




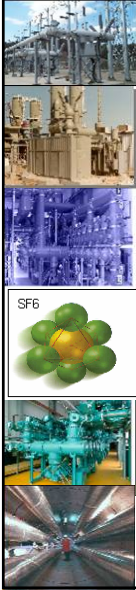
IEEE/PES Substation Committee - GIS Subcommittee





IEEE



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



T&D Chicago GIS

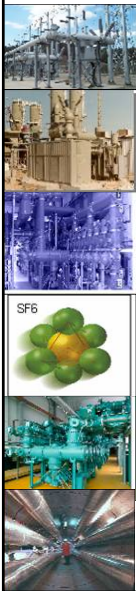
- 1 -

IEEE/PES Substation Committee - GIS Subcommittee



**Contents
GIS Basics**



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



T&D Chicago GIS

- 2 -

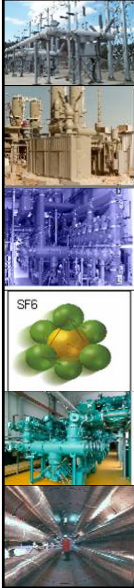
IEEE/PES Substation Committee - GIS Subcommittee



Contents

GIS Basics


A Introduction to GIS



T&D Chicago GIS

- 3 -

IEEE/PES Substation Committee - GIS Subcommittee



Introduction to GIS


Typical Air Insulated Substation 345/230/115kV



T&D Chicago GIS

- 4 -

IEEE/PES Substation Committee - GIS Subcommittee




Introduction to GIS

Typical Gas Insulated Substation 345/115kV






SF6




T&D Chicago GIS
- 5 -

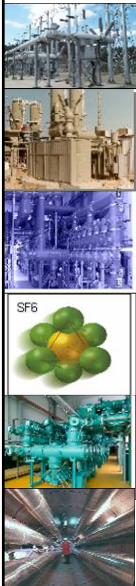
IEEE/PES Substation Committee - GIS Subcommittee




Introduction to GIS

Cable Feeder Unit

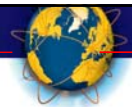




SF6



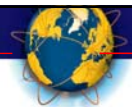
T&D Chicago GIS
- 6 -



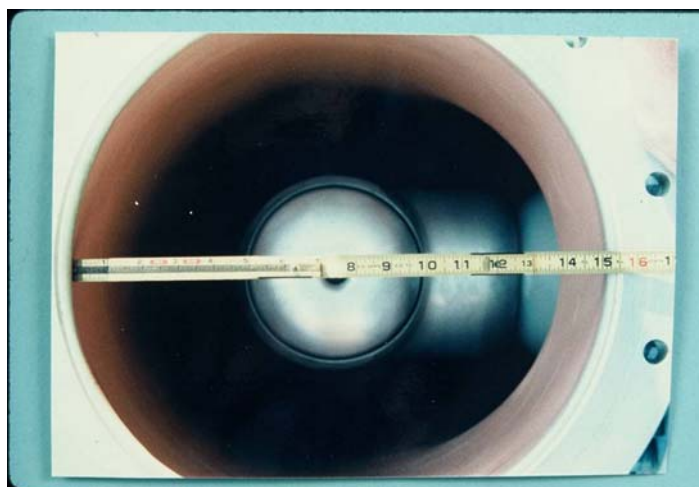
Introduction to GIS Dimension Comparison

GIS Technology



- SF₆ used as the insulating media
- Reduced clearances
 - 345 kV AIS 4.6 m (15 feet)
 - 345 kV GIS 380 mm (15 inches)



