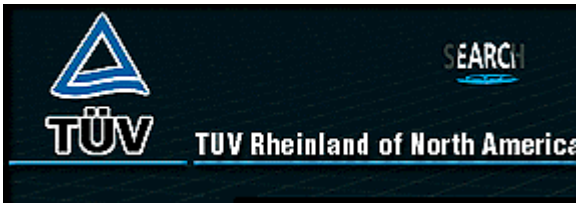
TUV RHINELAND (GERMANY)



TÜV MOTOR TEST LAB IN GERMANY

Test Report

No. D4-TPT 351 - 051 - 86

Nature of Test: Tests on a private car to investigate the effects of an addition to the motor, gear box and differential oils

Product Name: **BISHOP'S ORIGINAL PRODUCTS**

1. **Purpose of the tests**

   According to the customer's instructions, the effect of "**BOP**" when added to normally available engine and gears oils with regard to the reduction of friction losses as well as related changes in fuel consumption and exhaust gas emissions should be established.

2. **Test Vehicle**

   Manufacturer .....Ford (Germany).....
   Model Name.....Granada 2.3
   Type.....GU
   Chassis No.:.....GAGFUG 39020
   First Registered.....27.02.80
   Max. engine power. ....79 / 5000 kW / min –1

3. **Tests Conducted**

   3.1 Check of the idling setting of the engine

   3.2 Fuel consumption measurement - DIN 70030 (ECE - R 15/04 Annex 9)

   3.3 Coast - Down on the dynamometer

3.4 Exhaust gas measurement - ECE Regulation 15 / 04

4. **Measuring equipment and test devices**

4.1 Motor tester from Robert Bosch, Compact Test motor tester MOT 500 ignition oscilloscope MOT 400 report printer PDR 100 pressure and vacuum tester ETT 007.01

4.2 Dynamometer from Schenck, Type 500 / GS 60

4.3 Exhaust gas analyser : Horiba CVS - 61 2

4.4 CO measuring device : ULTRAMAT 13 P with NDIR analysors

5. **Procedures carried out on the test vehicle**

To establish the original values, all the tests listed under (3) above were first carried out with the original oils still in the vehicle. The engine settings as idle were found to be in accordance with the manufacturer's specifications (Motor Data)

Following this, the engine, gear box and differential oils were replaced with oils to which **BOP** was added according to the manufacturer's instructions.

Engine oil: 3.50 1 valvoline All Climate 10 W 40 - 0.75 1 **BOP**

Gear - box: 1.50 1 Castrol EP 80 -0.50 1 **BOP**

Differential: 1/30 castrol Hypoy 90 + 0.50 1 **BOP**

After a running - in period of about 2750 km, all tests listed under (3) above were repeated.

To avoid as far as possible external factors influencing the test series, as far as possible the tests were conducted with the same engine settings, with adjustments being made as necessary. Also, new oil and air filters and new spark plugs were fitted, and the engine idling speed was set back before the start of the second series of tests from 900 min -1 to 800 min - 1.

For the duration of the tests the bonnet was plumbed, and the oil filler holes were sealed with sealing paint.

After running about 1500 km of the running - in period had elapsed, about 0.6 1 of motor oil was needed to top up; after the further 1250 km a further 0.3 1 was required. The seals were on both occasions found to be undamaged.

In spite of extensive elimination of factors which could have lead to a distortion of test results, the figures in (6) below include the inevitable spread resulting from the practical

tolerances present in the test drives and their measurement. The figures in (6) can therefore, because of the lack of statistical certainty involved, not be taken as absolute. However, the possible spread in the measurements is smaller than the computed changes which were established during the second series of tests.

6. **Test Results**

	Base Values	After Values	Change
	Normal Oil	(+ BOP)	%
Odometer	46950	49700	2750
Engine Idling Settings			
idle speed	820	800	20
Motor Oil Temp	93	94	
Co Concentration (Vel%)	1.6	1.53	
Fuel Consumption (1/100km)			
City Cycle	13.91	13.22	-4.96
90 km / hr	7.82	7.41	-5.24
120 km / h	9.91	9.54	-3.73
Average (DIN 70030)	10.6	10.1	-4.7
Time To Coast Down	**Average from 2**	**measurements**	
	5.93	54.70	+19.1
Exhaust Values in the ECE Test	**Average from 2**	**measurements**	
CO (g/test)	41.72	48.40	+16.0
HC (g/test)	12.78	12.31	-3.7
NOx (g/test)	7.79	6.25	-19.8
HC + NOx (g/test)	20.57	18.55	-9.8

7. **Summary of Results**

The reduction of the frictional losses in the test vehicle are evidenced most clearly by the considerably longer coast - down time (19.1%) on the test rig. They gave an **improvement in fuel consumption of 4.7% i**n the ECE mix. The changes in the exhaust gas emissions come less from the use of BOP than from the vehicle and / or motor settings. They fall more or less within the scatter area expected in such measurements. **However, the reduction in Nitrous Oxides emissions can be attributed - at least by inference - to the lower frictional losses in the engine through the use of BOP.**
There were further test made, beyond the main scope of this report, which brought **no negative results;** among there were for example, an investigation for possible fluorine or other acidic combinations in the BOP treated engine and the gear - box oils, and in the exhaust gases which could have been undesirable for the environment or for the vehicle.

When the spark plugs were changed before each series of tests, the **compression of the cylinders was measured.** While the peripheral measurements - such as the battery voltage were not made, which would have allowed an unrestricted confirmation of the readings taken, the **improvement measured - about 7.5 psi per cylinder** - infers an improvement in the sealing of the cylinders

In summary, it is confirmed that the test described above under sections 3-6 showed a measurable reduction in the frictional losses of the test vehicle through the addition of BOP to the engine, gear box and back axle oils. No negative effects resulted from the treatment.