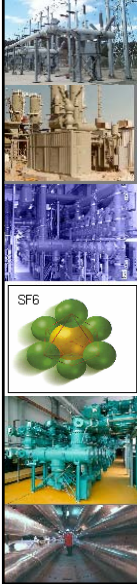




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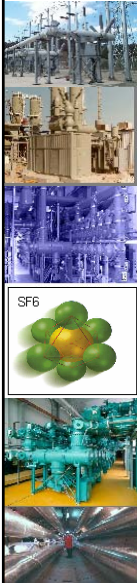


IEEE

**Substations Committee
GIS Subcommittee K0
Working Group K2
Module
Mixed Technologies Switchgear**

T&D Chicago MTS Mixed Technologies Switchgear

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Mixed Technologies Switchgear MTS**

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View of Future Switchgear Technologies Drivers

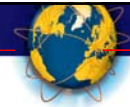






Changing Customer demands

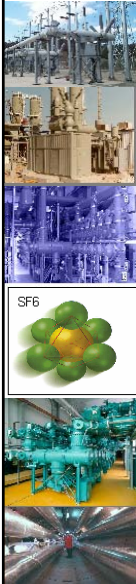
- Minimum life cycle costs:
Investment, Operation and Maintenance **together**
- High availability
- High flexibility
- Compact solutions for optimizing existing areas
- Competent system-solutions instead of product-suppliers

..... require Innovative Solutions

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Definition* of MTS



Mixed Technologies Switchgear is defined by the following:

- Compact switchgear assemblies consist of at least one switching device directly connected to, or sharing components with, one or more other devices such that there is an interaction between the functions of the individual devices.
- Such assemblies are made up of individual devices and are designed, tested and supplied for use as a single unit. The interaction between devices may be due to proximity, sharing of components or a combination of both.
- The assemblies may contain components of air insulated switchgear (AIS) only or a combination of AIS and gas insulated switchgear (GIS), so called mixed technology switchgear (MTS) and may be delivered entirely prefabricated or partially assembled.

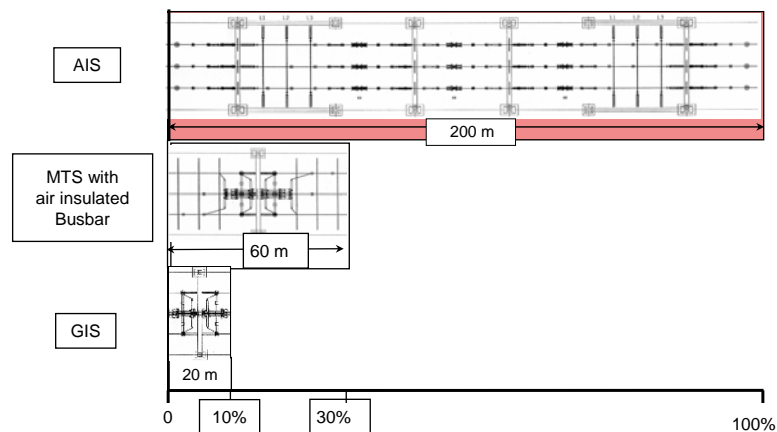
* IEC 62271-205

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Space Comparison of AIS, GIS and MTS CB-bays 420 kV level



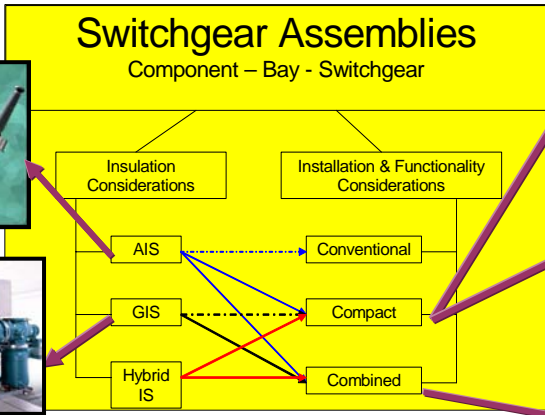
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Mixed Technologies Switchgear build of Switchgear Assemblies



Switchgear Assemblies
Component – Bay - Switchgear

Insulation Considerations Installation & Functionality Considerations

AIS Conventional

GIS Compact

Hybrid IS Combined



Mixed technologies switchgear (MTS) concerns the following combinations:

- AIS in compact and/or combined design
- GIS in compact design
- Hybrid IS in compact and/or combined design assembled together and using a common structure in order to minimize the installation time.

