

MULTI DOPE YELLOW

Multi-functional thread compound

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1. Product Introduction and Applications

MULTI DOPE YELLOW is the result of a comprehensive development project aimed at addressing both the severe technical and environmental challenges with which constructors have to cope. The product is designed to meet ultimate technical and environmental demands.

MULTI DOPE YELLOW is a lubricating grease, especially developed for use in offshore and marine applications, as a thread compound for drill pipes, casing and tubing.

MULTI DOPE YELLOW is formulated with readily biodegradable synthetic esters and a specially developed thickener system. It contains non-metallic solids to separate the surfaces and to provide good lubricity.

MULTI DOPE YELLOW has been developed to work in a number of applications:

- As a thread compound for drill pipes, casing and tubing.
- For greasing of gear pinion teeth and leg rack teeth on jack-up platforms.
- For greasing between skid beams and cantilever, during skidding of the cantilever.

Most extensive technical performance.

MULTI DOPE YELLOW provides a safer drill pipe connection than traditional greases due to its very low friction factor. It also withstands a very high torque, yet still able to break out the connection. It has been tested successfully to cope with a large number of make-ups and break-outs.

These excellent technical features give advantages such as vast savings on equipment costs and time savings, in connection with make-ups and break-outs.

Environmental adaptation.

The grease has been designed using the most environmentally friendly components in order to provide a product 100% environmentally adapted, addressing the most demanding environmental challenges (Figure 1).

The result is a product with both excellent technical performance and environmental advantages. The product is in use on platforms in both Denmark and Norway where it shows excellent technical performance and helps constructors to improve their daily activities and to save money.

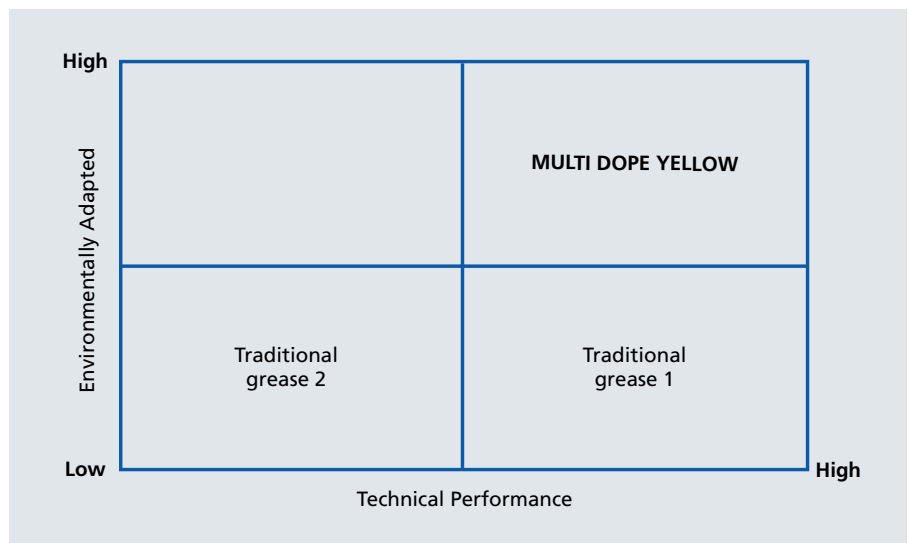


Figure 1 Comparison MULTI DOPE YELLOW – Traditional greases

2. Advantages and Features

- **Safer connection.** MULTI DOPE YELLOW is characterized by a very low friction API-factor, giving a safer drill pipe connection (*Figure 2*).
- **High torque properties.** MULTI DOPE YELLOW has been shown to withstand a very high torque, yet still able to break out the connections. It has also proven to be able to stand a large number of make-ups and break-outs without destroying the threads.

These features give vast savings on equipment costs as well as being very time saving in connection with make-ups and break-outs.

