




IEEE/PES Substation Committee - GIS Subcommittee

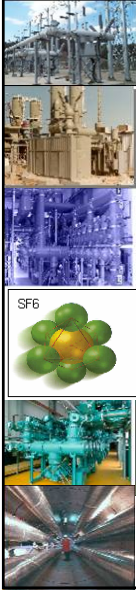


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IEEE



**Substations Committee  
GIS Subcommittee K2  
Module  
Gas Insulated Substation (GIS)  
Basics**



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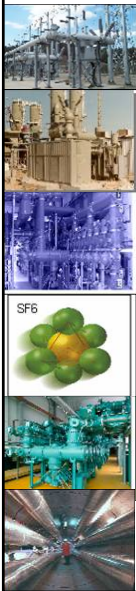
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**Contents  
GIS Basics**


- A Introduction to GIS**
- C Design Features of GIS**



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## Contents

### GIS Basics

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## A Introduction to GIS

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## Introduction to GIS

### Typical Air Insulated Substation 345/230/115kV

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## Introduction to GIS

### Typical Gas Insulated Substation 345/115kV






SF6




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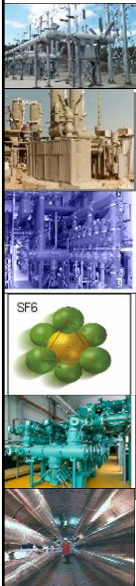
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## Introduction to GIS

### Cable Feeder Unit





SF6



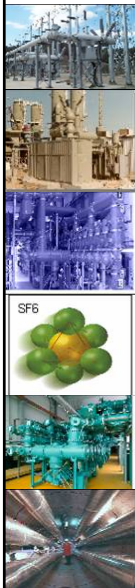
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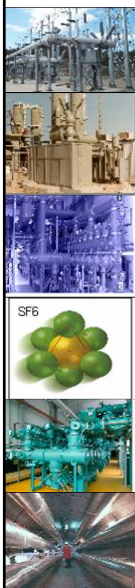
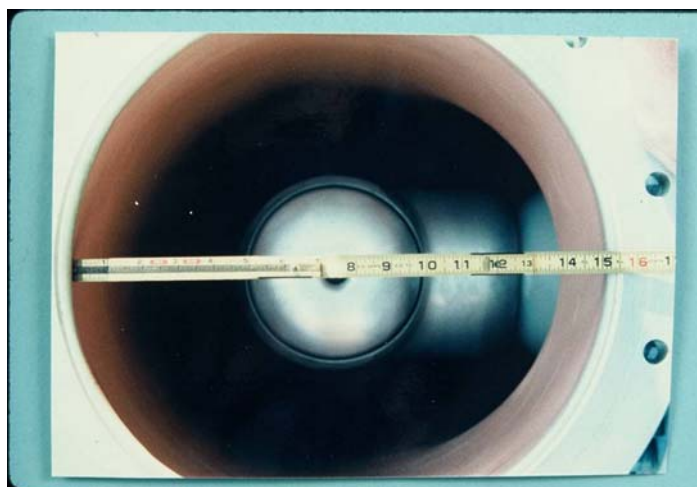
## Introduction to GIS Dimension Comparison

### GIS Technology



- SF<sub>6</sub> used as the insulating media
- Reduced clearances
  - 345 kV AIS 4.6 m (15 feet)
  - 345 kV GIS 380 mm (15 inches)










## Introduction to GIS View into Bus Bar: Conductor/Enclosure Dimension

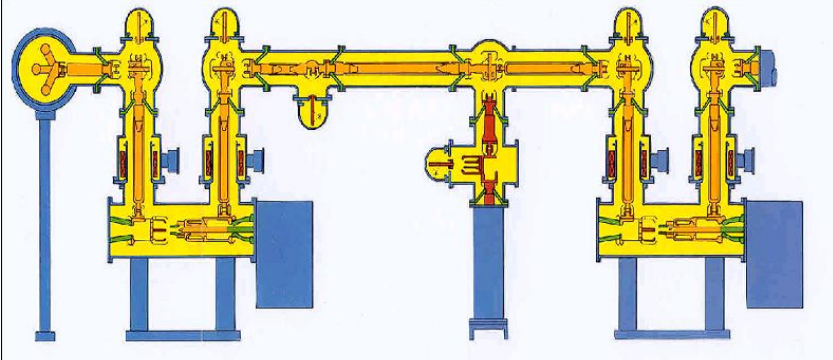


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## Introduction to GIS Classic Single Phase Enclosure of GIS