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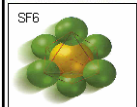
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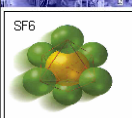


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Design Features

- **Special Features**
 - Using already known equipment components with high reliability
 - Compact design
 - Integrated functions
 - Modular system
 - Minimum space requirements
 - Outdoor design
 - Assembled and tested transportation units
 - Reduced planning and erection time
 - Easy exchange of complete modules




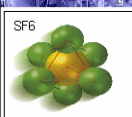


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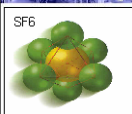

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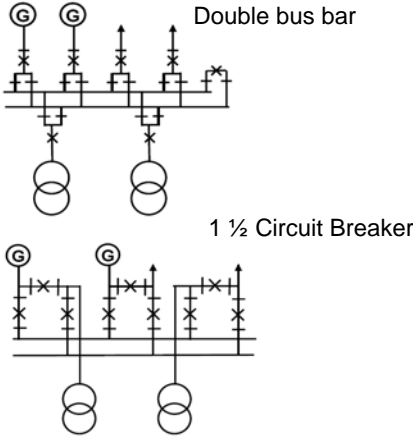


Single Line Layout

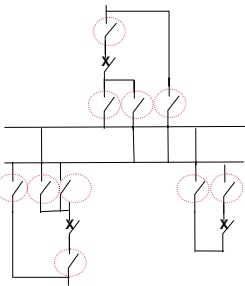


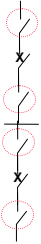
- Typical Single Line Layout since more than 80 years



Double bus bar
1 ½ Circuit Breaker




Traditional Double Bus with by-pass




Traditional Single Bus



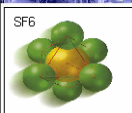

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Design on HV Substations based on Mixed Technology, Diagram & Layout










New 420/550 kV approach of REE drives on **New Segregated Ring – NSR, substation design** based on:

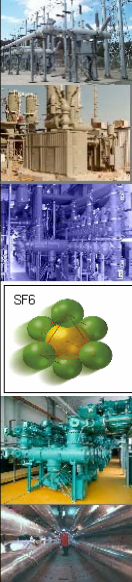
- **Technology**
 - GIS by reliability, flexibility and LCC (Life Cycle Cost)
- **Diagram**
 - Meshed Ring by simplicity, uniformity and flexibility
- **Layout**
 - Segregated phases by modularity, adaptability and cost

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NSR? - What is NSR* ?




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Solutions set for HV Substations needs



- **Integral:** regarding diagrams, switching equipment and layout
- **Availability and Reliability:** GIS values and redundancy by diagram
- **Modular:** it's developed depending on necessities
- **Compact and Simplified:** not unnecessary elements as bus bars
- **Uniform:** All substations with same solutions
- **Low maintenance :** Closest approach to zero maintenance
- **Environmentally integratable**
- **Life cycle cost optimized**

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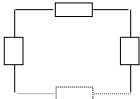
* 

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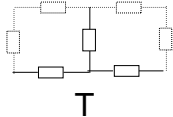
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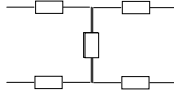
Meshed Ring Substation Design integrates all solutions



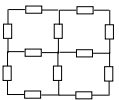
Pi



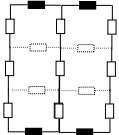
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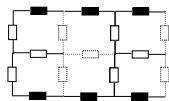
H



Meshed Ring



1 1/2 Circuit Breaker





1 Circuit Breaker



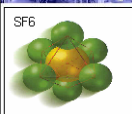

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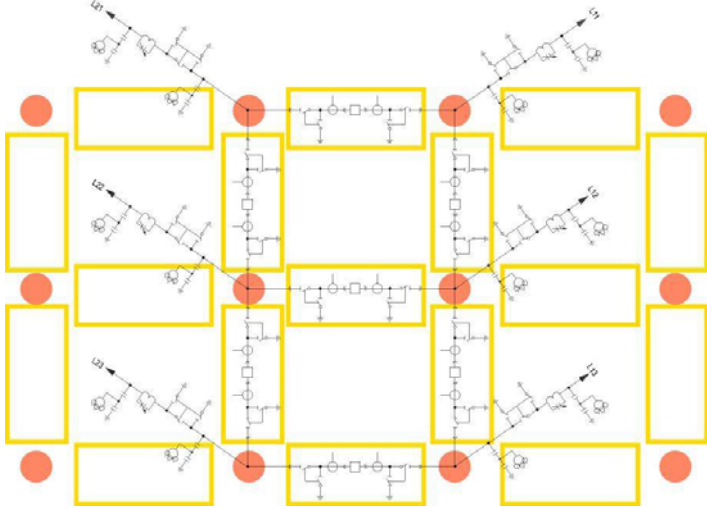
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NSR 1 Circuit-Breaker Single-Line Diagram