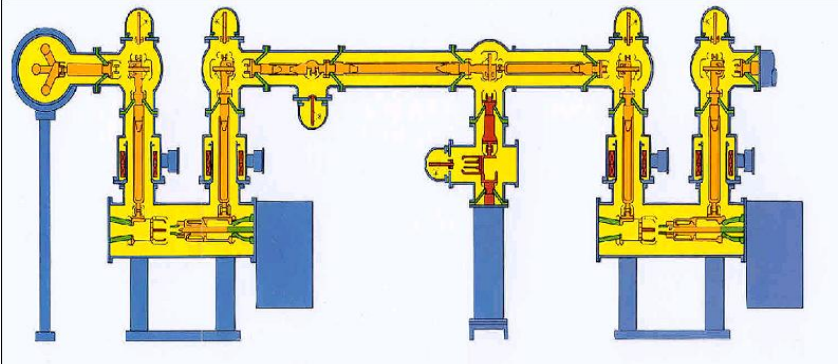
Introduction to GIS View into Bus Bar: Conductor/Enclosure Dimension



IEEE/PES Substation Committee - GIS Subcommittee

Introduction to GIS Classic Single Phase Enclosure of GIS



Busbar

Disconnecter
Current Transformer
Circuit Breaker



Cable
Connection

Disconnecter
Current Transformer
Circuit Breaker


T&D Chicago GIS

- 9 -

IEEE/PES Substation Committee - GIS Subcommittee

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

T&D Chicago GIS


- 10 -








IEEE/PES Substation Committee - GIS Subcommittee


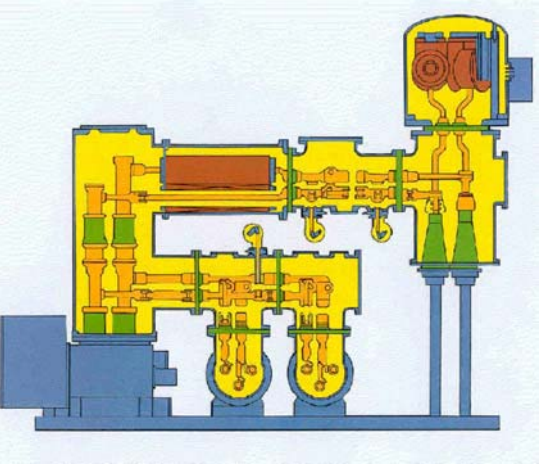


Introduction to GIS

Classic Three Phase Enclosure of 72.5 to 170 kV GIS





T&D Chicago GIS
- 11 -








IEEE/PES Substation Committee - GIS Subcommittee

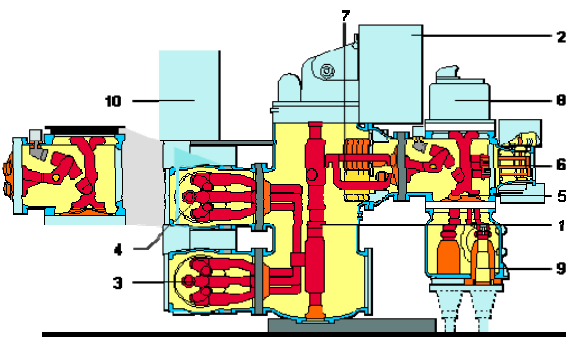
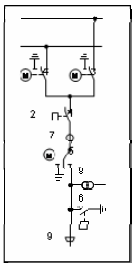


Introduction to GIS

Advanced Three Phase GIS 72.5 to 145 kV








T&D Chicago GIS
- 12 -


IEEE/PES Substation Committee - GIS Subcommittee




Introduction to GIS Advanced Three Phase GIS 72.5 to 145 kV














T&D Chicago GIS
- 13 -

IEEE/PES Substation Committee - GIS Subcommittee



Contents GIS Basics

B Design Features of GIS




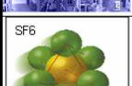










T&D Chicago GIS
- 14 -

IEEE/PES Substation Committee - GIS Subcommittee

Design Features



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 SF₆ density
- Sealed for operating life > 50 years
- Major inspection: not before 25 years ¹⁾




