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TEST REPORT
No. D4-TPT 351-051-86

Commissioned by: Petrolon (UK) Ltd. through:
140 Leicester Road Richard Chambers
Wigstone Dahlienweg 14
Leicester LE8 1DY 8011 Heimstetten

Nature of test: Tests on a private car to investigate the effects of an addition to the motor, gearbox and differential oils.

Product trade name: [redacted]

1. Purpose of the tests

According to the customer's instructions, the effect of "[redacted]" when added to normally available engine and gear oils with regard to the reduction of frictional 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
- report printer PDR 100
- ignition oscilloscope MOT 400
- pressure and vacuum tester ETT 007.01

4.2 Dynamometer from Schenck, Type 500/GS 60

Prod.No. LNB 0729,LEB 1417 diameter of rollers 502mm
max. power 60 kW max. speed 200 km/h

4.3 Exhaust gas analysor: Horiba, CVS-61-2
Analysors: MEXA 8420 Typ AIA 23 (AS), FIA 52, CLA 53, MPA 21

4.4 CO measuring device: ULTRAMAT 13P 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 at idle were found to be in accordance to the manufacturer's specifications (Motor Data).
Following this, the engine, gear-box and differential oils were replaced with oils to which [redacted] was added according to the manufacturer's instructions:

engine oil: 3.50 l Valvoline All Climate 10 W40 + 0.75 l [redacted] (red pack, 750 ml for 4-stroke engines, 1.6 - 3.5 l)

gear-box: 1.50 l Castrol EP 80 + 0.50 l [redacted] (blue pack, 500 ml for gearbox and differential treatment)

differential: 1.30 l Castrol Hypoy 90 + 0.50 l [redacted] (blue pack)

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

In spite of extensive elimination of factors which could have led to a distortion of the 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 complete 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 (normal oil)	'after' values (+ [redacted])	change (%)
Speedo reading,km	46950	49700	
Idling settings of the engine			
- idle speed (min^{-1})	820	800	
- motor oil temperature (^{o}C)	93	94	
- CO-concentratation (Vol %)	1.6	1.53	
Fuel consumption (1/100 km)			
- city cycle	13.91	13.22	-4.96
- 90 km/h	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 on the test rig from V = 100km/h to v = 20km/h (average from 2 measurements)	45.93	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
- NO_x (g/test)	7.79	6.25	-19.8
- HC + NO_x (g/test)	20.57	18.55	-9.8

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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% in the ECE mix. The changes in the exhaust gas emissions come less from the use of [redacted] 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 [redacted].

There were further tests made, beyond the main scope of this report, which brought no negative results: among these were for example an investigation for possible fluorine or other acidic combinations in the [redacted]-treated engine and 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 tests described above under sections 3 - 6 showed a measureable reduction in the frictional losses of the test vehicle through the addition of [redacted] to the engine, gear-box and back axle oils. No negative effects resulted from the treatment.

This test report consists of pages 1 - 4 and may only be reproduced in its entirety.

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TÜV

TEST REPORT
No. D4-TPT-351-006-87

Customer: Petrolon (UK) Ltd
140 Leicester Road
Wigstone, Leicester LE8 IDY

Type of test: Test of a private car to establish the effect of an addition to the oils of the engine, gearbox and differential

Trade name: [redacted]

1. Purpose of the test

According to the customer's instructions, the influence of "[redacted]" as added to the engine, gearbox and differential oils with regard to the reduction of the frictional losses and the related increase in power should be established.

2. Test vehicle

Make:	Ford	Trade name	Sierra L
Engine type:	LB OHC	Chassis number:	WFOAXXGBBA CG 18791
Engine number:	LB 18791	First registered:	24 Feb 83
Capacity (cm³):	1796		
Distance driven before engine change (km):			about 115200
Distance driven with replacement engine (km):			about 21470

3. Tests carried out

3.1 Check on the idling condition of the engine.

3.2 Measurement of the power at the driven wheels on the rolling road at various engine speeds.

4. Test equipment and measuring devices used

4.1 Motortester from Robert Bosch, Compact Test
- Motortester MOT 500
- Ignition timing oscilloscope MOT 400
- Report Printer PDR 100
- Vacuum tester ETT 007.01

4.2 Dynamometer from MAHA, Type LPS 13

- Build number 191
- Diameter of rollers 318 mm
- maximum loading 200 kW
- maximum speed 200 km/h

4.3 CO tester - UL TRAMAT 13P with NDIR analysors

5. Work carried out on the test vehicle

To establish the base values, the tests listed under (3) above were carried out with the original oils still in the vehicle. The engine settings at idle were found to agree with the manufacturer's recommendations (Autodate)

Following this, the engine, gearbox and differential oils were replaced with oils to which "[redacted]" was added, as follows:

engine oil: 3.50 l Valvoline All Climate 10 W40 + 0.75 l [redacted] (red box), 750 ml for four-stroke engines, 1.6 - 3.5 l)

gearbox: 1.5 l Castrol EP 80 + 0.50 l [redacted]

(blue box, 500 ml for gearbox, 500 ml for and differential)

differential: 1.00 l Castrol Hypoy 90 + 0.50 l [redacted] (blue box)

After a running-in period of about 1800 km all the tests under (3) above were repeated.

To eliminate distortions in the results as far as possible the vehicle was kept at or re-set to the same values for both series of tests. For instance, the air and oil filters and the spark plugs were changed, and the engine speed at idle was set back from 850 rpm to 810 rpm before the second series. For the duration of the running-in period the bonnet was plumbed and sealed, and the oil filler hole screws were sealed with sealing paint.

During a check after the first 800 km of the running-in period about 0.5 l of engine oil was used to top-up. At the end of the running-in period, after a further 1000 km, the dip-stick indicated a consumption of about 0.2 l. At each of these checks the above mentioned seals were found intact.

6. Test results

	Initial values before treatment	Values after treatment with [redacted]	Change (%)
km driven (engine)	21,470	23,270	
Idle settings of engine			
- engine speed (rpm)	810	810*	
- engine oil temperature(°C)	92	91	
- CO concentration (vol %)	1.5 - 1.6	1.5 - 1.6	
Power output (kW) at rpm:			
- 5500	46.33	48.78	5.35
- 5000	48.15	50.38	4.63
- 4500	47.97	50.03	4.29
- 4000	45.98	47.65	3.63
- 3500	42.62	44.00	3.24
- 3000	37.25	38.48	3.30
- 2500	30.10	31.03	3.09

The above performance data have been 'normalised' back to the standard base-line for intake air temperature and barometric pressure (t = 20°C, p = 10 13 mbar). In every case the average of two test readings has been taken.

The individual measurements are given in appendices 1-3.

* set back from 850 rpm

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7. Summary of Results

In the tests as described under 3 to 6 above, an increase in maximum power, as measured at the rear wheels of the test vehicle, of 5.3% was established resulting from the addition of "[redacted]" to the normal oils in the engine, gearbox and back axle. By keeping the peripheral conditions constant during the tests it was ensured that this increased power was achieved only by the reduction in frictional losses due to the treatment with "[redacted]".

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