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Equipment Arrangement in a Variable Speed – Pumped Storage Plant

Hans-Martin Schneider





A. PSP « AVCE »

B. Comparison Variable versus Fix Speed Units

C. Generator Design

D. Converter Technology

E. Excitation Transformer and Busduct

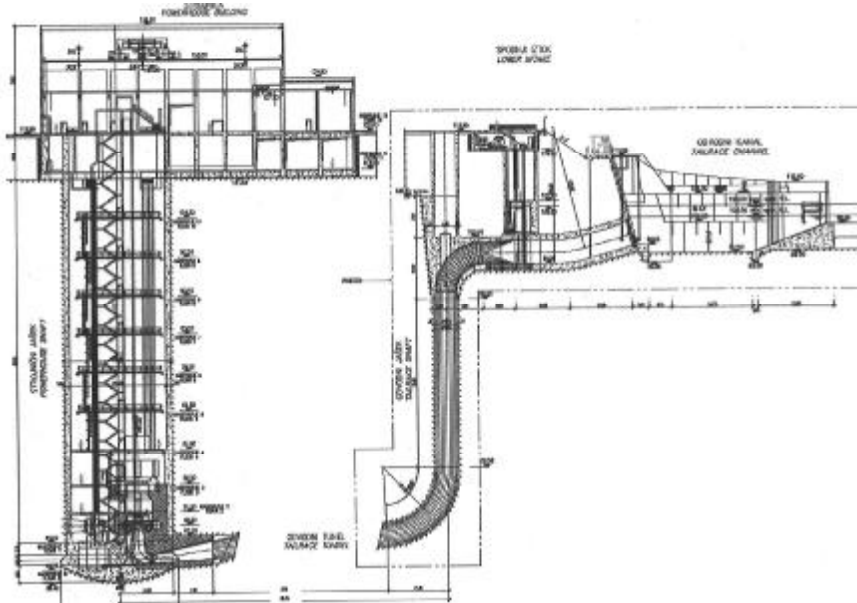
F. Slip Ring Cover

G. Benefits



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A.PSP « AVCE »

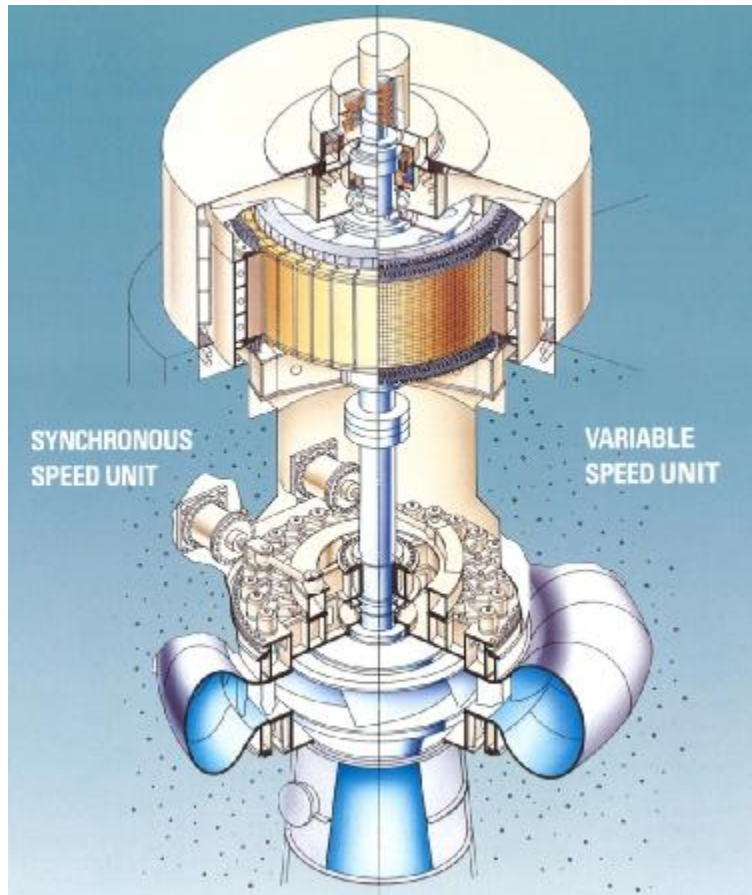


The Avce pumped storage scheme includes the following structures

- Upper reservoir with 2.2 mio m³ storage volume
- Power intake and 700 m long headrace tunnel of 4.5 m diameter, 40 m high surge shaft
- Inclined penstock 1300 m long 3.3 -2.9m,
- Shaft Powerhouse, 80m deep 18.5 m diameter with a single reversible Pump Turbine. The turbine that operates under a gross head of 500 m will have an output of 185 MW and an input of 180 MW, using variable speed technology with 600 rpm +/- 4%.
- Tailrace shaft of 4.6m diameter with outlet structure
- Lower Reservoir formed by the Soca River