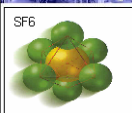



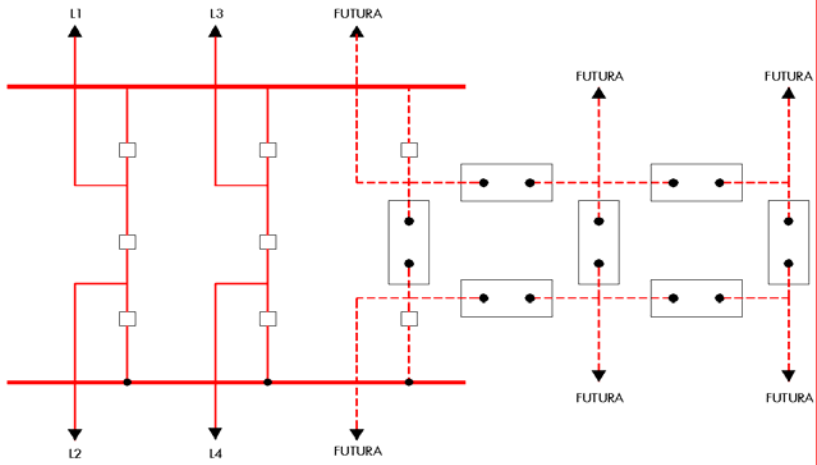
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Adaptation of NSR to existing 1½ Circuit-Breaker Single-Line Diagram










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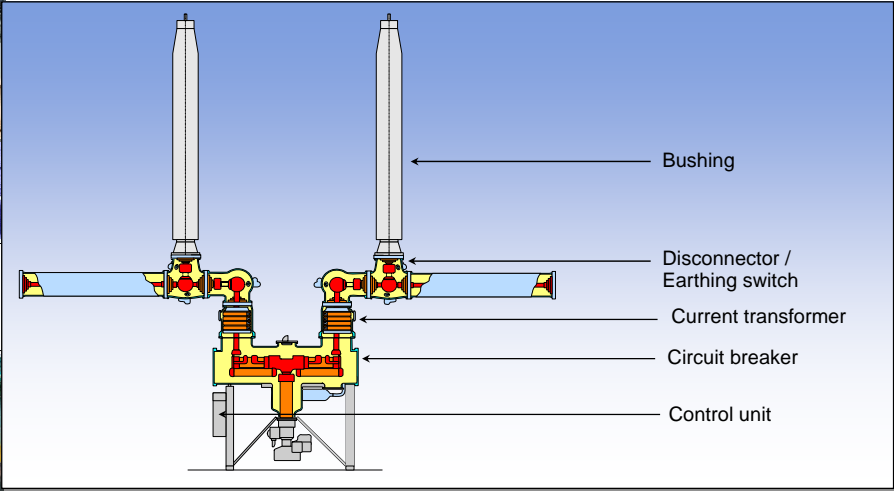
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MTS 550kV Bay Module For 1½ CB-Arrangement With Vertical Bushings













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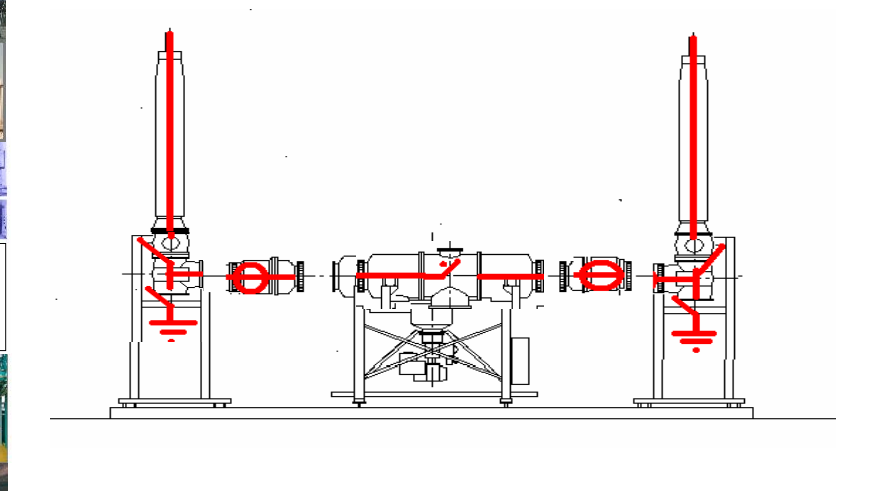
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MTS Module 420/550 kV Flexibility