- MULTI DOPE YELLOW is a product designed with the **most environmentally adapted components** available, without compromising on the technical properties. A product with the most extensive technical performance, together with environmental adaptation (*Figure 3*).
- MULTI DOPE YELLOW has shown **good rust protection** properties in field tests making it excellent even for storage of tubes.
- **Reduction of inventory stocks.** MULTI DOPE YELLOW is a multi-functional grease that can be used for multiple applications (drill pipes,

casing and tubing) resulting in reduction of inventory stocks and facilitating the handling and management of lubricant stocks.

- **Easy to apply.** MULTI DOPE YELLOW is easy to pump in an automatic greasing system and easy to apply by brush.
- **Easy to detect.** The white color of MULTI DOPE YELLOW makes it easy to detect whether or not the entire surface is lubricated.
- **Easy to remove.** It is also easy to remove from the surface using high-pressure hot water.

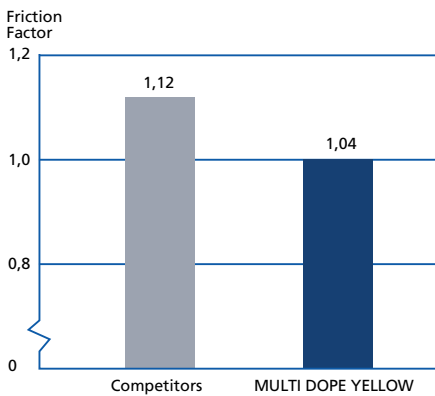


Figure 2 Comparison Friction API-Factor

Typical Grease	MULTI DOPE YELLOW
Mineral oil	Readily biodegradable ester
Additives (corrosion inhibitor, antioxidant etc.)	Thickener system
Soap	
Metal powder: Copper, Lead	Natural minerals

Figure 3 Comparison between typical thread grease components and MULTI DOPE YELLOW components

3. Test Results

3.1. Test 1: Make-up & Break-out tests

This test was set up to initially determine the performance of the product in real make-ups and break-outs. The test results were extremely satisfactory. The product made it very easy to perform the break-outs even after the highest torques.

Test location: Franks International, Den Helder, Holland.

The test was carried out with a 5" drill pipe, NC 50 connection.

- **Number of sequences:** 80
- **Torque:** from 15 000 – 32 000 ft-lbs



Figure 4 Drill pipe after first break-out

Result:

- Break out torque appr. 2/3 of Make-up torque
- No metal screaming between the thread and shoulder surfaces
- No changes to threads and shoulder after 80 sequences
- A layer of lubricant remaining on the surface after break-out (Figure 4)

3.2. Test 2: Extreme torque tests

From the promising results in the previous tests, it seemed interesting to find out how the product performs under extreme torque loads. Even after applying as high torque to the connection that the box was deformed, it was still able to break-out the connection.

Test location: Franks International, Den Helder, Holland. The test was carried out with a 5" drill pipe, NC 50 connection.

- **Number of sequences:** 1
- **Torque:** 90 000 ft-lbs (Figure 5)



Figure 5 Torque at 90000 ft-lbs

Result:

Deformation of the box due to the high torque, but still able to break out (Figure 6)



Figure 6 Connection after break-out

3.3. Test 3: Field test on Jacking systems

Due to its extremely good EP-properties, MULTI DOPE YELLOW should be suitable for greasing pinion teeth and leg rack teeth on jack-up platforms. This had to be confirmed in field tests.

Test location: Maersk Giant



Figure 7 Field test on Jacking systems

Result:

- No problem pumping the grease in the automatic grease system.
- No difference in performance between MULTI DOPE YELLOW and the standard grease.
- No wear marks on the teeth (Figure 7)

3.4. Test 4: Pumpability test

Evaluating low temperature flow using Lincoln-Helios 103 lubricating system. In this test MULTI DOPE YELLOW showed to be pumpable down to -30°C (Figure 6).

