

1,250 kVA DIESEL - GENERATING EQUIPMENT FOR EMERGENCY

We have recently completed the 1,250 kVA Diesel-generating Equipment for Emergency to supply the Tokuyama Oil Refinery, the Idemitsu Kōsan Co., Ltd., being combined with a diesel engine of the Fuji Diesel Co. Ltd., one of our subsidiaries. We have a pleasure of introducing in this brief article our newest Equipment, adopting the very first and epoch-making Vee type diesel engine of a medium speed revolution for the prime mover made in Japan.

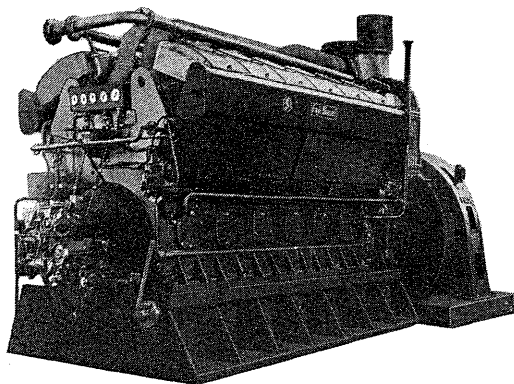


Fig. 1. 1,250 kVA Diesel-generating equipment

The specifications of this equipment are as follows :

1) Specifications of generator

Type : Open, horizontal shaft, revolving field, salient pole type

Model : F445/24-12

Number of phase : Three phase

Normal output : 1,250 kVA

Power factor : 80% in lag.

Rating : Continuous

Voltage : 3,300 V

Frequency : 60 c/s

Number of pole : 12 poles

Normal speed : 600 rpm

Class of insulation : A

Equipped with overhanging type d-c exciter,
13.5 kW, 110 V

Weight : 10,800 kg

2) Specifications of diesel engine

Type : Vee type, 4 cycle, single acting,
solid injection, trunk piston type.

Model : 12 VMD 27.5 H

Normal output : 1,500 HP

Normal speed : 600 rpm

Number of cylinder : 12

Vee angle : 45°

Cylinder bore : 275 mm

Stroke : 320 mm

Air compression ratio : 12.5

Brake mean effective pressure : 9.88 kg/cm²

Brake mean piston speed : 6.4 m/sec

Combustion type : Direct injection

Applied fuel : A class heavy oil

Fuel oil consumption : 170 g/HP/h or less
(at normal output)

Lubricating oil consumption : 2 g/HP/h
(at normal output)

Starting type : Automatic starting by compressed air

Lubricating type : Forced lubrication

Cooling type : Water cooling

Super charger : Exhaust gas turbine super-charger (with air cooler)

Speed regulation : 4% permanently,
8% momentarily

Thermal efficiency : 37% (using 10,000 kcal/kg fuel)

Dimension : 1,953 mm wide
4,740 mm long
2,580 mm high

Weight : 15,500 kg

3) Specifications of switchboards

Self-suspending, open type, sheet steel made, switchboard.

One board ; Generator panel (with high voltage apparatus)

One board ; Relay panel (for automatic starting)

Equipped with automatic voltage regulator of magnetic amplifier type

One board ; Automatic synchronizer panel

There had been employed, in former days, such a low speed diesel engine of a large output as 300 rpm to 500 rpm both for marine and land use.

Indeed, a low speed and a large size diesel engine with the output of more than 1,000 HP had been adopted even in a particular case of the private power generation for emergency. In recent days, however, demands have been increased for such a diesel engine of a large capacity as for the private power generation use on land and the longing for a small size and a light weight engine has resulted. These trends can also be presently observed in the increase of its revolving speed, not only from low to medium, but also from medium to high speed. In the 12 VMD 27.5 H Model diesel engine, a recent completion of the Fuji Diesel Co., you may find to your surprise the very small and the light weight for its comparatively large output as this type. This engine has been brought to completion after two years' sufficient fundamental test for the vertical type engine (straight line type) an original of this accomplishment, which is a record of the Vee type medium speed engine made under a unique design in our country. The Vee type engine has a structural feature of its cylinders arranged in a Vee form, so that its size in the shaft directions may be much less than that of a straight line type and that its performance may be more excellent. In comparison with the old conventional low speed ones (300 rpm) of the same output, the newly made engine is much smaller in size and much lighter in weight, for example, approx. 35% in weight, approx. 65% in total length, and approx. 60% in the occupied floor space, respectively of the former ones. In spite of its increased revolution per minute about twice as much as that of the former low speed ones, its structure is very solid to stand for a long durability. Particularly, the Trimetal of a high quality is adopted both for the main bearing metal and crank pin metal, and the kelmet is applied to the piston pin metal, in order to secure a distinguished reliance of those moving parts. The fuel oil consumption is also considered as an important problem, since the fuel oil applied is to require almost all costs of its operation. In order to meet this requirement, this engine has a high mechanical efficiency together with an excellent supercharging performance by adopting a cylinder cover of the four valve type (two suction valves and two exhaust valves in each) and a supercharger utilizing the energy of exhaust gas. In this reason, this engine is of satisfactory fuel combustion with very small fuel oil consumption at each load, and its ratio is nearly constant within a range from the full load to a half load. Therefore, it can also be driven in a high efficiency at a light load operation.

These features of a long mechanical endurance and a small fuel oil consumption may be shown pro-

minently in such a case of its consecutive operation for a long duration as that of the main engine at a small scale thermal power plant.

Besides, this engine is equipped with many cylinders in a Vee form arrangement in order to secure a good balance and little vibration of the engine body. The compressed air for starting the engine is supplied only for the cylinders in either side of a Vee rows, and only the fuel oil is injected into those in the other side, so that a slight drop in the temperature by the expansion of the compressed air may not cause the engine to make trouble in starting and the consumption of the air to be small for starting it. In former days, the power generator for a low speed engine of a large size was designed in an unnecessarily large dimensions in order to supply it with such a large GD^2 as the engine required. As for the new product, however, the economical design in a small size of it has been realized by the fact that the prime mover is of a good balanced Vee type and of a high speed revolution. The automatic voltage regulator adopts the magnetic amplifier type, which, on starting the generator, is aimed at making the exciter act by self exciting to stabilize the voltage of its output for power sources of the magnetic amplifier and to make best use of this amplifier by converting the field of the exciter to a separate exciting.

Being put to use in a parallel running with the former 625 kVA generator, the new equipment is to be fitted with an automatic synchronizing device to provide in safety the automatic parallel supply of the required load, in a high speed and with no mechanical shock.

In order to omit complicated manual operations on starting the diesel-generating equipment, the automatic starting device is recently applied for many cases. On the other hand, however, a perfect but non-defective reliability of its starting is required for this type of equipments as one of the power sources for emergency. As far as our equipment is concerned, starting of the above-introduced Vee type engine is highly reliable and its automatic starting is also quite possible in an easy way within a very short time.

As have been cleared in this brief article, our 1,250 kVA Diesel-generating Equipment for Emergency may certainly be found to be the newest for private use both in its reliable automatic operations, from starting to load supply, and in realizing an easy maintenance of it and an economical equipment by simplification of its operations.

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