Busbar



Disconnector  
Current Transformer  
Circuit Breaker

Cable  
Connection








Disconnector  
Current Transformer  
Circuit Breaker


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## Introduction to GIS Midway Sunset Sunoco Cogen 242 kV GIS












Supply year	1988
No. of breakers	4
Rated voltage	242 kV
Rated current	2000 A
Rated short-circuit current	40 kA


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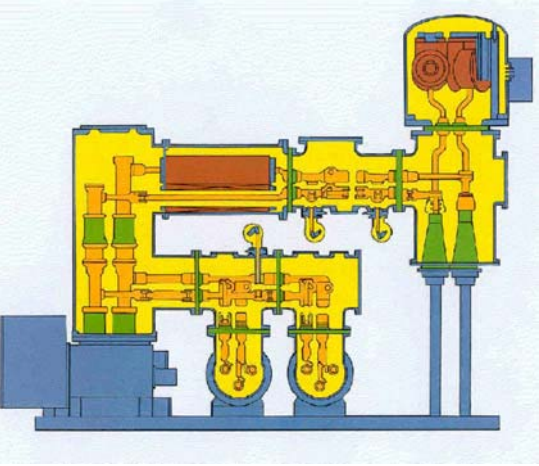


## Introduction to GIS

### Classic Three Phase Enclosure of 72.5 to 170 kV GIS





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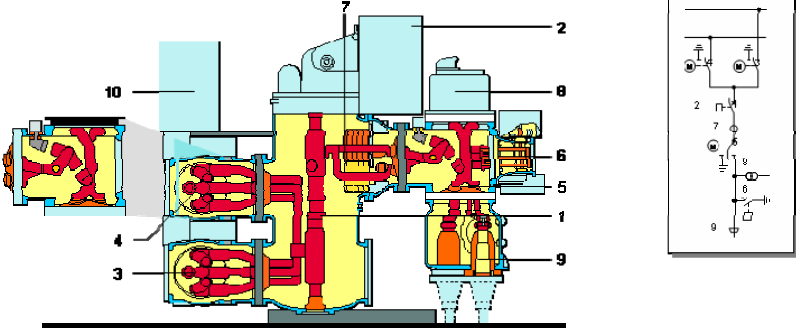


## Introduction to GIS

### Advanced Three Phase GIS 72.5 to 145 kV







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## Introduction to GIS Advanced Three Phase GIS 72.5 to 145 kV



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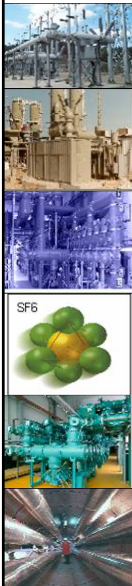
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## Contents GIS Basics



### B Design Features of GIS



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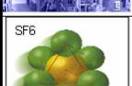


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## Design Features

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**GIS technology: compact, low-life cycle cost and modular for indoor and outdoor applications**

- Modular design, factory pre-assembled and tested units
- Space requirement less than 20 % of comparable AIS
- Safety (enclosed energized components)
- Continuous monitoring of SF<sub>6</sub> density
- Sealed for operating life > 50 years
- Major inspection: not before 25 years <sup>1)</sup>

<sup>1)</sup> Is influenced by the operation duties




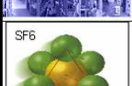


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## Design Features

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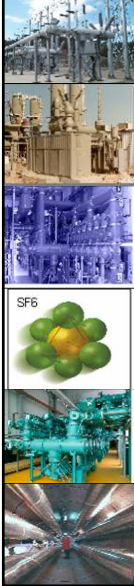
**GIS technology: compact, low-life cycle cost and modular for indoor and outdoor applications**