B. Comparison - Variable versus Fix Speed Units



Generator Features

- Stator Winding on the Rotor
- Huge Slip Rings Cover
- Stator is larger

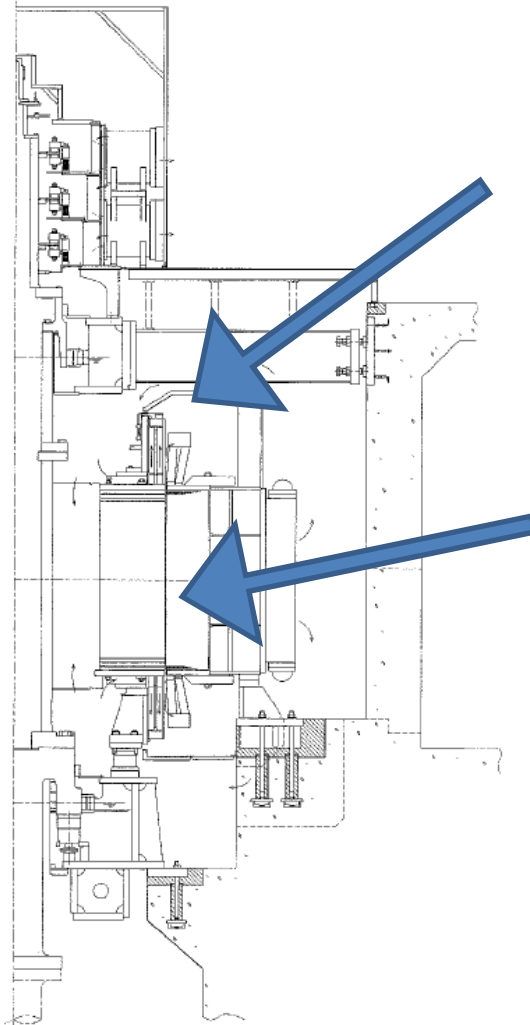
Equipment Features

- Converter
- Excitation Busduct
- Excitation Transformer
- No SFC



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C. Rotor Design « Avce »



Binding Tape for Coil End Support



Rotor Core

Specification of the Generator/Motor

Generator capacity (system)	195MVA
Motor capacity	180MW
Rated voltage	18kV
Rotational speed	576-626 rpm
Runaway speed	900 rpm
Fly wheel effect (GD2)	< 1640 tm ²
Rated power factor	95% lagging
Rated field voltage	1980 V
Maximum field voltage*	7000 V
Maximum field current	4800 A

* maximum field voltage will be applied at the start-up in the motor mode.



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D. Converter Technology



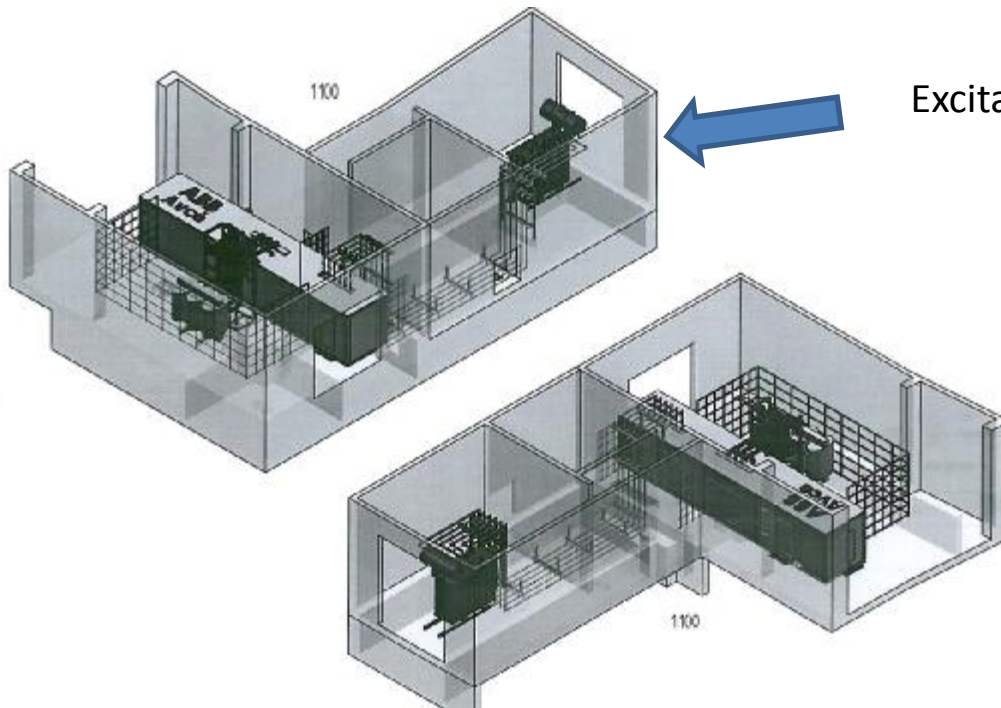
- 26 MVA Rated Power (Startup)
- Arrangement in a Container
- Cooling of semiconductor with pure water circuit
- External water/water heat exchanger
- Testing in the factory





