

Power Transmission and Distribution

Mixed Technology HV Switchgear and Substations
September 2004
Ohrid / Macedonia

SIEMENS

A woman in a red hood and safety glasses is shown in profile, looking towards the right. In the background, another person in a red hood stands in a vast, flat, open landscape under a clear blue sky. The overall scene suggests a remote or high-altitude location.



Mixed Technology HV Switchgear and Substations

High Voltage

S

Siemens AG

Power Transmission and Distribution

High Voltage

Postal Address:

Siemens AG, PTD H 23

P.O. Box 32 20

D-91050 Erlangen

Germany

Office Address:

Paul-Gossen-Str. 100

D-91052 Erlangen

Germany

Dipl.-Ing.

Davor Kralj

Senior Area Manager

High Voltage Substations

Sales and Marketing Europe

Tel. +49 9131 7-33858

Fax +49 9131 7-34496

Mobile +49 170 562 7480

E-Mail rainer.koop@siemens.com



High Voltage

Mixed Technology HV Switchgear and Substations

Content of the Presentation

- Siemens at a Glance
- Siemens Group „Power Transmission and Distribution“ (PTD)
Structure, Supplies and Services
- PTD Business Unit „High Voltage“
Structure, Supplies and Services
- 123/145 kV HIS - The Solution to your Switching Functions
Technical Data and Advantages
Modules
Examples
Photos of executed Projects
- 420 kV HIS - Switching into the Future

Key figures for 2003

At a glance

Corporate culture

Corporate structure

Business areas

Siemens
in the regions

Innovations

Company history

(in millions of euros)	2003 ¹⁾	2002 ¹⁾	Change (in %)
New orders	75,056	86,214	- 5 ³⁾
Sales	74,233	84,016	- 4 ³⁾
Net income			
Excluding a gain on sales of shares of Infineon	2,445	1,661	+ 47
Gain on sales of shares of Infineon	—	936	
Total net income	2,445	2,597	
Net cash provided by operating activities	5,712	5,564	+ 3
Net cash used in investing activities	(3,939)	(810)	
Research and development expenses	5,067	5,819	
Shareholders' equity (September 30)	23,715	23,521	
Dividend	€1.10²⁾	€1.00	
Employees (September 30, in thousands)	417	426	- 2
Number of shares (in millions)	891	890	

