



Sealing control of hydrogen cooled generators

The generator is the electro-mechanical organ that causes the electrical energy production. Although its performance is excellent (close to 99%), the power loss by Joule effect is enormous, and this in a small volume. It is therefore necessary to develop systems based on heat dissipation using heat transfer fluids circulating in the stator, the rotor and the statoric conductors.

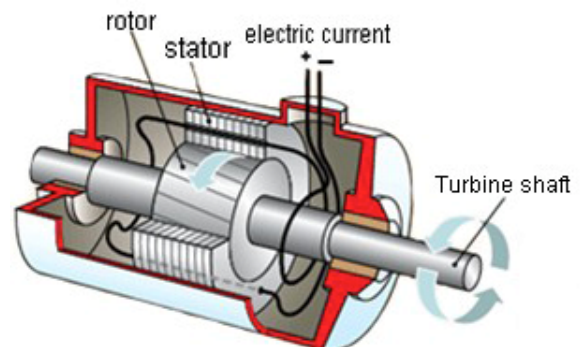


The hydrogen cooling system

The role of the system is to provide cooling to the rotor, the stator magnetic circuit and tightening frontal organs of the generator.

Why using hydrogen ? Hydrogen was chosen for its superior physical properties to the air.

- Its density is less than fourteen times.
- Its thermal conductivity is seven times higher.
- Hydrogen reduces the insulation aging because it pre-vents the ozone formation.



Protection against explosion



Despite its interesting thermal properties, hydrogen is none the less a flammable and explosive compound when it is in high concentration in the air. To prevent the risk of explosion, it is essential to take some precautions:

- Pre-filling of the circuit with carbon dioxide before to fill it with hydrogen to avoid air-hydrogen mixture.
- Permanent control of hydrogen purity in the circuit between 98 and 99.9% of purity.
- **Regular inspection of the generator shaft sealing** in order to prevent leakage out of the machine.



Hydrogen cooling system inspection

What methods of control?

For the sealing control of hydrogen cooled generators, we most often use leak detectors selective to hydrogen. Also for safety reasons, it is better to use equipment which are ATEX certified, approved to be use in zone0.

What are the elements to be checked?

If the carcass and bearing are designed to be gastight, other elements may have leaks.



The hydrogen supply circuit of the generator.

The generator is supplied with pure hydrogen, under a 35 bars pressure, at a 45m³/second flow rate. Under these conditions the smallest leak can cause substantial losses of hydrogen, that's why it is quite important to check all the valves. The sealing of flange is also carefully control on the hydrogen filling station.

The shaft sealing

The shaft sealing is provide by a coil system having a groove, in which are housed two other rings each composed of four segments. The oil is under pressure, through the rings and the shaft, and escapes into two streams on both sides of the joint, it makes the part between hydrogen and air portion. The oil flow is recove-red in the hydrogen side and degassed by vacuum sputtering.

The sealing of flange at this point of the generator must be checked carefully to avoid the release of hydrogen outside of the machine. To do this each connection and every bolts must be control.

Areas of hydrogen refrigeration

The hydrogen refrigeration is provide by four internal refrigerants supplied with water. In this areas it is the interface of the clamping hydrogen/air which must be carefully controlled.

