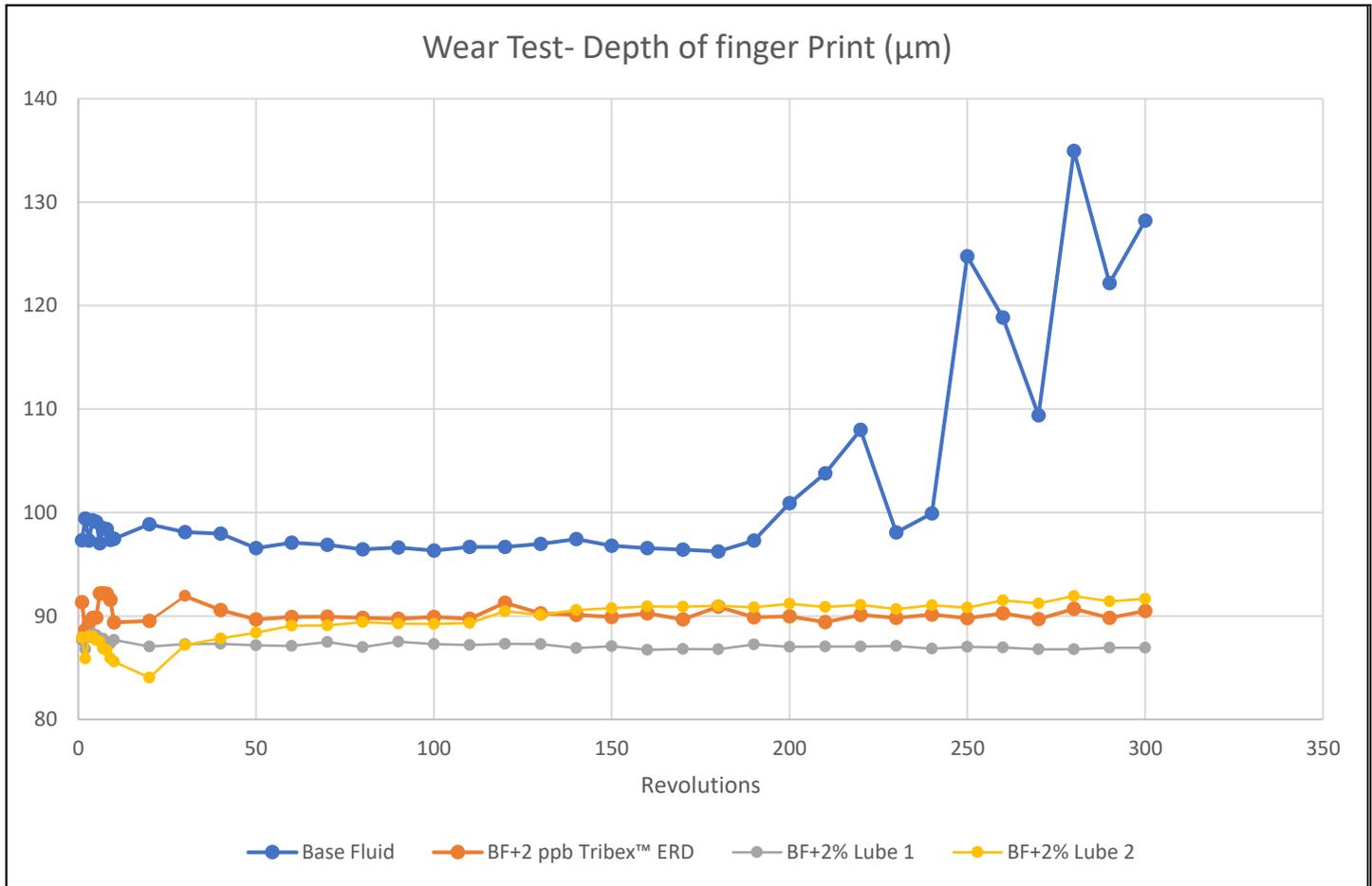
Illustrates the first 30 seconds of the friction and wear testing with the tribometer. The COF for Tribex™ ERD Additive (green line) peaked at about .04. The other test samples peaked at a higher COF.

In **Figures 2 and 3 below**, the tribometer measures the maximum and mean depth by examining the wear that is present inside the disc during COF measurements with fixed load, temperature, and rotation speed. As the pin rotates, the tip produces a rotative wear track. Friction and wear values are calculated continuously and simultaneously. Notice the low COF of Tribex™ ERD Additive with progressive revolutions. The BF with no lubricants experienced a significant increase in wear as indicated by the increase in COF.



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**Figure 4** above, this graph illustrates the depth progression of the fingerprint created while running the wear test. Notice the depth of Tribex™ ERD is lower than the base fluid along the wear test. An LVDT is attached to the measuring arm to record depth during the test. This gives the ability to follow the change of the wear rate over time.

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