¹⁾ Fiscal year: October 1 – September 30

²⁾ To be proposed at the Annual Shareholders' Meeting

³⁾ Adjusted for currency effects and portfolio activities

The top ten companies in electrical engineering and electronics in 2003

At a glance

Corporate culture

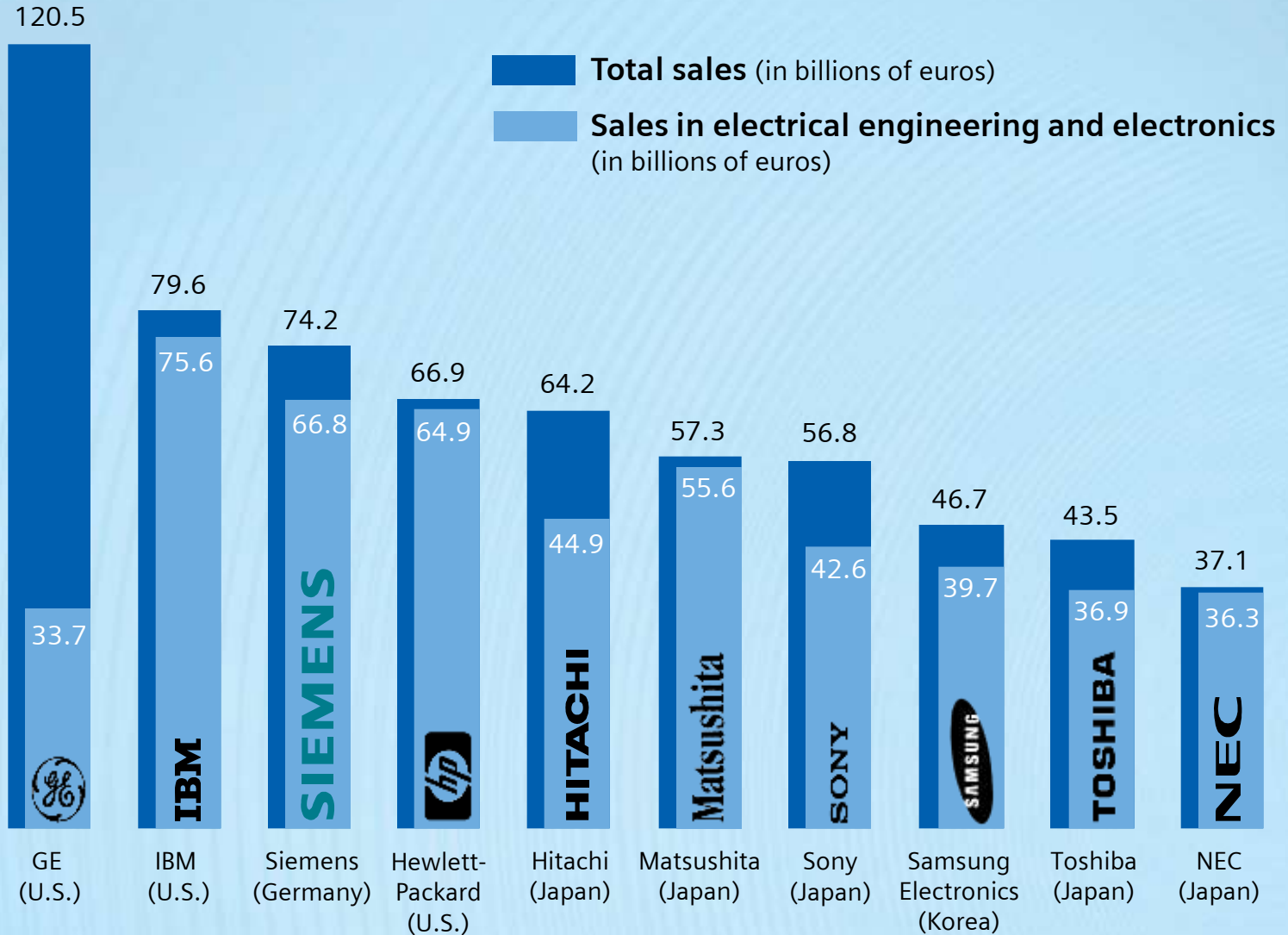
Corporate structure

Business areas

Siemens in the regions

Innovations

Company history



Sales by region

At a glance

Corporate culture

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(in billions of euros)

74.2

84.0

87.0

Other

6 %

6 %

5 %

Asia-Pacific

12 %

12 %

13 %

The Americas

25 %

29 %

30 %

Europe (excl. Germany)

