inter·noise 83

EXPERIENCES WITH LOW-NOISE VEHICLES WITH DIESEL ENGINES

Gert Kemper

Umweltbundesamt, Bismarckplatz 1, D-1000 Berlin 33

DEVELOPMENT OF LOW-NOISE VEHICLES

In cooperation with the Umweltbundesamt (Federal Environmental Agency) car and lorry manufacturers developed low-noise vehicles. All of them have an enclosure, some have a quieter engine as well.
Daimler-Benz / 1 / demonstrated on three versions of commercial vehicles noise reductions of about 10dB(A) in the acceleration test according to 81/334EEC. A distributor van (85hp, 5000kg total mass) was improved from 87dB(A) to 77dB(A) by a combination of engine compartment encapsulation, improved exhaust system, visco-drive fan, sound insulation on the engine and sound absorption on the cooling air intake system. The noise of a municipal vehicle for waste collection (192hp, 16000kg) was reduced from 91dB(A) to 80 dB(A) by changing the engine to a 6-cylinder in-line version with exhaust turbosupercharger and intercooling, encapsulating the engine compartment, installing a visco-drive fan and insulating the exhaust system. A long-distance lorry (330hp, 16000kg) was reduced from 94dB(A) to 84dB(A) by conversion to a V-8 engine with exhaust turbosupercharger, dual muffler exhaust system, installation of a visco-drive fan, engine compartment encapsulation, insulation of the exhaust system and modifications to the drive line (transmission, ring and pinion, planetary hub reduction gearsets). In all cases the cooling capacity was found to be sufficient for temperate zones.
M.A.N. is also working on a long-distance lorry (320hp, 22000kg). As yet the noise has been reduced from 90dB(A) to 81dB(A) without modifications to the engine but with an enclosure and a hydrostatic-drive fan outside the enclosure. The reduction is now limited by the transmissions and rear axle noise. Gearing noise can be expected to become an important problem for the development of heavy low-noise vehicles in the future.

Outside any governmental programme M.A.N. developed medium size low-noise lorries (96 and 130hp, 6000 to 10000kg) with noise values of 80dB(A) or less. Since spring 1983 all types in this category can be bought in a low-noise version.

Together with FKFS Magirus-Deutz worked on low-noise off-road lorries (280hp, 19000÷26000kg,4-or6-wheel-drive). Fig. 1 shows the results in noise reduction. The curve for the quiet lorry demonstrates an increase of noise emission in the acceleration test with the number of gear selected. This phenomenon can only be explained by tyre and gearing noise.

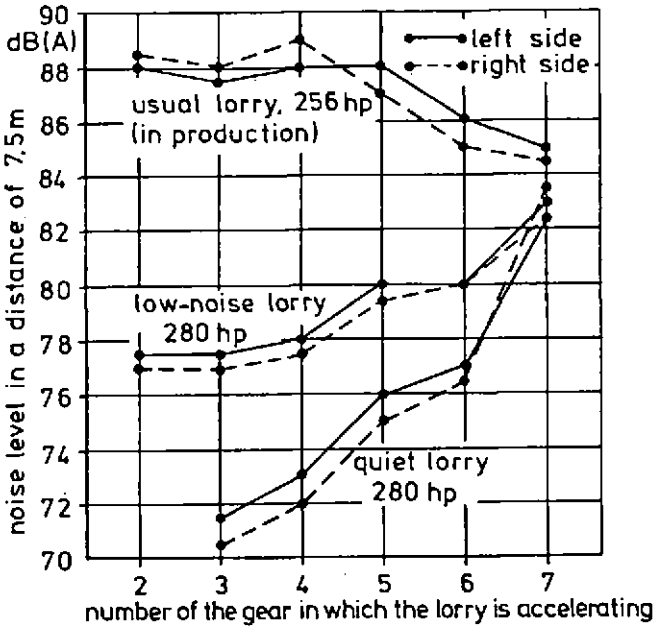

Fig.1. Dependence between gear selection and noise emission for three different off-road lorries.