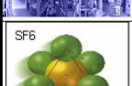


¹⁾ Is influenced by the operation duties

T&D Chicago GIS
- 15 -

IEEE/PES Substation Committee - GIS Subcommittee

Design Features

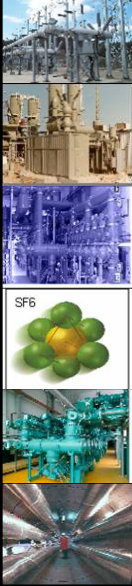
GIS technology: compact, low-life cycle cost and modular for indoor and outdoor applications

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

T&D Chicago GIS
- 16 -



Design Features Space Savings



145 kV/31,5 kA
4000 A

Previous

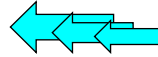


Retrofit of an
existing AIS
Substation by
Compact Substation



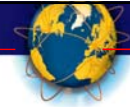
Afterwards

Space Reduction
appr. 70 %

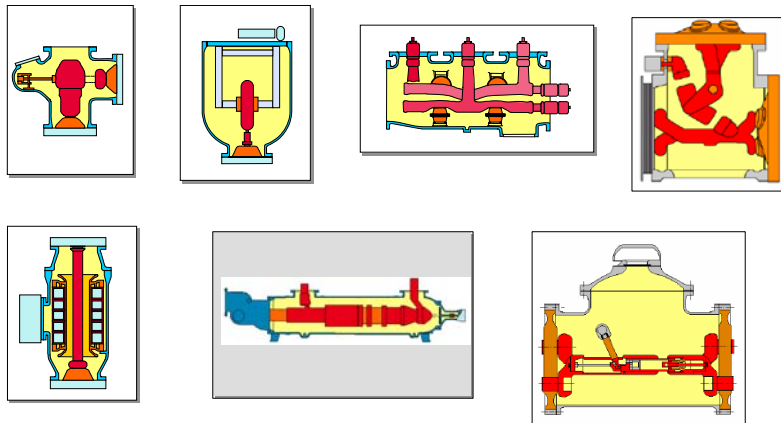
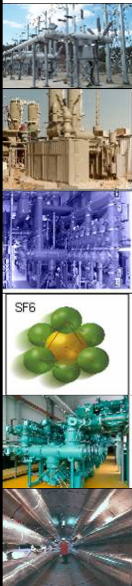


T&D Chicago GIS

- 17 -




Design Features Modular Structure (schematic)




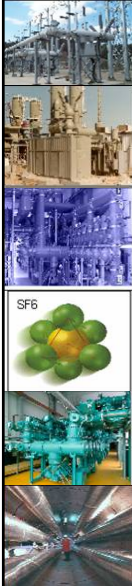
T&D Chicago GIS

- 18 -








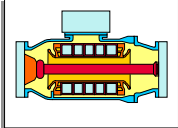


IEEE/PES Substation Committee - GIS Subcommittee






Design Features Modular Structure (devices)











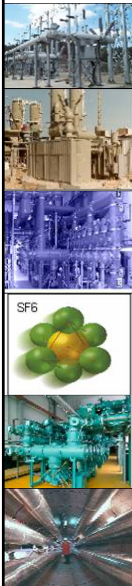
T&D Chicago GIS

- 19 -



IEEE/PES Substation Committee - GIS Subcommittee





Design Features GIS Pressure Systems

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


T&D Chicago GIS

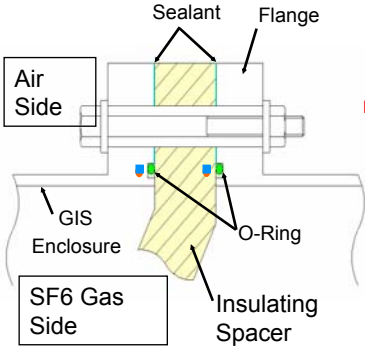
- 20 -

IEEE/PES Substation Committee - GIS Subcommittee

Design Features Example for Static Double Sealing System





■ O-RING
➔ GAS SEALING



■ LIQUID SILICONE SEALANT

PROTECTION AGAINST

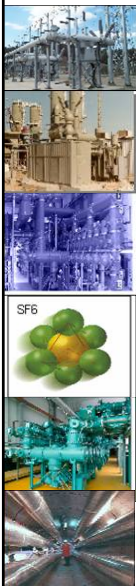
- WATER INGRESS FROM AIR SIDE
- RUST OF FLANGE