34 %

32 %

30 %

Germany

23 %

21 %

22 %

2003

2002

2001

Employees worldwide

At a glance

Corporate culture

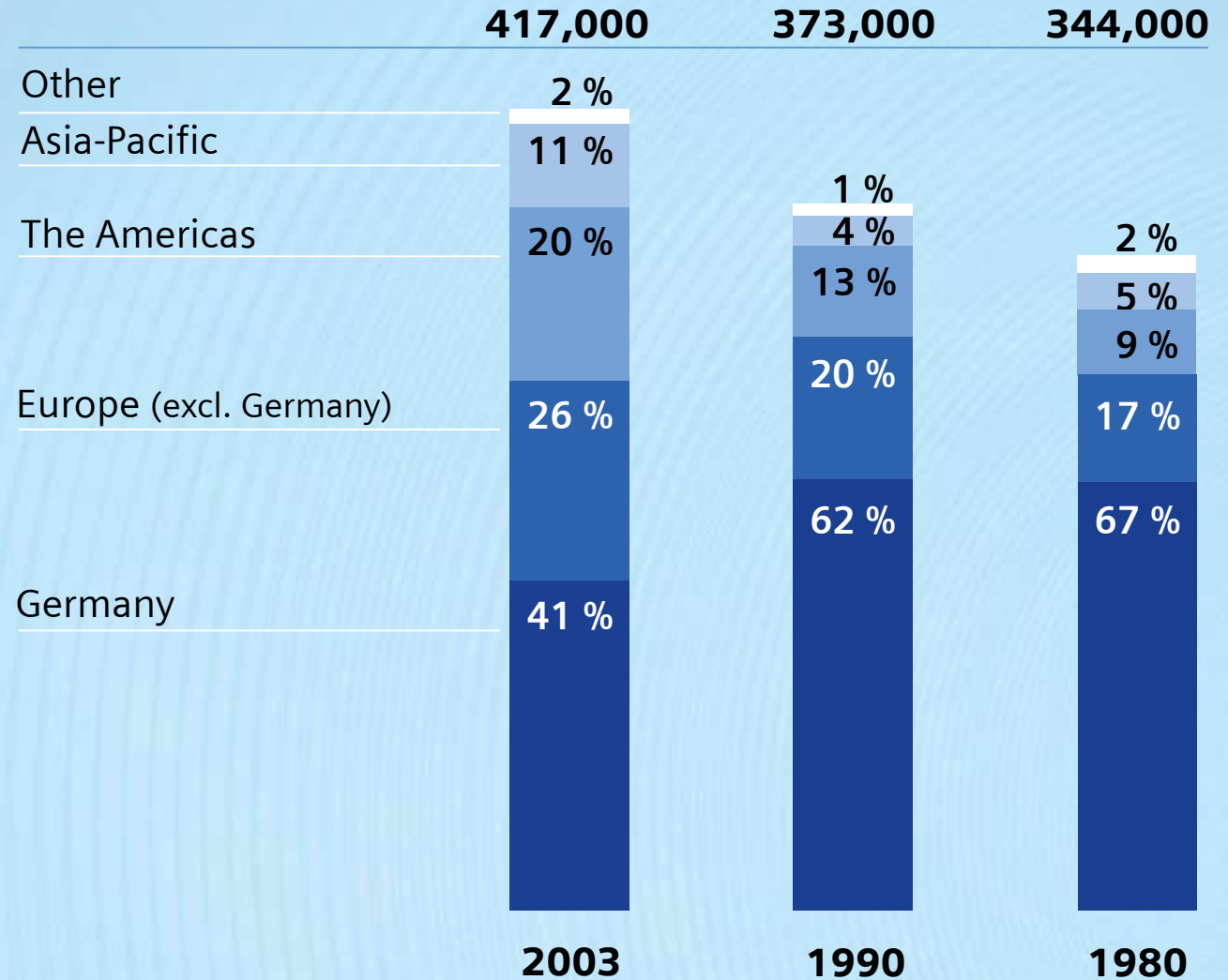
Corporate structure

Business areas

Siemens
in the regions

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Company history



Production locations around the world

At a glance

Corporate culture

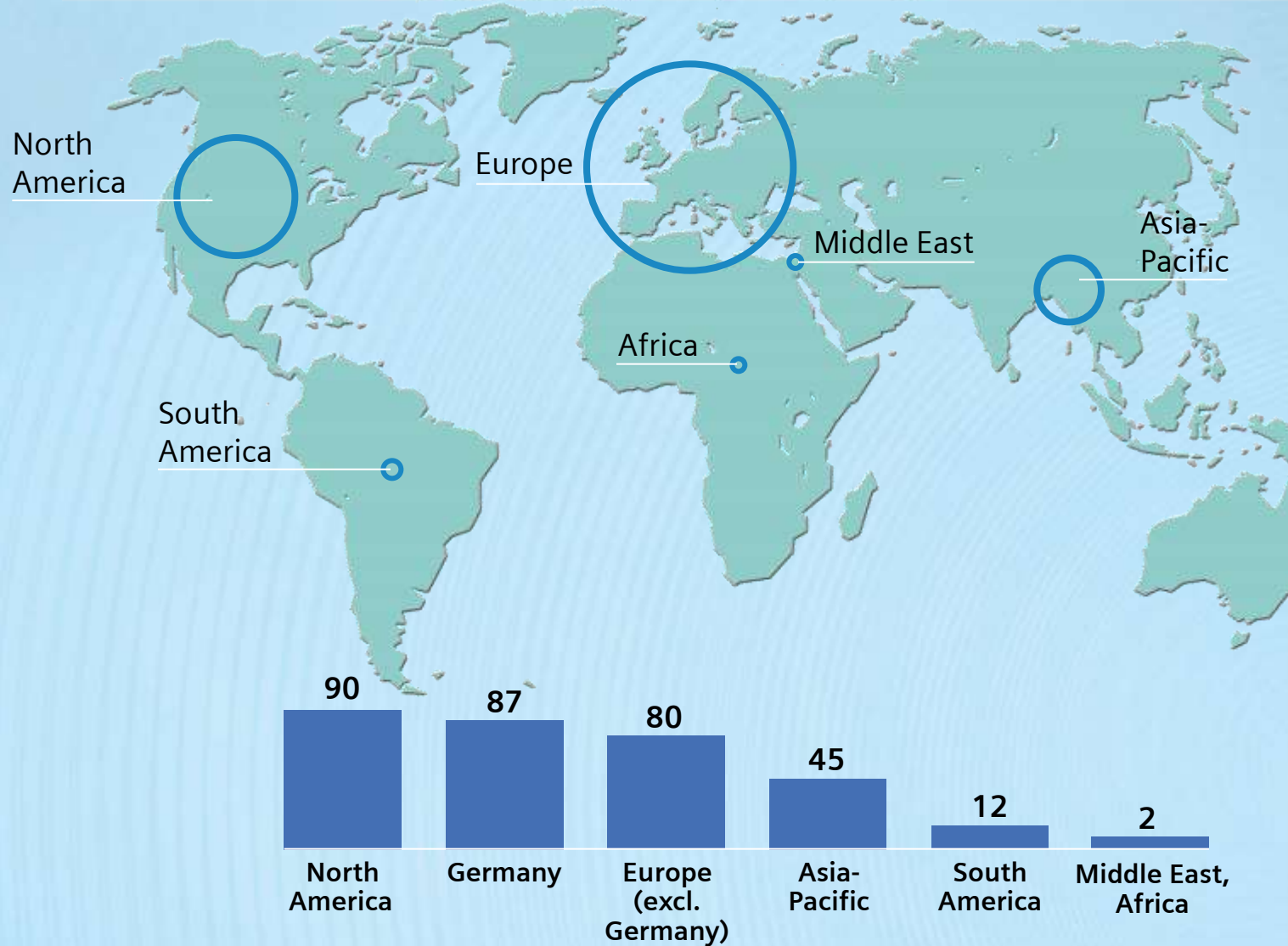
Corporate structure

Business areas

Siemens
in the regions

Innovations

Company history



● Production locations by region

Research and development expenditures

At a glance

Corporate culture

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in the regions

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Company history

(in billions of euros)

5.07

5.82

as % of sales

6.8

6.9

Other

Lighting

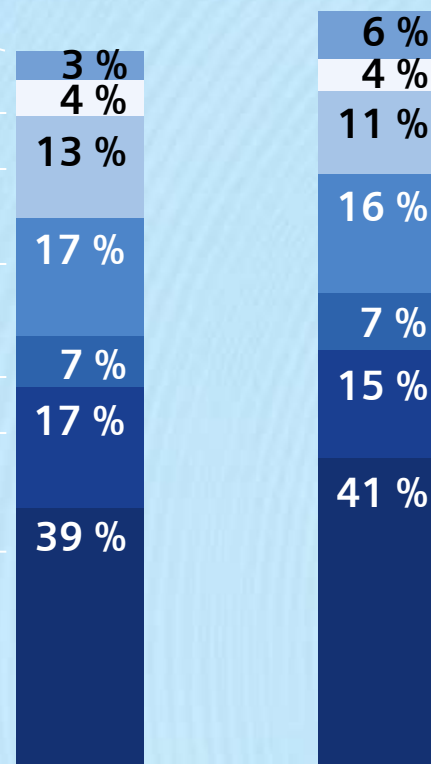
Medical

Transportation

Power

Automation and Control

Information and
Communications



2003

2002

From a backyard workshop to a global network of innovation – More than 150 years of company history

At a glance

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Company history



Werner von Siemens invents the pointer telegraph – Founding of "Telegraphen-Bauanstalt von Siemens & Halske" in Berlin

1847



Discovery of the dynamo-electric principle – Invention of the dynamo

1866



Siemens' global workforce exceeds 100,000 for the first time

1923



Siemens develops zone refining method for production of high-purity silicon

1953



Siemens listed on the New York Stock Exchange

2001



1897



1936