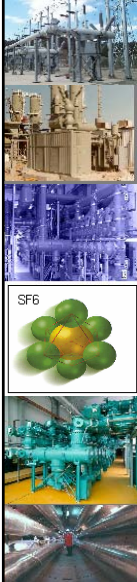
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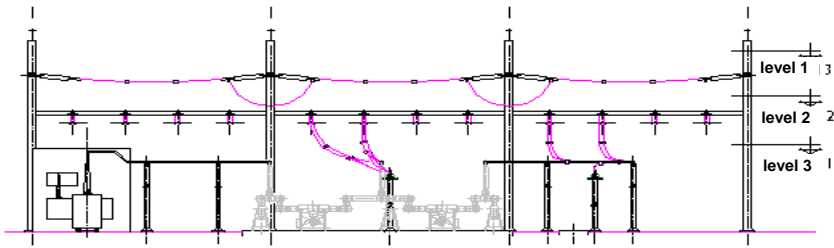


NSR Physical Layout- Diagram





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Example REE, Spain

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REE Spain 420 kV Ring Arrangement






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Comparison MTS / GIS 4 CB-Arrangement, 145kV

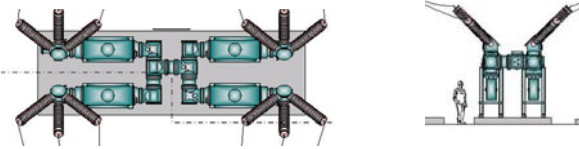




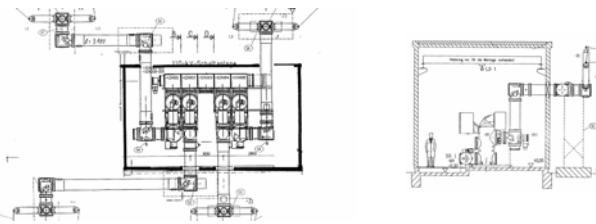
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MTS




GIS





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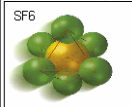



Application of MTS 145 kV

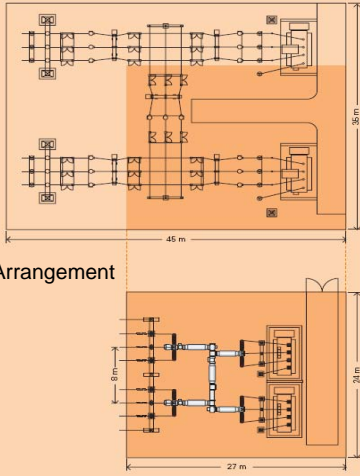





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H- Arrangement



Previously: Air-insulated switchgear unit; Space requirement: approx. 1600 m²





Subsequently: HIS - Highly Integrated Switchgear; Space requirement: approx. 650 m²

Space reduction 60%




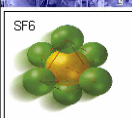


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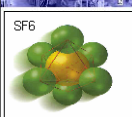


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MTS Applications Outdoor (1)




GIS Project PUGET
Sound Electric, USA
Bow Lake
145 kV 40 kA, 3150 A


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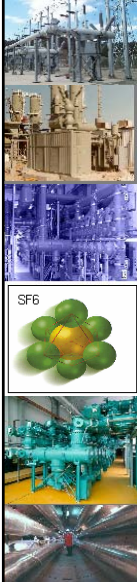
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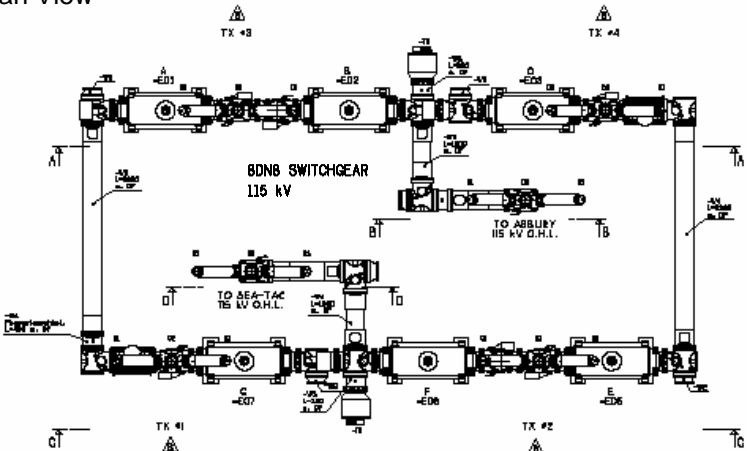
MZS Applications Puget Sound





