UNIVERSITY OF NANTES
NATIONAL COLLEGE OF MECHANICS

E.M.S.M.

1 rue de la Noe - 44072 NANTES CEDEX
Tel.: (40) 74.79.76.

Technology and Production
Techniques Department

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Engine and Machinery Laboratory

OBJECTIVE

To treat an engine with BISHOP'S ORIGINAL ANTI WEAR ENGINE PROTECTION according to the established by the manufacturer and to measure all characteristics.

TEST PERFORMED

Test Engine:

All test were made on a RENAULT type 841 engine with the builder's specifications concerning electromagnetic brakes on Foucault currents SCHENCK W 70.

The basic settings were:

Bore ⌀ 79mm Stroke: 84mm Head of Cylinder Pressure: 821

Carburetor; Weber 32 DIR 35 - double body differential
1st body: venturi ⌀ 24 mm - main jet 140
correction jet 165
2nd body: venturi ⌀ 24 mm - jet 132
correction jet 185

Ignition:
Points DUCELLIER R 254 D 60
Spark Plug LODGE 2IILNY
Coil DUCELLIER Competition 14 KV

The motor oil used shall be a commercial oil: IGOL 20 W 40

At the beginning of the test, the engine registered about 400 hours of bench tests of which 80% were at full load. This would be the equivalent of between 30,000 nad 40,000 kilometers.

To be effective, the treatment should be made on an engine with a minimum of 20-25,000 kilometers. This condition is required.

Measurement of test engine:

The following characteristic curves are traced.
* torque at full load
* horsepower at full load
* specific consumption at full load
* loss by mechanical friction at full load
* acceleration in speed regulation from least torque to greatest torque.

The results are shown on the following table:

Speed rpm	Torque N_m *	Horsepower hp	Consumption g/hp/h	Loss by Friction	Accelerations
2000	118.2	33.67	223.2	2.85	3.4
2500	123.2	43.85	211.1	3.92	5.0
3000	123.7	52.83	208.8	5.34	5.2
3500	122.2	60.90	204.6	8.47	6.0
4000	116.0	66.05	204.4	12.53	8.5
4500	108.4	69.42	207.4	16.34	5.8
5000	99.5	70.80	208.0	22.8	5.4
5500	88.6	69.35	225.1	---	5.3

*NOTE: N_m = Mechanical Efficiency

In view of these results, it can be stated that the characteristics of the test engine are an average of only 2% below manufacturer's specifications.

Treatment with BISHOP'S ORIGINAL

Since the engine's crankcase has a capacity of 4 liters, treatment is made with 1 quart of BISHOP'S ORIGINAL and 3 liters of IGOL 20 w 40.

The duration of the treatment is established on a base of 5000 km for every 40 hours of bench tests distributed as follows:

City	20%	8 hours
Highway	45%	18 hours
Turnpike	20%	8 hours
Uphill	15%	6 hours

For purposes of the test, motor load conditions have been calculated from an R1152 body with a rolling weight of 1200 Kg equipped with a 4-speed transmission (gear ratio--1st = 2.26; 3rd = 1.48; 4th = 1.03) with a 9 x 34 torque and 165 x 14 wheels.

Test of treated engine:

The following table shows the characteristic curves on a treated engine under the same test conditions as the base engine:

Speed rpm	Torque N_m	Horsepower hp	Consumption g/hp/h	Loss by Friction	Accelerations
2000	123.0	35.03	227.7	2.0	3.2
2500	130.9	46.61	209.8	2.0	4.6
3000	129.1	55.17	208.8	4.7	4.8
3500	127.1	63.35	201.5	7.0	5.3
4000	122.0	69.48	201.6	11.8	6.4
4500	113.8	72.91	205.5	15.7	5.2
5000	104.0	74.08	209.5	20.3	4.7
5500	92.2	72.25	221.5	---	5.0

COMPARATIVE RESULTS

Engine torque at full load:

As these comparative results show, the torque increase is very clear and is established at an average of 4.7% which will provide the greatest flexibility of use accompanied by better acceleration.

Speed	ENGINE TORQUE			
rpm	Base N_m	Treated N_m	Gain N_m	Gain %
2000	118.2	123.0	4.8	4.0
2500	123.2	130.9	7.7	6.3
3000	123.7	129.1	5.4	4.4
3500	122.2	127.1	4.9	4.0
4000	116.0	122.0	6.0	5.2
4500	108.4	113.8	5.4	5.0
5000	99.5	104.0	4.5	4.6
5500	88.6	92.2	3.6	4.2

Horsepower furnished at full load:

Here again one finds the same gain in percentage as for the torque curves since horsepower is the torque product per speed.

