

# High Speed Generator for Direct Coupling to Small Capacity Gas Turbines

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## 1. Introduction

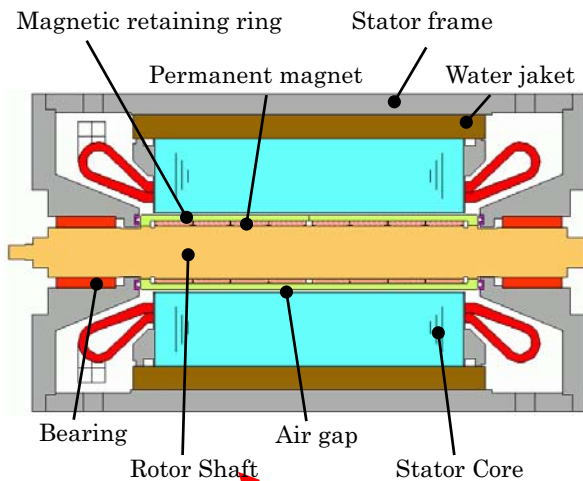
The improvement of strong magnets and high power switching devices encourages the high-speed generator's development using magnet to energize the rotor. It can couple to turbines directly without a gearbox used for conventional electric generating sets and achieve small size and high efficiency.

This paper describes the Toshiba's development of 53,000 (min-1)- 200(kW) generator.

## 2. Design of the 200(kW) generator

The high-speed permanent magnet generator rating 53,000 (min-1)- 200(kW) was designed. The generator consists of an air-cooled stator and a rotor with magnets held by a magnetic retaining ring considering the simplicity of operation and maintenance. It is also good for environmental protection.

At the detailed design stage, effects on generator performance of structural dimensions, such as pole



**Fig. 1 Cross sectional drawing of the 200(kW) machine**

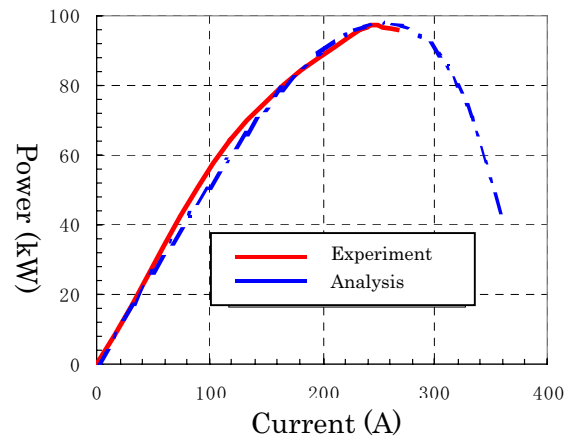
number, stator slot number, air gap length, and rotor

inter-pole arrangement ,retaining ring material, et al. were studied using electromagnetic analysis. Furthermore, heat conduction analysis was performed to obtain the temperature rise of each point. The thermal reliability was checked on its insulation specification.

According to these studies, most suitable dimensions were selected. Figure1 shows cross sectional drawing of the 200(kW) machine.

## 3. Results and conclusions

Based on this design, the 53,000 (min-1)- 200(kW) machine was manufactured and tested for its high-speed performance. Fig.2 shows resistor load test result. It shows close match between test result and design. From these tests and the Inverter's controlled load test, we conclude the design technique of the high-speed permanent magnet generator of the output 300 (kW) class and efficiency 95 (%) was established. This work was performed by the fund of NEDO.



**Fig. 2 Resistor load test result**

## References

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