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● Plan View




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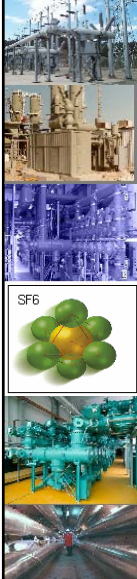
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MTS Applications Outdoor (2)





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Compact substation
H-arrangement
UW Badenstedt, Germany

145 kV/31,5 kA, 4000 A

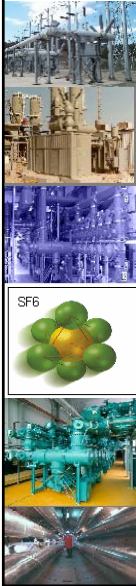
2001

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MTS Applications Outdoor (3)



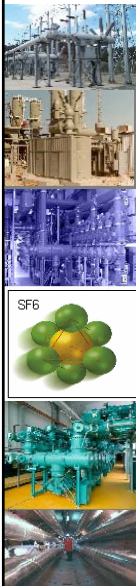
Compact substation
H-arrangement
Lai Wu Substation,
Peoples Republic of
China

145 kV/31,5 kA, 4000 A

2002




MTS Applications Outdoor (4)




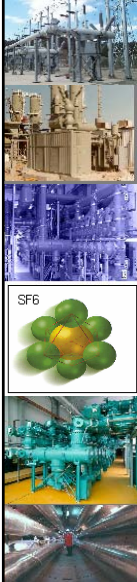
Compact GIS Substation
Termobahia
230 kV, 50 kA, 3150 A
Insulation Type:
- Single Phase
Feeder Bay to AIS and
Overhead Line

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MTS Applications Special Applications






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145 kV/31,5 kA
Connecting a
Windfarm

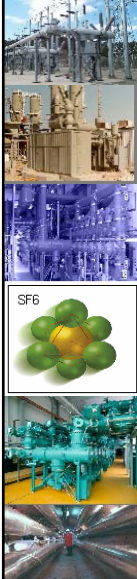
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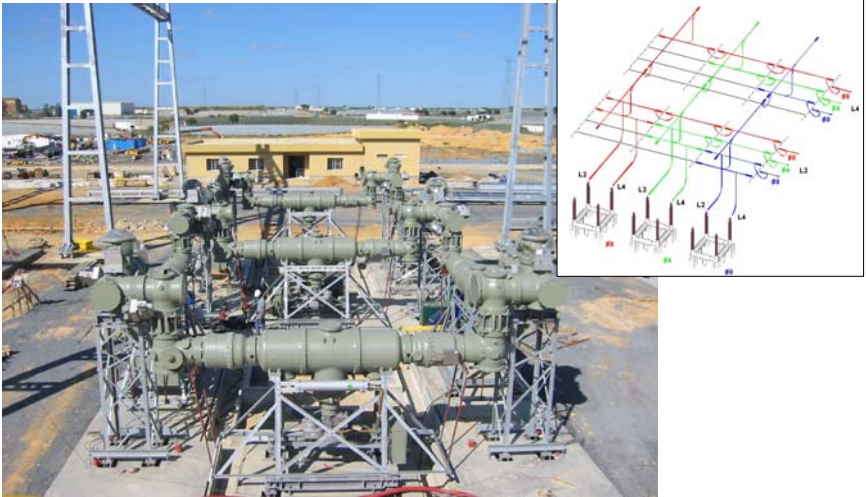


Ringarrangement - NSR Physical Layout Double Busbar S/S Palos de la Frontera 400 kV







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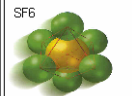





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MTS 420kV Ostiglia, Italy















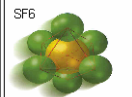


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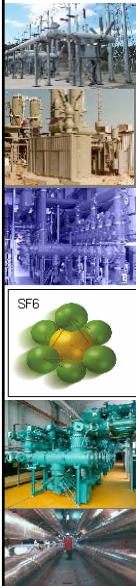
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Conclusion



- Mixed Technologies Switchgear modules can be used in any substation application
- Compact modules
 - Gives the highest availability
 - Suitable for applications with high operating frequency (Capacitor and reactor)
 - Excellent for extension of existing S/S.
- Combined modules
 - High Felexibility
 - Cost optimised solution
 - Shortest erection time
 - Minimum of space



**Thank you for your attention
for
the MTS Module.**

