

October 1, 2002

Electric Power Development Co., Ltd.

New High-Voltage Generator Put into Service for the First Time in Japan

The J-POWER-owned Katsurazawa Hydroelectric Power Station (commissioned in September 1957; licensed output: 15,000kW (Rated generator output: 9,000kVA 2 units) in Mikasa City, Hokkaido, has now been in operation for 45 years since it was first put into service in 1957, and time has taken its toll in the form of serious deterioration affecting all major equipment and necessitating large-scale modification work. The No. 2 Unit (Rated generator output: 9,000kVA) was put first on the repair schedule and a thorough search and assessment of the new technological trends in the field has led to the decision to install a new type of generator for the first time in Japan. This is a new high voltage generator built by Alstom Power Sweden AB. Even abroad there are only four of this novel type generator in service in Sweden and one in Canada.

The new high voltage generator is a revolutionary breakthrough in that it is capable of directly generating the power system voltage so that it requires no main transformer.

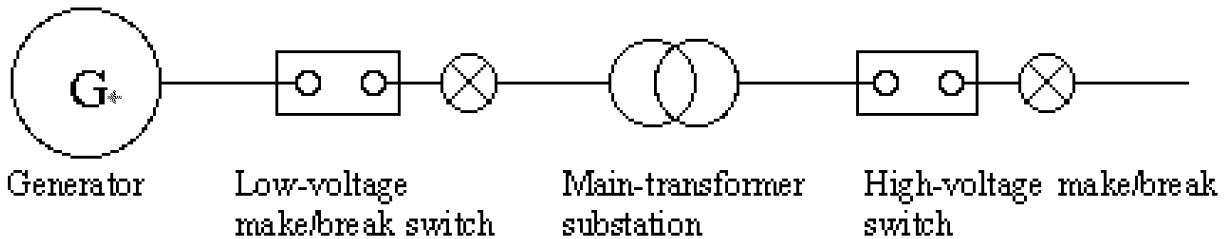
Main Features of the New High Voltage Generator

The conventional generators had rectangular section coils. This means that the corner sections of the coils had a large potential gradient. Because of the limited insulating strength of the resin-impregnated mica tape used as the main insulation for the stator windings, the maximum permissible generator voltage was limited to a level in the region of 30,000V. In contrast, the new high voltage generator uses sheathless CV cables with a high insulation performance for the windings. As these CV cables have a round cross-section, the interior of the winding insulator has a uniform electric field. This goes to minimize the electric stresses on the insulation which is thus capable of withstanding high voltages.

The new high voltage generator that can thus be used to generate the high output voltages tolerated by the insulation was developed in Sweden and has already established a record of successful operation on a commercial basis in Sweden.

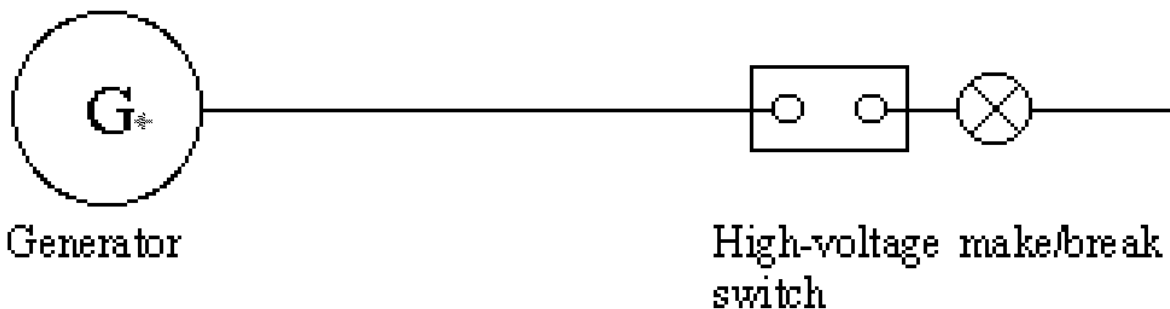
1. Previous Systems

The schematic below shows the general circuit arrangement for the conventional generators. The power generated by the generator had to be fed to a main transformer substation to step up its voltage to the system voltage before it could be connected to the power grid.



2. New System

As can be seen from the main circuit schematic below, the new generator feeds its power output directly into the power system. It generates a power whose voltage is in line with the system power for direct connection to the power system. This means that no step-up transformer and no low-voltage make/break switch and busbar cubicle are required.



3. Merits of the New High Voltage Generator

- Savings in equipment costs as no main transformer and no busbar cubicle and low-voltage make/break switch are required.
- Savings in maintenance costs as no main transformer and no busbar cubicle and low-voltage make/break switch are required.
- Improvement in generator efficiency (equivalent to an approx. 2% increase in efficiency in the case of the Katsurazawa Power Plant. (Higher efficiency is the result of lower power losses because of the smaller rated current value and of reduced losses in the main transformer.)
- Improved reliability as no main transformer and no busbar cubicle and low-voltage make/break switch are required.

Furthermore, as the capacity of the generator increases so also does its power output. As a result, the merits of improved efficiency for the new high-voltage generator will be the greater the higher its output voltage and the higher its capacity are.

Future Deployment of the New High-Voltage Generator

The new high-voltage generator to be installed at J-POWER's Katsurazawa Power Plant is a relatively small unit with a rated output of only 9,000kVA. Since it will be the first of its kind to be put into service in Japan, the costs for its installation will be relatively higher than for a conventional generator. J-POWER is therefore considering the replacement of the high-voltage, large-capacity generators at the large-scale hydroelectric power plants with a service life of 40 years or more with the new high-voltage generator.

The merits of the new high-voltage generator will also benefit the new small- and medium-scale hydroelectric power development projects that are seen as having a promising potential as a natural energy and will contribute to their progress.

Comparison of Generator Specifications (For reference)

| | Existing generator at the Katsurazawa Power Plant | Generator to be installed at the Katsurazawa Power Plant | Overseas Example (Maximum) | Generator capacity to be installed in the future |
|--------------|---|--|----------------------------|--|
| Rated output | 9,000kVA | 9,000kVA | 75,000kVA | In the order of 100,000kVA |
| Power factor | 0.85 | 0.85 | 1.0 | -- |
| Voltage | 6,600V | 66,000V | 155,000V | -- |
| Current | 787A | 79A | -- | In the order of 275,000VkVA |

End of announcement