

Development of Portable Gas Turbine Generator “Dynajet 2.6”

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1. Introduction

Based on its small gas turbine and turbo charger technology, IHI AEROSPACE CO., LTD. (hereinafter called IHI AEROSPACE) has developed the smallest-ever portable gas turbine generator—the Dynajet 2.6—which has a rated output of 2.6 kVA.

With the increasing use of information technology, growing demand is anticipated for small power supplies with high-quality electric components for industrial and emergency use. Such a power supply must be compact and light, operate quietly and have a low-vibration level. Its electrical components must also be sophisticated enough to allow the unit to connect directly to computers and the unit must also have high fuel storage performance (this is particularly important in emergency applications). However, it was difficult to meet these requirements satisfactorily with conventional generators driven by reciprocating engines. IHI AEROSPACE’s solution is a next-generation portable turbine generator that builds on IHI AEROSPACE’s experience and techniques with small gas turbine generators.

This paper briefly describes the Dynajet 2.6 portable gas turbine generator along with systems being developed or contemplated for introduction as new products that will utilize the exhaust gas from the Dynajet 2.6.

2. Overview of Dynajet 2.6

Figure 1 shows a general view of the Dynajet 2.6 wherein a single-shaft regenerative gas turbine engine, a high-speed generator connected directly to the engine and running at 100 000 rpm, and an inverter to convert the high-frequency power (about 1.6 kHz) from the generator into the voltages and frequencies of commercial power supplies are put together to achieve the compactness, light weight, and low noise and vibration levels, as well as high electrical and fuel storage performance. The high-speed generator also serves as a starter motor. The main particulars of the unit are shown as below.

Type NMGT-2.6DX

Engine	Single-shaft regenerative gas turbine
Generator type	Permanent magnet system
Rated rpm	100 000 rpm
Rated power	100 V
Rated output	2.6 kVA
Frequency	50/60 Hz (can be switched to either frequency)
Fuel used	Kerosene
Fuel consumption rate	Less than 4.5 l/h (at rated output)
Operating temperature range	-20°C to 50°C
Sound level	55 dB(A)
Dimensions	825 (L) × 420 (W) × 455 (H) mm
Dry mass	67 kg

IHI AEROSPACE’s advanced techniques to utilize the gas turbine characteristics have produced the Dynajet 2.6 portable gas turbine generator. Its size and weight are significantly reduced to between one-half and one-third of the conventional diesel engine generators of the same capacity. Also the lowest-ever operating sound in generators of the same capacity has been realized due to the high frequency of the Dynajet 2.6’s operating sound.

Figure 2 compares the wave distortions of electric



Fig. 1 General view of Dynajet 2.6

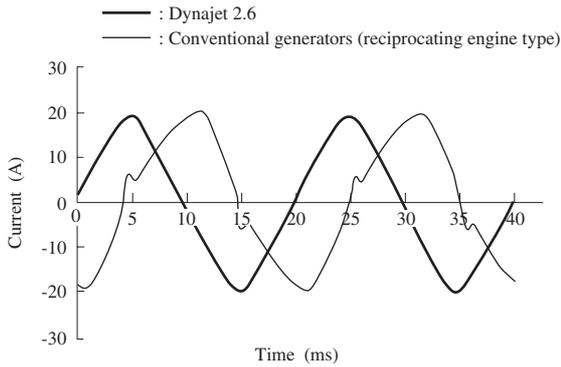


Fig. 2 Wave distortions of electric current

current of the Dynajet 2.6 and conventional generators and shows the Dynajet's wave distortion is nearly the same as that of commercial power supplies. Furthermore, the unit can be connected directly to computers and telecommunication devices.

3. Technical features of the Dynajet 2.6

The schematic diagram of the engine (Fig. 3) for the Dynajet 2.6 has been determined, taking into consideration the following requirements.

- (1) The high-speed generator should be properly cooled

Generators should be constructed in a way that no heat is transmitted to the generator from such high-temperature components as turbines, heat exchangers and combustors to ensure that the generator is readily cooled to the required level.

- (2) Heat loss to the exterior should be reduced

Heat loss from the high-temperature components of the engine to the engine exterior should be reduced to ensure thermal efficiency and to suppress temperature rise within the package. Specifically, the engine must be so structured that its high-temperature components are housed in a chamber and the high-temperature component area is entirely covered with the air from the compressor outlet.

To realize this, bearings are placed between the generator and the high-temperature engine components to thermally isolate the generator from these components. Figure 4 shows the high-speed generator and the engine (some parts are not shown).

4. Systems utilizing the exhaust gas heat

Small gas turbines of 100 kW or smaller are attracting increasing interest, not only as a distributed power generation systems or mobile power supply, but as the core of a cogeneration system because of the excellent quality of the exhaust gas from such generators. The Dynajet 2.6 offers the following advantages when served as the core of a miniature cogeneration system.

- (1) Significantly lighter and more compact than other

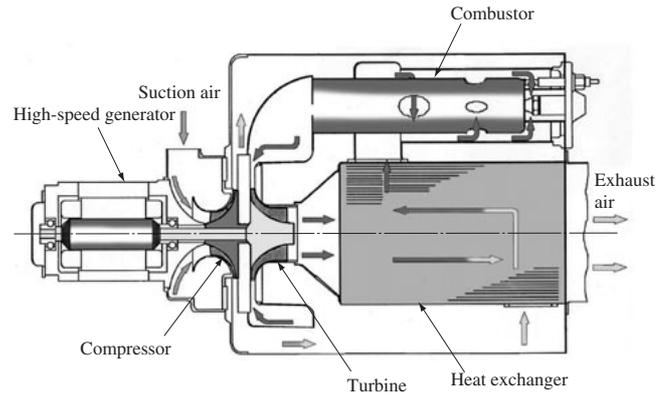


Fig. 3 Schematic diagram of engine

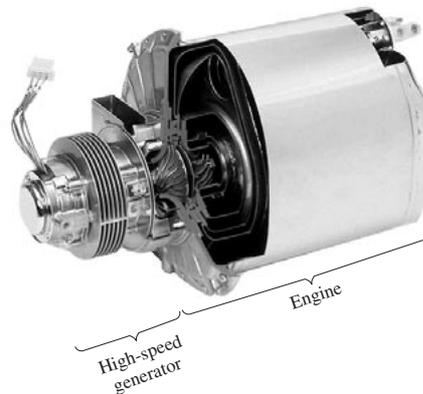


Fig. 4 High-speed generator and engine

- gas turbines, with resultant high portability
- (2) Suitable for emergencies because it uses a fuel that retains excellent quality over prolonged periods.
- (3) High exhaust pressures are available that cannot be obtained by inexpensive hot-air sources.

Taking advantage of Merits (1) and (2) above, IHI AEROSPACE is developing an emergency space-heating system (hereinafter referred to as a "cassette heater") as one of possible system products based on the Dynajet 2.6. This cassette heater is intended for use as a means of providing electricity as well as space-heating functions in emergency refuges. This is one of many potential applications in which the Dynajet's portability can be of great help.

The Dynajet 2.6 is also undergoing development of mobile dry toilets featuring its Merit (3).

5. Conclusion

IHI AEROSPACE has introduced the world's smallest portable gas turbine generator—the Dynajet 2.6. Its advantages include small size and light weight, quiet operation and low operating vibration, as well as compatibility with kerosene oils having long storage life.

In addition, IHI AEROSPACE is working to develop system products that utilize the high-quality exhaust gas available from the Dynajet 2.6.