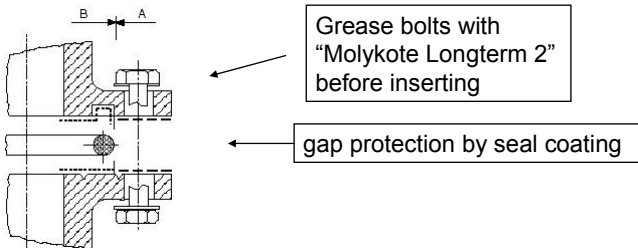
T&D Chicago GIS
- 21 -

IEEE/PES Substation Committee - GIS Subcommittee

Design Features Example for Corrosion Protection



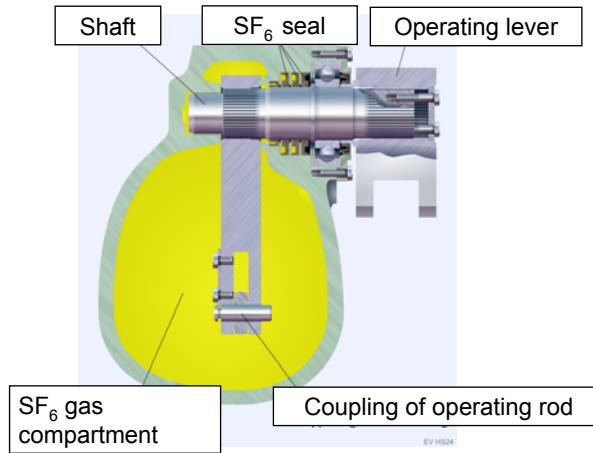
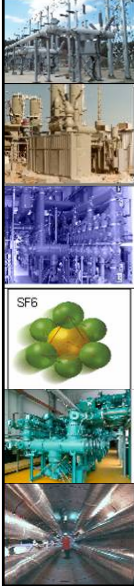


--- Tectyl 506 coating for external area A
 ---- Trost Multifunction Oil coating for inner area B

T&D Chicago GIS
- 22 -

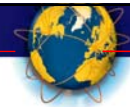


Design Features Example for Dynamic Sealing System

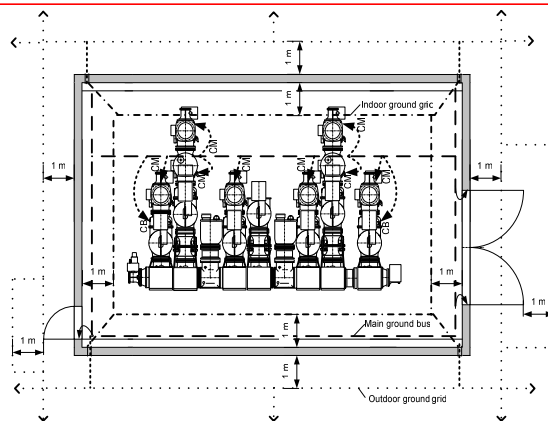
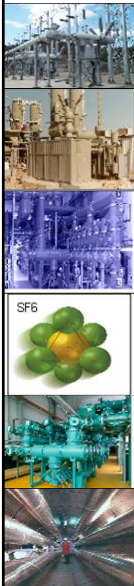


T&D Chicago GIS

- 23 -



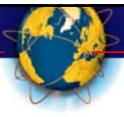
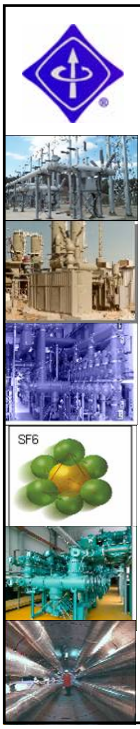
Design Features Typical Grounding / Earthing Arrangement of GIS



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

T&D Chicago GIS

- 24 -



Thank you for your attention.

Any Questions?