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MEASUREMENT OF EXHAUST OUTLET

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ABSTRACT
The noise from a truck silencer should be $7 - 10$ dB lower than the total pass-by noise. This requires measurements close to the silencer. Our methods are: 1. Measurements made on a truck at 0,1 and 0,5 m. The silencer is placed behind the cabin giving shielding from noise of engine, transmission, tires ... 2. Measurements in a big acoustically damped engine test cell. The engine is enclosed and the noise is measured outside the enclosure. Suction of the gas flow is made through a conical net that allows the noise to be measured through the net at 0,5 m from outlet. 3. Measurements in a not acoustically treated engine test cell by measuring inside a large absorbent silencer with fresh air cooling the microphone placed 0,5 or 0,25 from outlet.

1 - MEASUREMENTS ON AN ACOUSTICALLY TREATED TRUCK

To get a low background noise from engine, transmission, tires, wind ... we place the muffler behind the cabin. The pipe from the turbine is taken right up behind the cabin thus getting a long pipe of about 2 m. This exceeds the normal length of the inlet tube with about 1 m.
Behind the cabin is placed a heavy flat steel plate giving 5 000 kg extra weight to the truck. When full power for a longer time is needed the truck pulls a heavy loaded trailer. Time for engine to go from half to full number (nominal) of revolutions is about 5 respectively 20 seconds giving different damping and different sound generation (flow noise).
Heavy rubber covers openings towards engine and transmission. This is also hanging down partly covering the wheels. In this way we get a background noise more than 10 dB lower than from noise measured 0,5 m from outlet.
The outlet is placed at the same height over the surface as is used on a truck over the road. The microphone is placed 0,5 m from the outlet with a 45-degree direction from the pipe. The microphone is also placed 0,1 m from the outlet.
Measurements from the shell can also be performed, measuring distance is $0{,}05 - 0{,}1$ m. The outlet is then connected to a long tube ending far away from the silencer and lower than the flat surface thus getting lower level and some sound shield. The low frequency of the noise from the outlet is changed but this is normally not important for shell noise that normally is dominating at frequencies $200 - 800$ Hz (normally stiff shell).
Engine conditions are of great importance for the measurements.
Good control of pressure and temperature of compressed air is essential thus having control of the gas mass flow, which is well coupled to the engine power.

2 - ACOUSTICALLY DAMPED ENGINE TEST CELL

At engine test cells built for large diesel engines (for tanks) I got the opportunity to arrange measurements of truck silencers. The size of the test cell was so large that the engine could be built in by a temporary enclosure and still has room for measurements of a silencer with fairly good distance to the walls.
Suction of the gas flow is made through a conical very fine meshed wire netting that allows the noise to be measured through the net at 0,5 m from outlet.
It is very important to take care of reflecting walls and cover them by thick absorbent.

We could not suck the exhaust gas straight up, so we had to build a big tube with thick absorption in the upper end and suck out the exhaust gas from the tube by 3 smaller tubes.
You must avoid generating disturbing flow noise and still having enough suction for getting out all gas avoiding gas to leak out in the test cell. The gas flow must be well designed to avoid unnecessary noise generation. Noise from the suction blower must be under control giving low background noise.

3 - AN ORDINARY NOT ACOUSTICALLY TREATED ENGINE TEST CELL

Measurements in a not acoustically treated engine test cell are normally not possible because of high background noise. By enclosure the outlet the background can be kept down to an acceptable level. The enclosure should not give high acoustic reflections within important frequencies. This is achieved by covering the walls by 0,5 m absorption. The solution is using a large absorbent silencer with a hole for the microphone and cooling it by fresh air being sucked in and passing or rather close by to avoid to high flow noise generation.
The microphone is placed 0,5 or 0,25 from outlet, 90 degrees from flow.