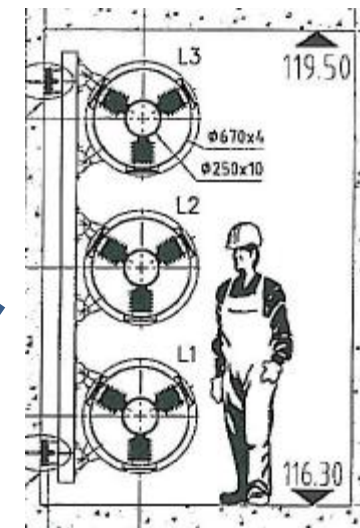
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E. Excitation Transformer and Busduct



Excitation Transformer 26 MVA

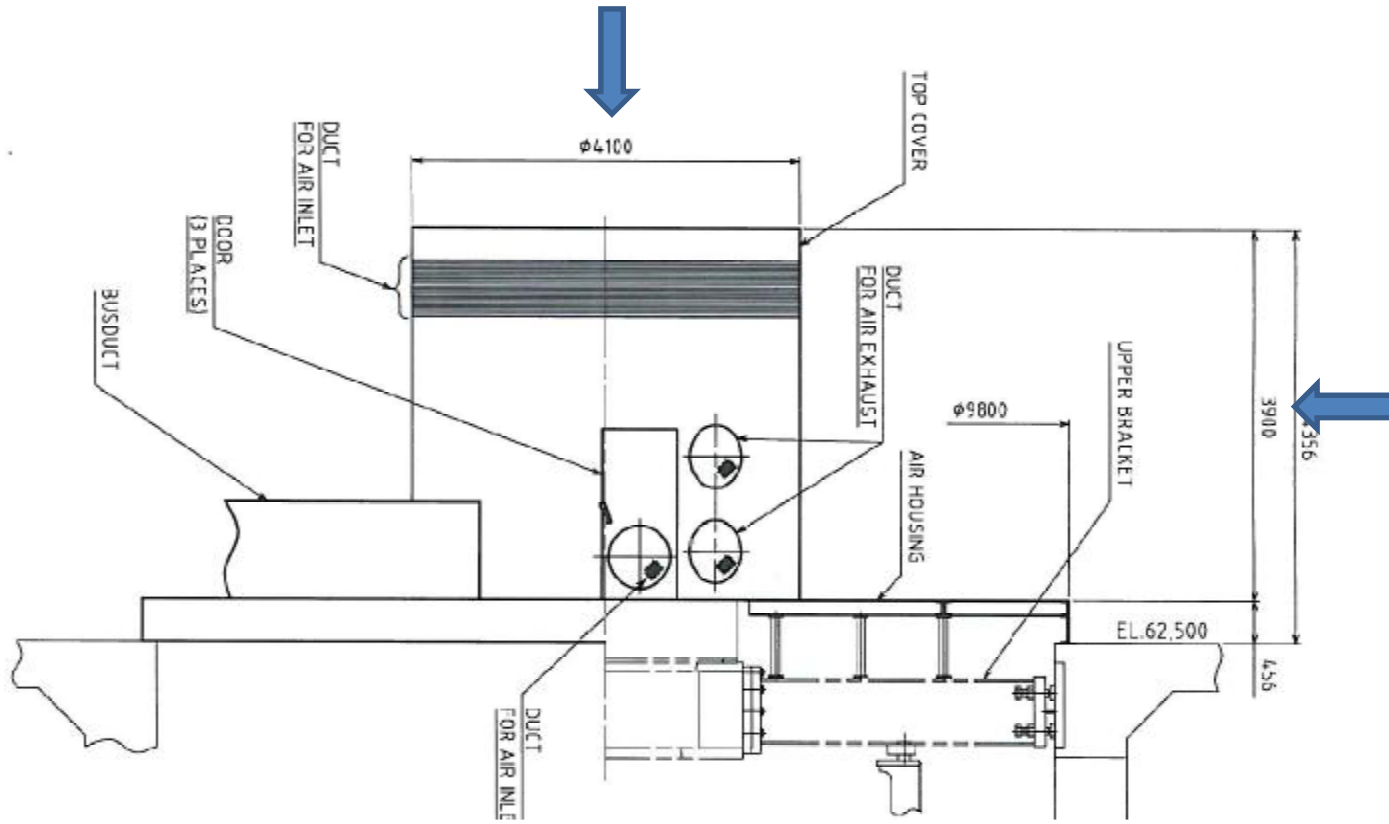
Converter Container is connected to the rotor by Excitation Busduct





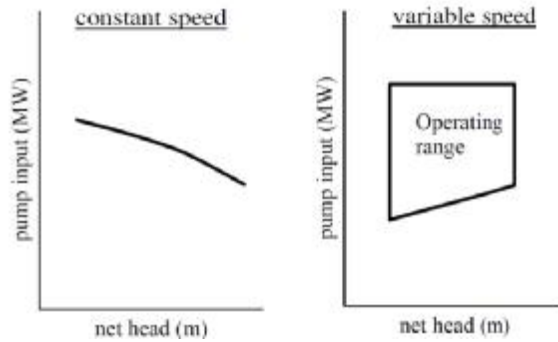
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F. Slip Ring Cover





G. Benefits



Benefits of Variable Speed

- Adjustable Pump Input
- Improved Turbine Efficiency
- Smaller Pressure Pulsations