- Corrosion-resistant
- Low fault-probability/high availability
- Protected against aggressive environmental conditions
- Seismic resistant
- Low EMF and susceptibility to EMC

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## Design Features Space Savings



145 kV/31,5 kA  
4000 A

Previous

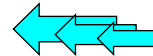


Retrofit of an  
existing AIS  
Substation by  
Compact Substation



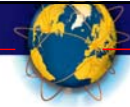
Afterwards

Space Reduction  
appr. 70 %

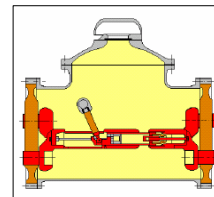
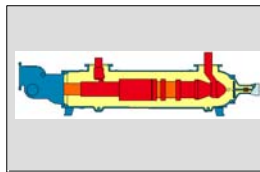
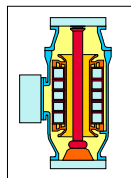
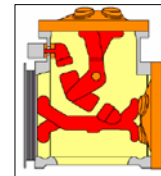
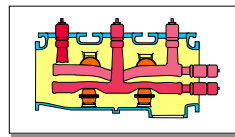
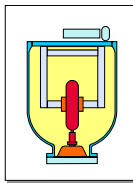
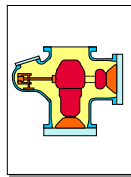
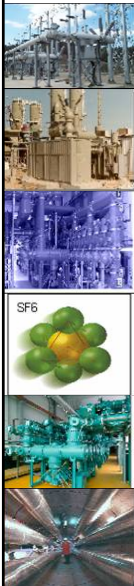


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## Design Features Modular Structure (schematic)



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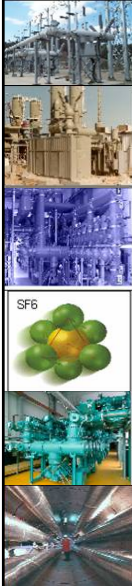
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## Design Features Modular Structure (devices)

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SF6



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## Design Features GIS Pressure Systems

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**Closed pressure systems:**

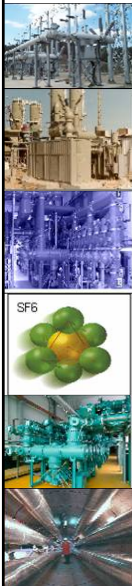
The closed pressure system uses isolated apparatus compartments with o-ring sealed bolted flanges.

The tightness characteristic of a closed pressure system stated by the manufacturer shall be consistent with a minimum maintenance and inspection philosophy.

**The leakage rate from any single compartment of GIS to atmosphere and between compartments shall not exceed 0.5 % per year for the service life of the equipment.\***