81/334EEC, with the intention to look for the loudest gear in order to find the maximum engine noise, does not provide a suitable procedure for low-noise lorries. The best information about the engine noise would be given by a test that shows the highest level to be found anywhere around the stationary vehicle accelerating its engine dynamically up and down.

LOW-NOISE VEHICLES IN THE FIELD TEST

In a contract with the Umweltbundesamt Magirus-Deutz built 50 lorries (130hp, 7500kg) with fully encapsulated engines under regular production conditions. The lorries were bought by the Deutsche Bundespost (Federal German Post Office) and have been running since 1981. Fig. 2 shows an average noise increase after one year of 1dB(A). Some lorries became up to 5dB(A) louder in the acceleration test. A comparison with the noise at high speed idling demonstrates that this increase can not result from increasing engine noise alone. In some cases it can be assumed that this increase is partly due to tyre noise since some lorries have been fitted with snow tyres.

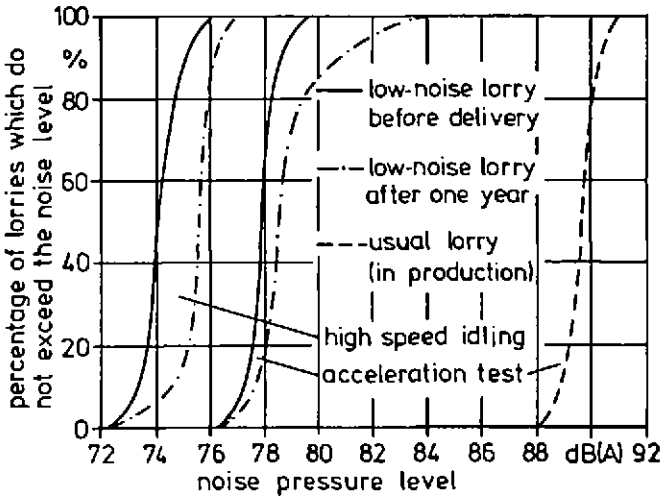

Fig. 2. Cumulative distribution of the noise emission from fifty similar lorries (130hp,7500kg)

Magirus-Deutz comes to the conclusion / 2 /: "Good durability was shown by the various sealing elements. No thermal problems arose during the period of the test. Although the noise level has increased, the trucks are still classed as low-noise when assessed subjectively (see also the comparison to usual lorries in fig. 2). The overall rating by the postal services which tested the trucks is good. The trucks can be employed without any restrictions under the specific conditions of use in postal delivery service. The demonstration test for a practical evaluation of low-noise trucks could be completed with positive results from both the user's and the manufacturer's point of view".
Meanwhile, the Umweltbundesamt has started a new field test with Daimler-Benz. 10 low-noise distributor vans and 20 low-noise diesel taxis have been sold to customers in the area of Bad Reichenhall (near Salzburg). The noise emission of the typical German taxi, Mercedes-Benz 240 D, has been reduced by engine compartment encapsulation from 80dB(A) to 74dB(A) in the acceleration test.

CONCLUSIONS AND ADDITIONAL REMARKS

Engine compartment encapsulation has proved to be a good way of reducing engine noise. The research work of the Umweltbundesamt has given important impulses in this field. Meanwhile, the competition between manufacturers is showing results and one can assume that the International Automobile Exhibition in Frankfurt in Sept. 1983 will present several low-noise vehicles for the market. Future tasks in the reduction of lorry noise will concern gearing and tyre noise. Other important sources of traffic noise to be dealt with are motorcycles and mopeds.

REFERENCES

/ 1 / P. Fietz, J. Möhlenkamp, R. Herz: "Definitionsstudie geräuscharme Nutzfahrzeuge", Umweltbundesamt Berlin, 1982.

/ 2 / J. Fischer: "Demonstrationsversuch zur praktischen Erprobung leiser Lastkraftwagen", Umweltbundesamt Berlin, 1982.