BIOS No. A2
24.1.41
I.G.(Oppau) Rep. No. 445.

WEAR TESTS ON AN INJECTION NOZZLE AND PUMP PLUNGER WITH FUEL R.300 and GAS OIL

Survey: In an endurance run of 700 hours on the special fuel R 300 no damage was observed to have occurred to the injection nozzle and pump plunger. The wear of the nozzle was insignificant. A parallel test with gas oil gave the same result, except that a thin layer of coke formed on the nozzle, so that the sealing was slightly improved.

Object of the Tests

The object was to determine whether the fuel R 300 affects the injection nozzle and pump plunger of the Bosch pump.

Test Method

Two apparatus as in Fig. 1 were constructed. In one the test fuel R 300 was used, and in the other gas oil. Each apparatus consists of an injection pump, a heatable injection nozzle, and the measuring vessels. In the first 500 hours the nozzle was pre-heated to 150°C. In the last 200 hours there was no pre-heating. The engine speed was about 800 rpm and the injection volume about 0,25 litres per hour. The Bosch nozzle DN 8S1 was used. After 100 hrs. the nozzle and plunger were removed, weighed, and tested for leakage. The change in weight was measured on an accurate balance, and the leakage with the apparatus shown in Figs. 2 and 3 (plate 1).

The latter was tested first with nitrogen. The nozzle was fitted up in a chamber. The volume of nitrogen passing the nozzle needle was determined with a gas meter. The values obtained depended somewhat on the method of fitting and on the position of the nozzle (width of aperture). Therefore the nozzles were turned five times during the measurement, and the average value of the five was calculated. The same procedure was adopted with the pump plunger.

The leakage losses were also determined with the apparatus in Fig 3. This consists of an injection pump and a nozzle holder. Into these were built the nozzles and pump parts which were used in the corrosion test. Then the volume of fuel before the pump, the leakage losses of the nozzle, and the volume of fuel after the nozzle were measured. The leakage of the nozzles and pistons were measured with:-

Gasoline of 0,6 c st. 20° and
Kerosene of 1,5 c St. 20°

The injection pressure of the nozzle was set to 220 atü, so as to obtain large differences.

Results of Tests

The results of tests are shown on plate 2.

1. Alteration in weight (Fig. 4)

Practically speaking, the nozzles did not alter their weight during the test. The somewhat irregular course of the curve probably arises from variations in measurement. With the nozzle which was run on gas oil there was light coking, which explains the somewhat higher values. The nozzle which operated with R 300 appeared to be unchanged. The alterations in weight measured at the pump plunger were not shown, as they were too inaccurate.

2. Measuring the leakage with nitrogen (Figs. 5 and 6)

After a short period of running in, the leakage underwent practically no further change either at the nozzle or at the pump plunger, except in the nozzle operating on gas oil, which was made tighter by deposits and light coking at the cylindrical sleeve of the needle.

The pump element used for gas oil was already less tight at the beginning of the test than the one which worked on R 300.

3. Leakage losses (Figs. 7 and 8)

The nozzles which worked on R 300 and gas oil were tested for tightness with kerosine and gasoline. During the long period of running there were no pronounced changes from the initial values. It appears from this that the nozzle is not attacked by R 300. Here also the leakage losses are higher with the R 300 nozzle than with the gas oil nozzle, for the reasons given under 2. With the pump plunger also there was practically no change in the losses.

The pump losses were calculated from the total loss by deducting the nozzle losses. Only the values measured with kerosine are entered, as the high volatility made the values with gasoline too inaccurate.

Finally, an endurance run of 42 hours was made on an I.G. test diesel engine at low load. There were no signs of damage from R 300.

PLATE 1

Test Apparatus

Fig. 1 Apparatus for wear tests on nozzles and pumps.

Fig. 2 Apparatus for measuring leakage of nozzles and pumps.

Fig. 3 Apparatus for measuring leakage losses of nozzle and pumps.

PLATE 2.

Results of Wear Tests

Fig. 4 Alteration in weight of the nozzles.

Fig. 5 & 6 Measurement of leakage with nitrogen at 75 atü

Fig. 7 & 8 Leakage losses.