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"Gas Insulated Substation"

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ABSTRACT

Reliable and economical power transmission and distribution are key functions for the future electric power supply. Gas insulated switchgear is used in industrial areas to fulfill high-energy demands by space saving design with a minimum of cost. Only SF6 insulated switchgear is able to fulfill these requirements. SF6 switchgear installed in Canada in a 550 kV substation with 100 kA as the highest breaking capacity ever achieved in one of the steps of development since then. Consistent research and development and innovative energy led to the third generation of nowadays compact and overall optimized switchgear. The advantages of gas-insulated switchgear are its compact design and the modular system. The standardized modular structure is made to match the various customers' specifications and allows realizing almost all substation configurations in compliance to them

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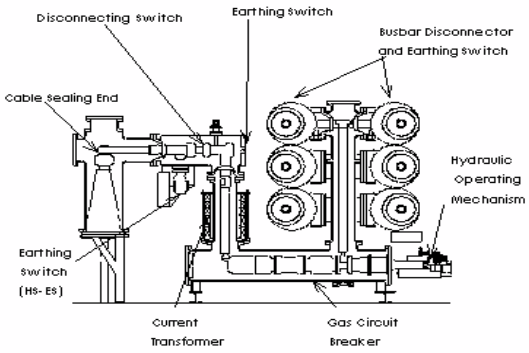
I. INTRODUCTION

A gas-insulated substation (GIS) uses a superior dielectric gas, SF6, at moderate pressure for phase-to-phase and phase-to-ground insulation. The high voltage conductors, circuit breaker interrupters, switches, current transformers, and voltage transformers are in SF6 gas inside grounded metal enclosures. The atmospheric air insulation used in a conventional, air-insulated substation (AIS) requires meters of air insulation to do what SF6 can do in centimeters. GIS can therefore be smaller than AIS by up to a factor of 10. A GIS is mostly used where space is expensive or not available. In aGIS the active parts are protected from the deterioration from exposure to atmospheric air, moisture, contamination, etc. As a result, GIS is more reliable and requires less maintenance than AIS.GIS was first developed in various countries between 1968 and 1972. After about 5 years of experience, the use rate increased to about 20% of new substations in countries where space is limited. In other countries with space easily available, the higher cost of GIS relative to AIS has limited use to special cases.

System Architecture:



Methodology

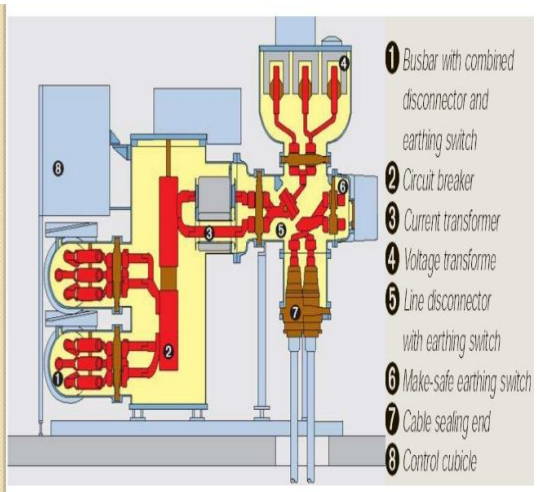


Fig: essential parts of Gas insulated substation

BUS BAR

Three phase conductors made of aluminum or copper, depending on the current rating, are supported by gas tight insulators.

Disconnectors and Earthing Switches

Line disconnector combined with a maintenance earthing switch forms a three-position switch. Busbar disconnectors are assembled in each busbar compartment. One of them is combined with a maintenance earthing switch and forms a three-position switch. The disconnector has a switching capability of bus-transfer current, small capacitive current as bus charging and small inductive current as transformer magnetizing current, if required. Earthed side of the earthing switch is brought out from the earthed metal housing and earthed to it through a removable link for primary injection test. Disconnectors and earthing switches are normally motor or manual-operated.

The make-proof earthing switch is provided with a motor-charged spring operation mechanism.

Current Transformer

The current transformer is of foil-insulated type with ring core mounted in the CB enclosure. SF6 gas provides the high-voltage
insulation. A separate compartment is available upon request.

Voltage Transformer

The voltage transformer is of induction type. SF6 provides the high-voltage insulation.

Surge Arrester

The surge arrester consists of zinc oxide (ZnO) element with excellent low residual voltage characteristics and long service life

Where and Why Gas Insulated Substations are used
Gas Insulated Substations are used where there is space for providing the substation is expensive in large cities and towns. In normal substation the clearances between the phase to phase and phase to ground is very large. Due to this, large space is required for the normal or Air Insulated Substation (AIS). But the dielectric strength of SF6 gas is higher compared to the air, the clearances required for phase to phase and phase to ground for all equipment's are quite lower. Hence, the overall size of each equipment and the complete substation is reduced to about 10% of the conventional air insulated substation.

Locations where Gas Insulated Substation is preferred:

- Large cities and towns
- Underground stations
- Highly polluted and saline environment Indoor GIS occupies very little space

- Substations and power stations located Off shore
- Mountains and valley regions

Merits of SF6 Gas Insulated Substation:

Safe:Gas insulated Substations are very safe and operating personnel are protected by the earthed metal enclosures. While the Substation in operating condition the Operating personnel can touch the compartment.

Reliable: The complete enclosure of all live parts guards against any impairment of the insulation system.

Space Saving: SF6 switchgear installations take up only 10% of the space required for the conventional installations.

Economical: Initial high investment is required for installation but the cost can be comparable for the less maintenance, reliable, safe operation against conventional substation.

Maintenance Free: An extremely careful selection of materials, an expedient design and a high standard of manufacturing quality assure long service life with practically no maintenance requirement.

Low Weight: Low weight due to aluminum enclosure, corresponds to low cost foundations and buildings.

Shop assembled: Quick site assembly ensured by extensive pre assembly and testing of complete feeders or large units in the factory.

Demerits Of Gas Insulated Substation:

- Cost is higher compared to Air Insulated Substation or conventional substation.
- Procurement of SF6 gas and supply of gas to the site is problematic
- Normally this type of substations are indoor type and requires separate building
- Maintaining Cleanliness is very important. Dust or moisture inside the compartment causes the flash overs
- When fault occurs internally, the outage period will be very long. The damage effect will also be severe

II. CONCLUSION

- GIS-necessary for extra HV and Ultra HV
- Some important areas to be studied include
- More conservative design
- Improved gas handling
- Decomposition product management techniques
- Achieving and maintaining high level of availability require more integrated approach to quality control by both users and manufactures.

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I have personaly worked on project of 220/33 kV GIS substation in Odisha first of its kind for OPTCL (ODISHA POWER TRANSMISSION CORPORATION LIMITED)