NB! Not all lubricating systems are suitable for the product due to the system design, i.e type of pump, pipe lengths, type of valves etc.

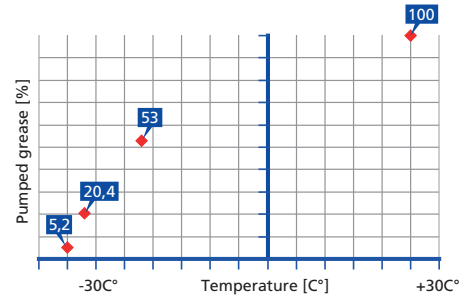


Figure 8 Pumpability test on MULTI DOPE YELLOW by L.H. 103

Result:

This result indicates that MULTI DOPE YELLOW has good pumpability in temperatures well below 0°C.

3.5. Test 5: Field test at Maersk Exerter

To confirm the results in the laboratories, a field test was carried out at the Maersk Exerter platform. MULTI DOPE YELLOW was applied to the saver sub at the top drive, and all other heavy-weight drill pipe connections were the torque loads are most severe. (Figure 9)

MULTI DOPE YELLOW proved to perform as expected, giving smooth break-outs.



Figure 9 Dope condition of top drive saver sub & main shaft

Result:

No problems to make-up or break-out.

3.6. Test 6: Casing & Tubing tests

MULTI DOPE YELLOW is also designed for use in casing & tubing applications. To confirm the performance comparative tests were carried out.

Test location: BJ Completion Assembly Services, Aberdeen

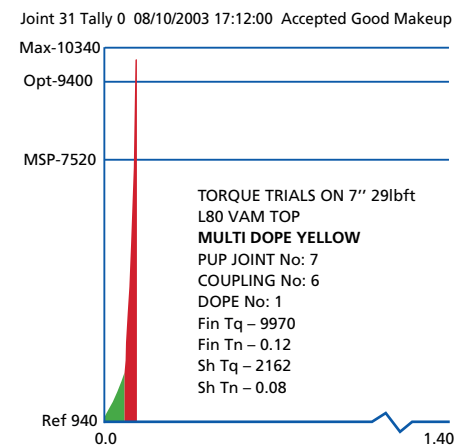


Figure 10 Results casing and tubing tests

Result:

- Easy to apply by brush
- Good cleaning ability
- Good connection
- Low shoulder torque
- Low break out torque
- Very low interference
- Consistent graph (Figure 10)
- Excellent performance on high chrome or nickel alloys

3.7. Test 7: Additional Make-up and Break-out tests

Further tests carried out at another tube manufacturer.

Test location: Vallourec & Mannesmann Tubes, France. The test was carried out with 5" FH VAM EIS tubes. Reference tests with common competitor.

Test 1

- **Number of stages:** 12
- **Torque:** from 5 000 - 65 320 ft-lbs

Result:

- No problems to make-up or break-out with MULTI DOPE YELLOW. Appr. 30% less grease quantity needed. Only light deformations on the pin nose at 60 000 ft-lbs
- The competitor showed wear on the phosphatation on the pin thread after 3 make-up and break-outs

Test 2

Number of stages: 5
Number of make-up and break-outs: 50
Torque: 38 824 ft-lbs

Result:

No wear on the connection with MULTI DOPE YELLOW.

3.8. Swivel Joints

Extending lifetime on swivel joints more than 3 times! (Figure 11)



Figure 11 Swivel Joints

3.9. Predopeing of casing and tubing

The excellent rust protection properties of MULTI DOPE YELLOW, makes it suitable for predopeing directly from the pipe manufacturer.

Summary of advantages:

- Safer connection
- High torque propertie
- Environmentally adapted
- Rust protective
- Easy to apply
- Easy to detect
- Easy to remove
- One product for several applications



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Every lubricant change should be preceded by expert consultation on the application in question. Only then the best lubricant system can be selected. Our experienced engineers will be glad to advise on products for the application in question.

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