BP MARINE **Technology Centre, Sunbury**

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TITLE: Assessment of the Compatibility of Militec-1 and BP Marine Energol CLO

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1. COMPATIBILITY

The compatibility test is an internal MTU method (OTC-721 -006). This test is a visual method which evaluates the compatibility on mixing marine lubricating oils. A 50: 50 mixture of BP Energol CLO 50M and Militec 1 was stored at an ambient temperature and at 60 deg C. The samples were checked and observations recorded after 1, 2, 4 and 6 weeks.

The Militec seems to cause no compatibility problems with the CLO 50M. The sample remained light and clear and bright at both temperatures for the full 6 week period. A deposit was not observed throughout this period.

2. PANEL COKER

The Panel Coker test was carried out in accordance with the MTU procedure OTC-721-001, details of which are presented in Table 1.

Table 1.
Panel Coker Conditions

Test Duration 2 x 4 (Hrs)	8	Sump Temp (°C)	120
Splash/Blake time (sec's)	15/45	Plate Temp (°C)	320

This test is a quick laboratory method that can determine the relative deposit forming tendency of the lubricant. This is achieved by intermittently splashing the lubricant against a heated metal plate, thermal and oxidative stresses cause lubricant degradation which can result in the formation of deposits the weight of which is measured. Results obtained from the Panel Coker tests are presented in Table 2 and compared to Energol CLO 50M.

Table 2.
Panel Coker Results for the CLO 50M Lubricants

Product	Laboratory Number ,	Dep. On 1st Plate (mg)	Dep. On 2nd Plate (mg)	Total Deposit (mg)	Mean Deposit (mg)
CLO 50M & Militec	L00/41647	22.8	22.5	48.3	24.2
CLO 50M	L00/41166	36.5	38.7	76	38

The Militec mixed with the Energol CLO 50M does not affect the thermal oxidate stability of the lubricant.

The attached Panel Coker report from BP Marine is very significant for Militec-1 distributors and customers. However, the data presented does need some explanation to better appreciate the importance of the report to the marine industry and, specifically for the use of Militec-1 in the very large diesel engines of Deep-Draft vessels.

OSG Ship Management called upon the BP Technology Center in England to implement this Panel Coker test which is a means of testing the compatibility of Militec-1 and an oil produced by BP Marine called **CLO 50M**. This is a highly specialized cylinder oil that is injected directly onto the engine cylinder walls from a separate oil tank (called a "day tank") during engine operation. It lubricates pistons, rings and cylinders that the regular oiling system cannot reach. About 5-10% of the world's shipping fleets use this oil. Included in many of these fleets are the largest Deep-Draft ships in the world reaching up to 300,000 Dead Weight Tonnage (DWT) which is a VLCC (Very Large Crude Carrier)…up to 3 times the size of a modern American aircraft carrier. And these are powered by extremely large engines.

The engines are so large that a man can be lowered into the cylinder openings, and this occurs during routine inspections and overhauls. Unlike other on-board components that have back-up components to cover repair time, when the large engine components fail the ship is unable to run its engines and the ship experiences extensive downtime. This accentuates the value of Militec-1 as it reduces engine wear and thereby extends engine life.

The CLO 50M cylinder oil is injected onto the cylinder walls of the engine on every down stroke of the piston, and the oil is consumed with the diesel fuel during combustion. Thus a continuous supply of oil is required. The ratio of Militec-1 recommended for this application is 5%. It is poured into the ships day tank which is refilled every 24 hours. OSG routinely checks oil wear metals and other readings.

According to BP Marine in Houston: "A Panel Coker Test is the determination of the amount of carbon residue left after evaporation & pyrolysis of an oil and is intended to provide an indication of relative coke-forming propensities". This test for carbon residue and the Compatibility Test were required before Militec-1 could be used routinely in these large engines. While CLO 50M is considered incompatible with synthetic oils, the test showed that synthetic-based Militec-1 is compatible. The results of the Compatibility show that Militec-1 did not cause any separation from the CLO 50M and there was no discoloration or precipitates. It was found through the Panel Coker Test that Militec-1 does not leave carbon deposits on the pistons, rings and cylinder walls. This removed any concerns about adverse effects using Militec-1.

As a result of this testing, OSG Ship Management is so comfortable with applying Militec-1 into these large capacity engines that they are processing a requisition from OSG Operations NYC for the use of the product in 6 vessels of the American fleet. Their interest in Militec-1 also extends to other onboard components such as diesel generators, turbo chargers, oil purifiers, etc.