講演番号	172

A Study on the Detailed Classification of Vehicle Fuel Pump Noise and Improvement Method for Each Noise Generated

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KEY WORDS: **Vibration, Noise, Fuel pump, resonance, NTF, fluid induced noise analysis(B3)**

Noise and vibration have a great influence on the emotional performance of a vehicle. Noise is inevitably generated in the fuel system when the engine of an internal combustion engine vehicle is driven. With the development of sound insulation technology of the vehicle body, the noise from outside of the vehicle has been greatly improved. Therefore, the noise of the fuel system connected to the vehicle body has been highlighted. Elements such as the pump and jet pump of the fuel system as a noise source, and components such as the vehicle body and the fuel tank as noise transfer paths were analyzed. Through this, each noise was classified in detail to find the cause of the occurrence and improvement plan.

1. Analyzing the Cause of Fuel Pump Noise by Inspecting Fuel Pump Components

By analyzing the characteristics of noise generated during rotation by components like the fuel pump shaft, brush, rectifier, diesel fuel pump gear rotor, and gasoline fuel pump impeller, we can identify the source of the noise based on its frequency.

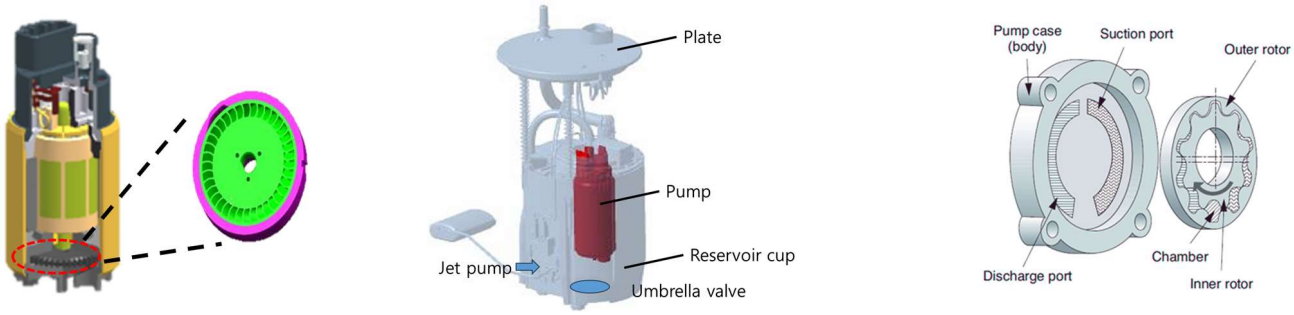


Fig.1 Fuel Pump Components

2. Noise Cause Analysis and Improvement

The moving components inside the gasoline fuel pump can collide, cause friction, and cause vibrations. These vibrations are transmitted to the outside through the pump casing and can be identified as noise. The main causes of mechanical vibrations are as follows.

Pump unbalance (operating noise): This vibration occurs when the pump's rotating components are unbalanced. This can also occur due to imbalance in the manufacturing process or wear during use.

Structural Resonance: This phenomenon occurs when vibrations in a specific part of the pump or vehicle body rapidly increase upon reaching the resonance frequency, which can be influenced by various design factors.

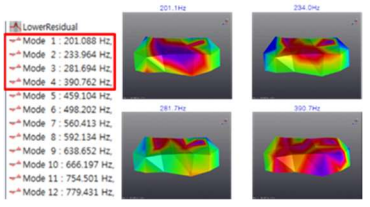
The fuel pump delivers fuel at a constant pressure and flow rate. However, unstable fluid flow can lead to noise.

We have introduced cases to address noise issues caused by pump imbalance and fluid instability among the above causes.

CASE1 addresses noise reduction from pump imbalance and resonance between the vehicle's natural frequencies, while CASE2 addresses noise reduction from fluid flow instability.

Table 1 Fuel Pump Noise Improvement case

Case 1



	Idle	#1	#2
PWM Duty(%)	75	80	100
200~600Hz RMS(dB(A))	38.4	37.3	36.3

Case 2

	JETPUMP		HOSE + OUTLET ANGLE	SUCTION (200~600Hz)	FALLING (1kHz~2kHz)	FLOW (2kHz~4kHz)
	MAIN	SUB		O/A RMS dB(A)	O/A RMS dB(A)	O/A RMS dB(A)
1	0.4	0.4	ORIGINAL + 0°	44.9	46.7	42.9
2	0.4	0.4	IMPROVEMENT + 0°	41.8	44.6	43.0
3	0.4	0.4	IMPROVEMENT + 45°	43.2	43.7	42.2
4	0.5	0.3	IMPROVEMENT + 0°	39.2	44.4	43.0
5	0.5	0.3	IMPROVEMENT + 45°	36.7	43.4	42.8