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Development of vacuum insulation device for DPF with high performance on heat transfer

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A temperature of 300 deg. C or higher is necessary to catalyze PM in the DPF of diesel engines. However, as heat flows from the filter surface towards air having temperatures of 50 deg. C or less, the temperature of the outer part of DPF declines to a level below that of the inlet temperature, thereby causing uncatalyzed PM to accumulate in the outer part of the DPF.

In this research, we show that it is possible to equalize the inlet and outer component temperatures of a DPF by installing a vacuum insulation device in outer part of DPF and then explain the structure and function of our proposed vacuum insulation device.

Figure 1, which shows the structure and the function of our newly developed vacuum insulation device, we see that the device is composed of a double cylinder that can be installed in existing DPFs. An air-filled tube (C) that was produced based on Japan Patent No. 6807567 is inserted between the inner (A) and outer (B) cylinders, while grooved support boards (D) that were produced based on Japan Patent No. 7113578 are set up on both sides of both cylinders. These three components combine to produce a vacuum area (E) that imparts high-performance heat transfer characteristics on the DPF, thereby maintaining the diesel engine performance.

Figure 2 shows the difference in temperature distribution produced by the presence of the vacuum insulation device. As shown in Fig.2 (a), we can see that the temperature of the outer part of DPF without the device is at least 50 deg. C lower than the DPF inlet temperature. As shown in Fig.2 (b), the temperature of the outer part of the insulation device-equipped DPF is nearly equal to the inlet temperature.

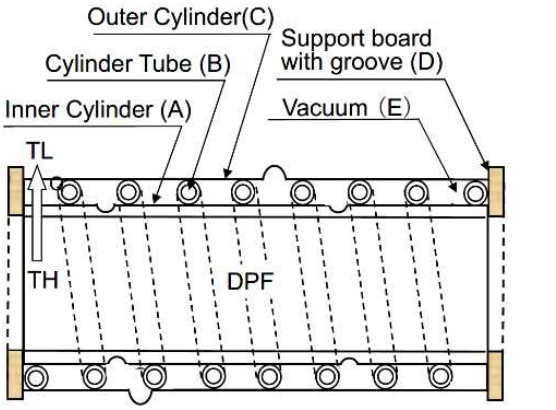
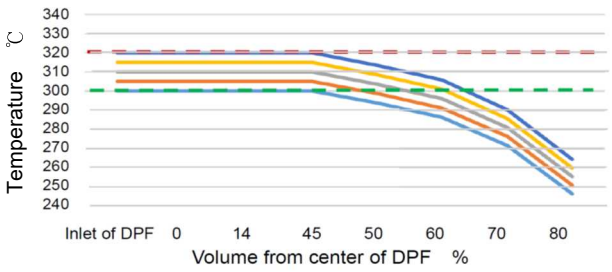
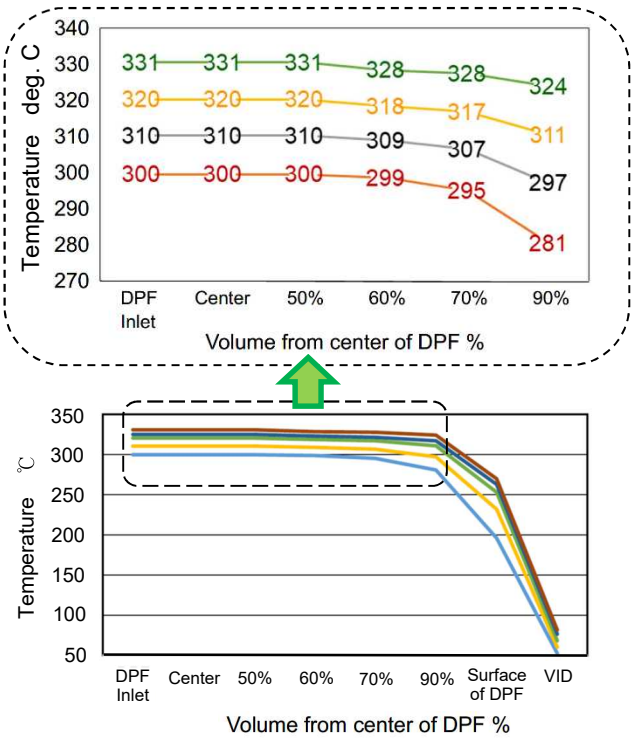


Fig. 1 Structure of newly developed vacuum insulation device



(a) Distribution temperature in normal DPF



(b) Distribution temperature in DPF with newly developed vacuum insulation device

Fig. 2 Insulating effect of DPF by newly developed vacuum insulation device