

Synchronous machines

Synchronous machines are traditional products of GTE. Nowadays our products involve salient pole motors and generators.

General characteristics

- Output range is 1–7 MVA.
- Voltage level is 1–15 kV.
- Pole numbers are 4 and more.

Reference standards

The machines are supplied in compliance with the applicable IEC Standards, i.e. IEC 60034. The electrical design parameters of the generators are selected to minimize the harmonic content and therefore to meet the requirements of IEC 60034-1 for Telephone Harmonic Factor (THF). The main mounting and coupling dimensions comply with IEC 60072. Mounting arrangement are both horizontal and vertical.

Mechanical characteristics

The stator is similar to that described at induction machines (see: first page of *General Technical Information*). The rotor has salient poles. The poles are either solid or laminated ones. In case of laminated poles there are damping cage bars built into the pole shoes. In case of motors, these bars serve also as starting cage. They can be connected together to create a complete cage system.

Fixing of the poles depends on the speed and size. For high speed low pole number machines we apply hammer head fixing, for lower speed medium size dovetails are common. For large size machines there is steel yoke, and the poles are fixed to it by bolts. The bearings are roller or slide type, depending on speed and size.



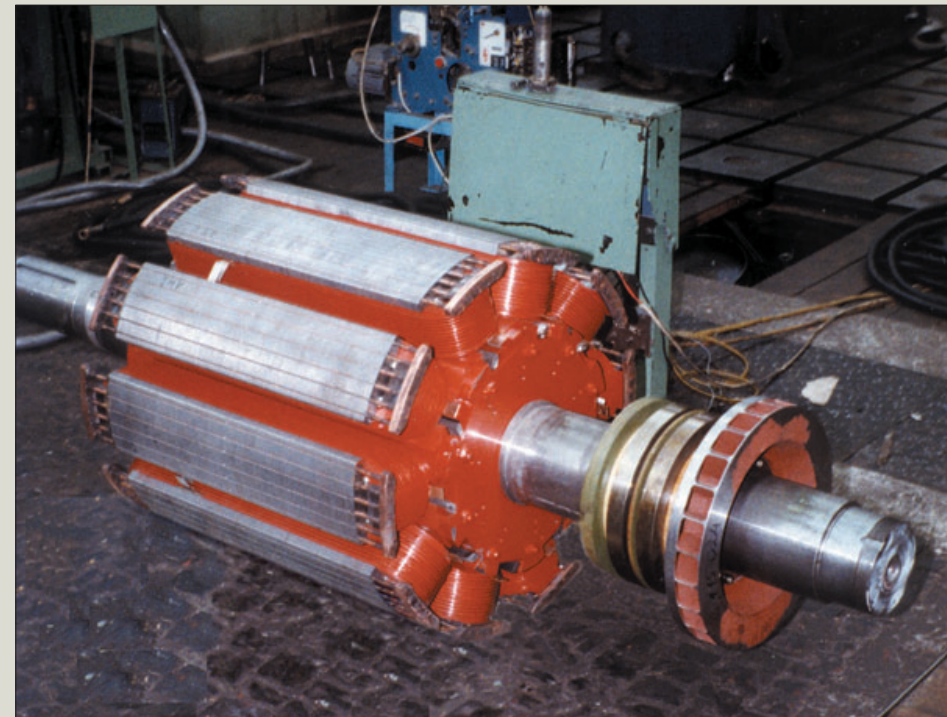
Excitation

- **Static:** static excitation takes the form of an external supply to a transformer/rectifier combination and a DC output via resistor and chngover switch to the main rotor. This solution is used for both generators and motors.
- **Brushless:** the standard brushless exciter is an alternator with rotating armature and stationary field. The rotating diodes of the brushless exciter are connected in a single or double three-phase bridge configuration and are selected with electrical and mechanical ratings according to actual requirements. Normally the diodes are protected by surge suppressors. The exciter can be

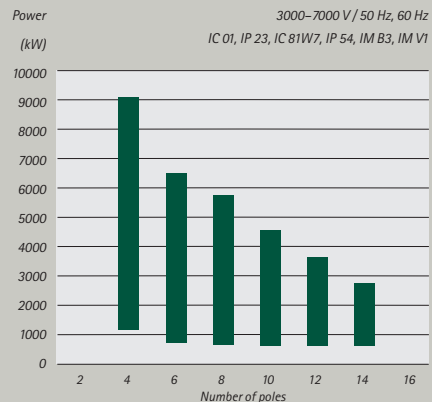
extended by a permanent magnet pilot exciter. In case of generators an automatic voltage regulator, which is normally a panel mounted equipment is applied. When applying for motors, to avoid the high voltage on the diode bridge during starting, rotating thyristors are applied which act as a short circuit across the excitation winding, protecting the diodes and avoiding slip frequency oscillating torques.

Synchronous condenser

A special application of synchronous machine is the synchronous condenser or compensator. This unit is not connected to any mechanical equipment and its reactive power is varied by adjusting its field current.



SH, SR, SD, SW SERIES



Ganz Transelektro
Electric Co. Ltd.
Rotating Machines
Business Unit

H-1095 Budapest
Máriássy u. 7.