The average gain is 4.7 percent.

Speed	ENGINE HORSEPOWER hp			
rpm	Base	Treated N_m	Gain hp	Gain %
2000	33.67	35.03	1.36	4.0
2500	43.85	46.61	2.76	6.3
3000	52.83	55.17	2.34	4.4
3500	60.90	63.35	2.45	4.0
4000	66.05	69.48	3.43	5.2
4500	69.42	72.91	3.49	5.0
5000	70.80	74.08	3.28	4.6
5500	69.35	72.25	2.90	4.2

Specific consumption at full load:

Speed	SPECIFIC CONSUMPTION g/hp/h			
	Engine		Gain	
rpm	Base	Treated	g/hp/h	%
2000	223.2	227.7	-4.3	-4.3
2500	211.1	209.8	1.2	0.6
3000	208.8	208.8	0.0	0.0
3500	204.6	201.5	3.1	1.5
4000	204.4	201.6	2.8	1.4
4500	207.4	205.5	1.9	1.0
5000	208.0	209.5	-1.5	-0.7
5500	285.1	221.4	-3.7	-1.6

The gain specific consumption, either positive or negative, is negligible, remaining intrinsically at +0.43%, which may be attributed to measurement error or to test conditions. This is normal since BISHOP'S ORIGINAL treatment is used for lubrication. The volumetric and combustion yields remain identical, treatment or no, which implies an identical specific consumption.

The specific consumption is the consumption per horsepower per hour and is expressed in grams.

Losses by Mechanical Friction at Full Load:

Speed	LOSSES BY FRICTION hp			
	Engine		Gain	
rpm	Base	Treated	hp	%
2000	2.85	2.0	0.85	30
2500	3.92	2.0	1.92	49
3000	5.34	4.7	.64	12
3500	8.47	7.0	1.47	17
4000	12.53	11.8	.73	6
4500	16.34	15.7	.64	4
5000	22.8	20.3	2.50	11

The gain is rather substantial and is established at an average of 16 percent, which implies an improvement in lubrication of all moving parts.

This, of course, explains the gains obtained in torque and power, starting with an increase in mechanical output.

Acceleration at Full Load:
The gain obtained on the average was 14 percent; this being a result of the improvement in mechanical output.

With the given regimen, the establishment of the greatest available torque being faster, the rise during testing will also be faster at full load.

Speed	ACCELERATION AT FULL LOAD			
	Engine		Gain	
rpm	Base	Treated	Seconds	%
2000	3.4	3.2	0.2	6
2500	5.0	4.6	1.6	32
3000	5.2	4.8	0.4	8
3500	6.0	5.3	0.7	12
4000	8.5	6.4	2.1	25
4500	5.8	5.2	0.6	10
5000	5.4	4.7	0.7	13
5500	5.3	5.0	0.3	6

Thermal Limitation: The bench tests for horsepower show
* An average increase of oil pressure of 0.5 bar.
* An average decrease of oil temperature of 15 percent

This is explained by the fact that a film formed by treatment with BISHOP's ORIGINAL Formula 101 is effectively spread on the moving parts. Thereby reducing the play, permitting the increase of pressure and reducing internal friction of the oil film on the adherent seats.

It is evident that the motor oil working under less heat stress loses its qualities less quickly and will, therefore, last longer

CONCLUSIONS:

In view of the results of the completed tests, we have come to the following conclusions:

- improvement of mechanical output through reduced friction due to the improvement of lubrication

- improvement of engine torque and available horsepower

- improvement of acceleration

- decrease of oil used

- reduction of fuel consumption

This last point deserves explanation. We have seen torque, horsepower and acceleration increase while specific consumption remains unchanged.

Actual consumption on automobiles is usually expressed in liters per 100 kms and is determined by the following factors which affect the performance of each engine:

- engine load (acceleration position)

- properly tuned engine

- the vehicle's speed

- aerodynamic design of the vehicle and atmospheric conditions

Thus, at equal horsepower, a better performing engine (such as one treated with BISHOP'S ORIGINAL) will work more efficiently and consume less.

Concerning increased acceleration, the treated engine consumes so much less that its acceleration is faster (greater horsepower is used for a shorter period).

Although these test results apply only to the laboratory tested engine, and actual consumption cannot be measured, similar results may be expected under normal driving conditions.

Under average usage, a single treatment with BISHOP'S ORIGINAL will provide a substantial savings due to improved engine efficiency and lubrication caused by the following factors:

- a decrease in fuel consumption during normal use

- longer periods between oil changes

- less wear and tear on the engine, especially during cold starts

- ease of starts increases, especially under winter conditions.

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M. LEMAIRE