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A.1.5. Câbles 550 kV en tunnel pour la station de pompage de Guangzhou

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Résumé

La sortie de la centrale de pompage de Guangzhou (Chine) est équipée de 6 câbles 550 kV (2 circuits) d'une longueur unitaire d'environ 600 mètres. Les câbles isolés au papier imprégné sous pression interne d'huile assurent la liaison entre le poste aérosouterrain situé au point haut et le poste blindé situé au point bas ; ils sont posés dans l'air et en nappe espacée sur la totalité du parcours, dont la partie en tunnel représente une longueur approximative de 400 mètres avec une dénivelée de 200 mètres environ. Chaque circuit composé de trois câbles peut transiter en régime permanent la puissance totale de la centrale soit : 1300 MVA en fonctionnement normal et 1500 MVA en régime de secours.

A.1.5. 550 kV cables laid in tunnel for the Guangzhou pumping station

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Abstract

The power output of the Guangzhou pumping power station (China) is made up of 6 cables, 550 kV (2 circuits) of a unit length of approx. 600 meters. The oil-filled impregnated paper cables maintain the link between the conventional outdoor substation situated at the higher level and the SF-6 substation situated at the lower level. They are laid exposed to air in parallel flat formation, and spaced along their entire route, of which the tunnelled portion approximates a length of around 400 meters, laid down a slope with a level difference of about 200 meters. Each circuit comprises 3 cables capable of carrying under permanent duty the total power station load of 1300 MVA under normal operation and 1500 MVA under emergency conditions.

Introduction

The Guangdong Province in the South East of China is now experiencing a tremendous economic and industrial boom. In order to keep up with the necessary growth in power supply, Guangdong Authorities decided the construction of a hydroelectric power station 90 km from Guangzhou city.

The underground power station worked from two water-stocked reservoirs with a capacity of 1.7 Mm^3 each, under a water column height of approximately 523 m. It was in principle made up of four groups, each furnished with a turbine pump of 306 MVA unit power, associated with a generator motor of 333 MVA and a power transformer.
The Guangzhou power station is reversible : that is, it has the capability to pump from the lower reservoir to the upper reservoir during off-peak hours and to restore the power during peak hours by turbine, simply by reversing the direction of group rotation.
The nuclear power station at Daya Bay, linked up to the 550 kV network, supplies the power for pumping. Today, production of these two 900 MW groups will be optimised despite variation in consumption.

Six 550 kV power cables were used in the link between the underground gas-insulated substation and the outdoor substation, which was in turn linked up to the overhead line network from Guangdong Province. Guangzhou hydroelectric power plant, energised since June 1993, is China's most powerful pumping station today.

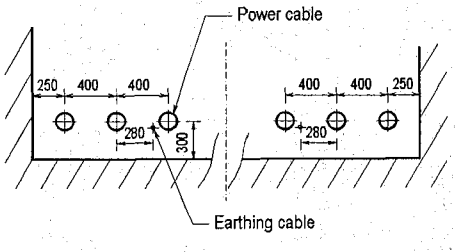

Fig. 1a : Cable arrangement (in mm)

550 kV power cable system

Main characteristics of the system

1)	Rated voltage Uo / U (Um)	290 / 500 (550) kV
2)	Rated frequency	50 Hz
3)	BIL 1.2/50 µs, peak value	1550 kV
4)	SIL 250/2500 µs, peak value	1175 kV
5)	Maximum short-circuit current - symmetrical / homopolar	50 / 28 kA for 3 s.
6)	Number of cables / circuits	6 cables / 2 circuits
7)	Route length / total length of cable	600 / 3600 m
8)	Transmission capacity for 1 circuit - in normal operation, with a load factor = 100 % - in emergency operation	1300 MVA 1500 MVA
9)	Laying conditions of the cables (see Fig. 1a and 1b)	In air (max 40°C), in spaced horizontal flat formation

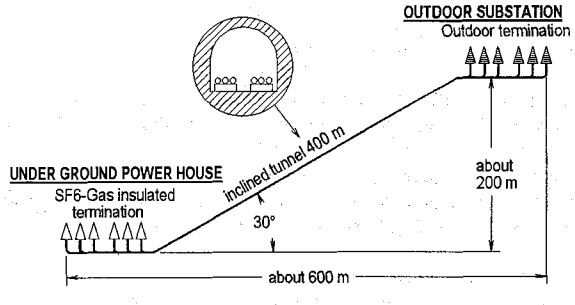

Fig. 1b : Cable route profile