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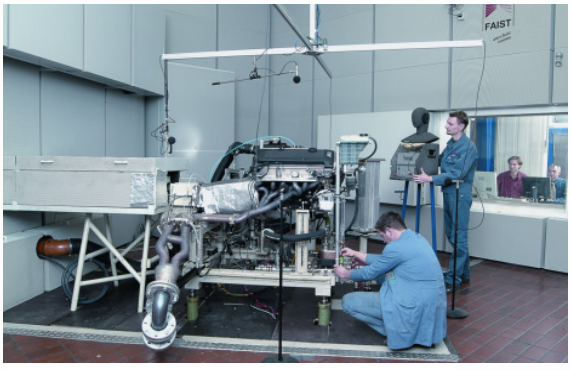
Highly Flexible NVH-Test Bench

"Peak-oil" applies pressure on internal combustion engines (ICE) from two sides and keeps driving the enthusiasm and efforts in NVH-development. This new generation test bench can support developers to react appropriately.

The conventional internal combustion engine is attacked from two sides. On the one side, in need for reduction of fuel consumption and exhaust gas emissions, engineers develop advanced technology. These range from combustion concepts like controlled auto-ignition, mechanical supercharging, cylinder deactivation to extreme down-sizing, for higher specific power. These technologies also bear considerable disadvantages e.g. an increase in noise, vibration and harshness.

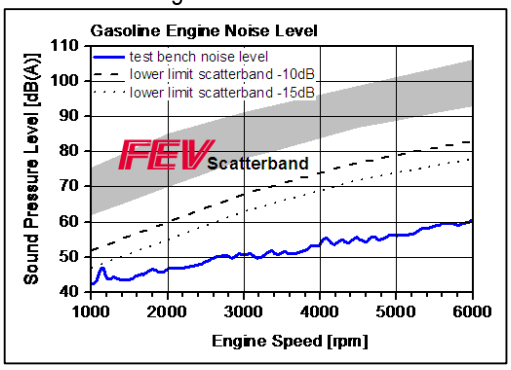
On the other side, there is the desire to decrease the NVH behavior of the vehicle and therefore the power train. As the major form of power source the ICE needs to keep up with the engine's quieter competitors: electric and hydrogen vehicle propulsion. Last but not least the operation of IC-engines in hybrid systems and hence the required minimization of differences of the two propulsion modes show the apparent needs. Thus, the developers have to find compromises, considering requirements and disadvantages. One key to successful NVH development is the test bench.

For precise measurement NVH test benches must provide a good acoustical shielding and isolation of vibrations from outside interferences. This is required for the whole operation range of the engine or power train (engine with gear box). To minimize the in-test bench noise level of the test bench, the dyno and shaft connection need to be silenced.



Fully equipped NVH test bench incl. test object

The diagram below shows a FEV™-scatter band of 100 modern engines, with the lower border including spark-ignition engines in coasting mode. All non-engine noise in the test bench shall then be at least 10 dB(A) lower than this border. If the test bench noise remains 15 dB(A) below this lower border, the measurements can be utilized even without any correction computation. The target values and the result in the test bench therefore give proof of the achievement being better than the target.



This outstanding achievement has been reached by mounting the testing object and intermediate bearing on a vibration-isolated concrete foundation. These are connected through a short shaft, exchangeable according to usage of the test bench. This distinction according to the specific testing situation considers different load situations (torque and speed) of the two modes, as well as the different mechanical connections to the test object.

The dynamometer is positioned in a separate room and separate from the above mentioned foundation. It is connected through a long shaft with the intermediate bearing. The shaft length of more than 2 meters ensures a position of the test object in the center of the testing room and thus a suitable distance of the microphones from the test object and the walls. The shaft is aligned using laser equipment to ensure the necessary coaxiality. The remaining dynamic displacement during operation is compensated with a disc coupling on each end of the shaft.

This strategy results in a customized state-of-the art test bench, providing outstanding development equipment for best-in-class engine and power train NVH behavior.

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