**Practical experiences to the today's design of GIS show as low as 0.2 % per year.**

\* IEC 62271-203 Gas Insulated Switchgear for voltages above 52 kV

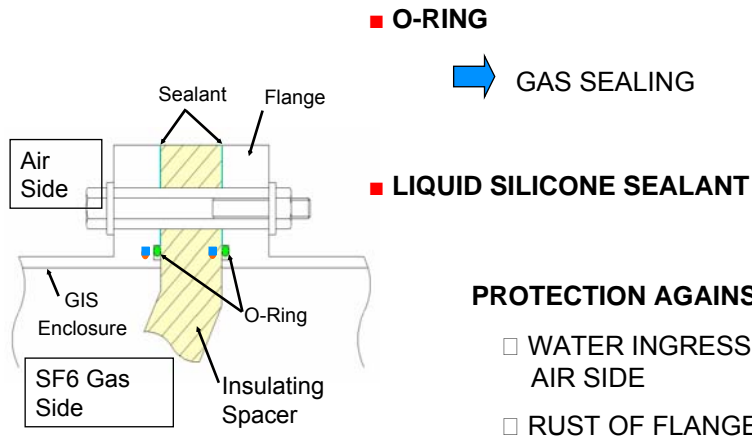


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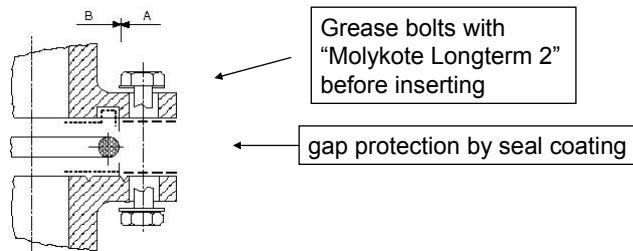
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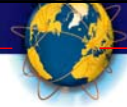
## Design Features Example for Static Double Sealing System



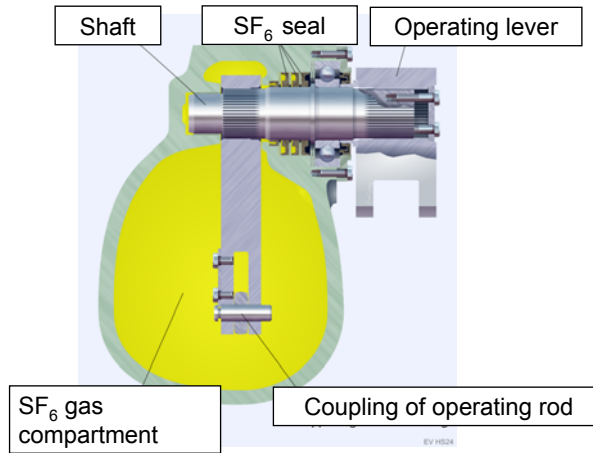
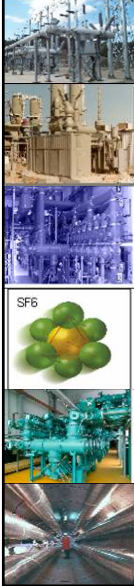
## Design Features Example for Corrosion Protection



--- Tectyl 506 coating for external area A  
 ---- Trost Multifunction Oil coating for inner area B

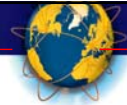


## Design Features Example for Dynamic Sealing System

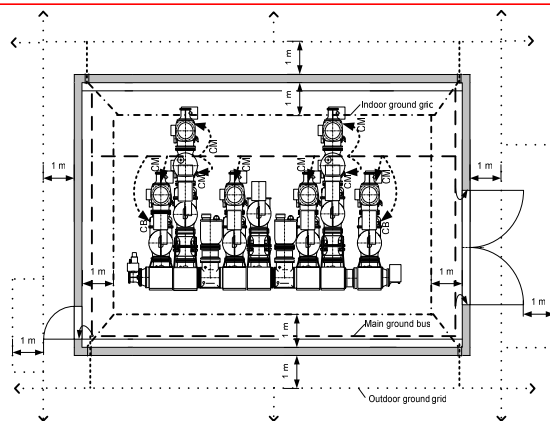
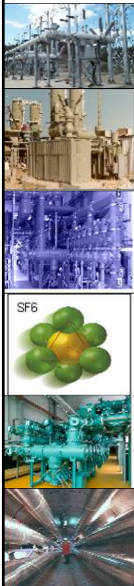


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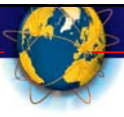
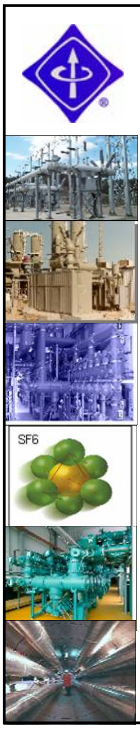
## Design Features Typical Grounding / Earthing Arrangement of GIS



- Earthing of the building
- Connection to GIS bay
- ..... Outside the building
- - - Earthing in the floor/ceiling
- ↙ Connection earthing of floor/ceiling to building

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**Thank you for your attention.**

**Any Questions?**