KES

Exhaust System Design

KES M – F010

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1. Scope of application

This standard shall be applied to a design of exhaust system of an automobile engine considering backpressure.

2. Purpose

The purpose of this standard shall be to specify the efficient method of backpressure calculation, which occur at exhaust system, and experiment.

3. Meaning of vocabularies

Backpressure

This is pressure loss that occur when burning gas go through an exhaust pipe and a muffler and sum of pipe backpressure that occur at a part of a pipe and muffler backpressure that occur at a part of a muffler.

4. Cause of backpressure generation

Backpressure occur due to complex causes of frictional loss of pipe wall when burning gas go through an exhaust pipe and a muffler, directional conversion loss of curved part of a pipe, extension · reduction · directional conversion loss due to structure of a muffler and etc.

5. Factor of excessive backpressure

(1) In case of too small diameter of exhaust pipe

(2) Excessive use of curved pipe

(3) In case of too long front pipe

(4) In case of too high muffler resistance

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6. Effect of excessive backpressure

(1) Power loss

About 1% power disappears every 50mmHg increment at allowed level.

(2) Aggravation of fuel expenses

About 1% of fuel consumption increases every 50mmHg increment at allowed level.

(3) Increments of burning temperature

About 5% of exhaust gas temperature increases every 50mmHg increment at allowed level.

Remark These kinds of effects cause engine overheating, excessive smoke occurrence and lifetime shortening of valve head and seat.

7. Backpressure calculation method (Theoretically)

Backpressure follows this formula

Backpressure = Pipe backpressure + Muffler backpressure

7.1 Pipe backpressure

Number sequence	Calculation items	Symbol	Unit	Calculation Method
(1)	Amount of exhaust gas	Q	m^2/S	$\frac{Vol \times rpm}{2 \times 60} \times \frac{Tex}{Tin} \times y \times \frac{1}{1,000}$ Here, Vol : Engine displacement (ℓ) rpm : Engine rotation number Tex : Average temperature of exhaust gas(OK) y : Volume efficiency
(2)	Amount of specific gravity	r	Kg/m^2	$\frac{0.001293}{(1+0.00367 \times Tex)} \times \frac{Patm}{760} \times 1,000$ Here, Patm : Atmospheric pressure in measurement but generally 755 mmHg. Tex : Average temperature of exhaust gas(°C) **Note :** Amount of specific gravity must be calculated by upper formula for amount of exhaust gas(Q) but is calculated by this formula.

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