Phone
+36 1 483 6602
Fax
+36 1 483 6637

E-mail
info.rotatingmachines
@ganztrans.hu
Internet
www.ganztrans.hu



EVERYDAY SOLUTIONS

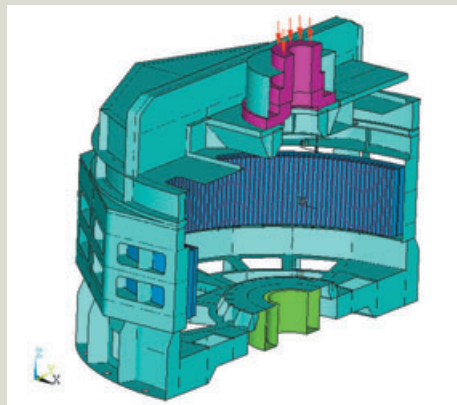
Technical description of ONv type vertical hydro generator

Ganz Transelektro, former Ganz Electric has had very long experience in manufacturing hydroelectric generators. Market segment of the hydroelectric generators and their associated equipment is considered very important. Nearly all of our equipments operate abroad (in India, Peru, New Zealand etc.) because of the Hungarian natural endowments. In many cases water turbines have also been supplied by a Hungarian firm, Ganz Machinery Works.

Stator

The stator frame is a welded structure strengthened with inside radial and axial ribs. The stator frame takes up the weight of stator laminated body, bearing forces, the windings placed into the slots of the core, and the different loads arising of short circuits and different operational conditions, and transfers them to the foundation. There are defined cross section holes in the strengthening ribs of the frame. These holes ensure and define the flow of cooling gas.

The mechanical strength of the windings' end is secured by insulated rings, suitable inserts and thermoshrinking ribbon bandages. The stator core is ventilated



by the means of radially arranged ventilating channels. There are 2 Pt 100 type thermometers between the layers of each phase in the middle part of the windings, for measuring the windings temperature. Circulation of the cooling air necessary to transfer the loss arising in the generator is promoted by the ventilating effects of the rotor poles.

The slip-rings and the brush holder system are placed over the upper combined bearing. Maintenance of the brushes can be made through the windows of the upper shield.

Rotor

The rotor is made with salient poles. The poles are laminated to decrease losses. In the pole shoes there are damping bars which are brazed to short circuiting (connecting) segments. Segments are connected with flexible conductive parts between the poles. These damping bars ensure good wave damping effect. Pole coils are made of edge banded flat copper plates, having good cooling conditions. Rotor windings is made with class F high quality insulation.

The poles are fixed to the rotor rim with bolts. The rotor rim is made of 150 mm thick solid steel cylinder. The rotor hub is connected to the rim with ribs. On the bottom surface of the rim, the hydraulic rotor brake system is arranged. To ensure the required GD² there is a flywheel connected to the upper part of the rim with ribs. The rotor hub is connected to the shaft with keys. The upper thrust bearing is connected to the upper part of the forged shaft.

Generator bearings

Thrust bearing

The thrust bearing is self lubricating, natural oil circulation type with oil to water coolers. Antifriction metal sliding surface is made of segments that ensures sliding contact with the very fine surface on the bell shaped hub piece pulled onto the shaft.

Guide bearings

The upper guide bearing is united with the thrust bearing, their oil system and cooler is a common arrangement. Lower guide bearing is situated in a holding structure also with self lubricating circulation and with oil to water cooler.

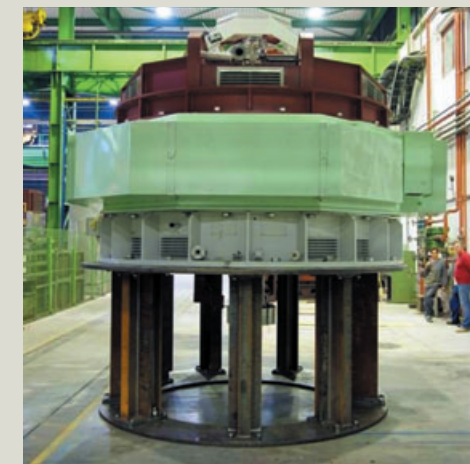
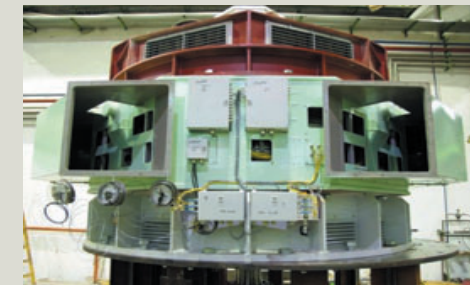
Temperature detectors are used to control bearing temperatures in operation.

The bearing on the exciter side is insulated from the earthed parts of the generator to avoid arising of the bearing currents. For above reason the oil pipe connections are also insulated.



ONv 2600L 30

- Rated output: 4007 kVA
- Rated Current: 350 A
- Rated frequency: 60 Hz
- Rated power factor: $\cos \Phi=0.9$
- Insulation class: F
- Enclosure: IP 23
- Rated speed: 240 rpm
- Construction: IM 8221
- Standard: IEC 34
- Weight: 41,500 kg



Ganz Transelektro
Electric Co. Ltd.
Rotating Machines
Business Unit

H-1095 Budapest
Máriássy u. 7.

Phone
+36 1 483 6602
Fax
+36 1 483 6637

E-mail
info.rotatingmachines
@ganztrans.hu
Internet
www.ganztrans.hu

