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TECHNOLOGY AND PRODUCTION TECHNIQUES DEPARTMENT

Objective

To treat an engine with Bishop's Anti Wear Protection (originally tested under another private label) according to the established criteria, 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 Foucalt currents Schenck W 70.

The basic settings were:
Bore : 79 mm..... Stroke : 84 mm..... 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 equivalent of between 30,000 and 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 ful load
* loss by mechanical friction at full load
* acceleration in speed regulation from least torque to greatest torque.

The results are show on the following table:

Speed	Torque	Horsepower	Consumption	Loss by Friction	Accelerations
rpm	Nm*	hp	g/hp/h		
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

*Nm = Mechanical efficiency

Test Performed
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 Products

Since the engine's crankcase has a capacity of 4 liters, treatment is made with one quart of BOP and 3 liters of IOGL 20w 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.

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	Torque	Horsepower	Consumption	Loss by Friction	Accelerations
rpm	Nm*	hp	g/hp/h		
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.

Engine Torque

Speed	Base Nm	Treated Nm	Gain	
rpm			**Nm**	**%**
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 %

Engine Horsepower HP

Speed	Base	Treated Nm	Gain	
rpm			**hp**	**%**
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:

Specific Consumption g/hp/h

SPEED	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 BOP 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:

Losses By Friction hp

SPEED	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	2.5	11

The gain is rather substantial and is established at an average of **16%,** which implies an improvement is 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%**; 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.

Acceleration at Full Load

SPEED	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 test for horsepower show:

* An average **increase of oil pressure of 0.5 bar.**
* An Average **decrease of oil temperature of 15 %.**

This is explained by the fact that a film formed by treatment with BOP 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 on the adherent seats.

It is evident by the fact that the motor oil working under less 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 in 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) will work more efficiently and consume less.

Concerning increased acceleration, the treated engine consumes so much less that it's 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 BOP Engine Protection 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.

Nantes, 14 February 1979
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