SIEMENS

1991

SIEMENS

Global network of innovation

2002

"Ever since my youth, I've been fired by the ambition to build a global business."

Werner von Siemens, 1887

Power Transmission and Distribution

SIEMENS



Corporate structure

Corporate structure

Organizational structure

What we have to offer

At a glance

Sales structures

Europe

Overseas

References

Divisions

Managing Board

Operations

Information & Communications

Information & Communication Mobile (ICM)

Information & Communication Networks (ICN)

Siemens Business Services GmbH & Co. OHG (SBS)

Transportation

Transportation Systems (TS)

Siemens VDO Automotive AG (SV)

Automation & Control

Automation and Drives (A&D)

Industrial Solutions and Services (I&S)

Siemens Dematic AG (SD)

Siemens Building Technologies AG (SBT)

Medical

Medical Solutions (Med)

Lighting

Osram GmbH

Power

Power Generation (PG)

Power Transmission and Distribution (PTD)

Financing and Real Estate

Siemens Financial Services GmbH (SFS)

Siemens Real Estate (SRE)

Corporate Departments

Corporate Development (CD)

Corporate Finance (CF)

Corporate Personnel (CP)

Corporate Technology (CT)

Corporate Centers

Corporate Communications (CC)

Corporate Information and Operations (CIO)

Global Procurement and Logistics (GPL)

Chief Economist/ Corporate Relations (ECR)

Management Consulting Personnel (MCP)

Regional Units

(Regional Offices, Regional Companies, Representative Offices, Agencies)



Organizational structure

Corporate structure

Organizational structure

What we have to offer

At a glance

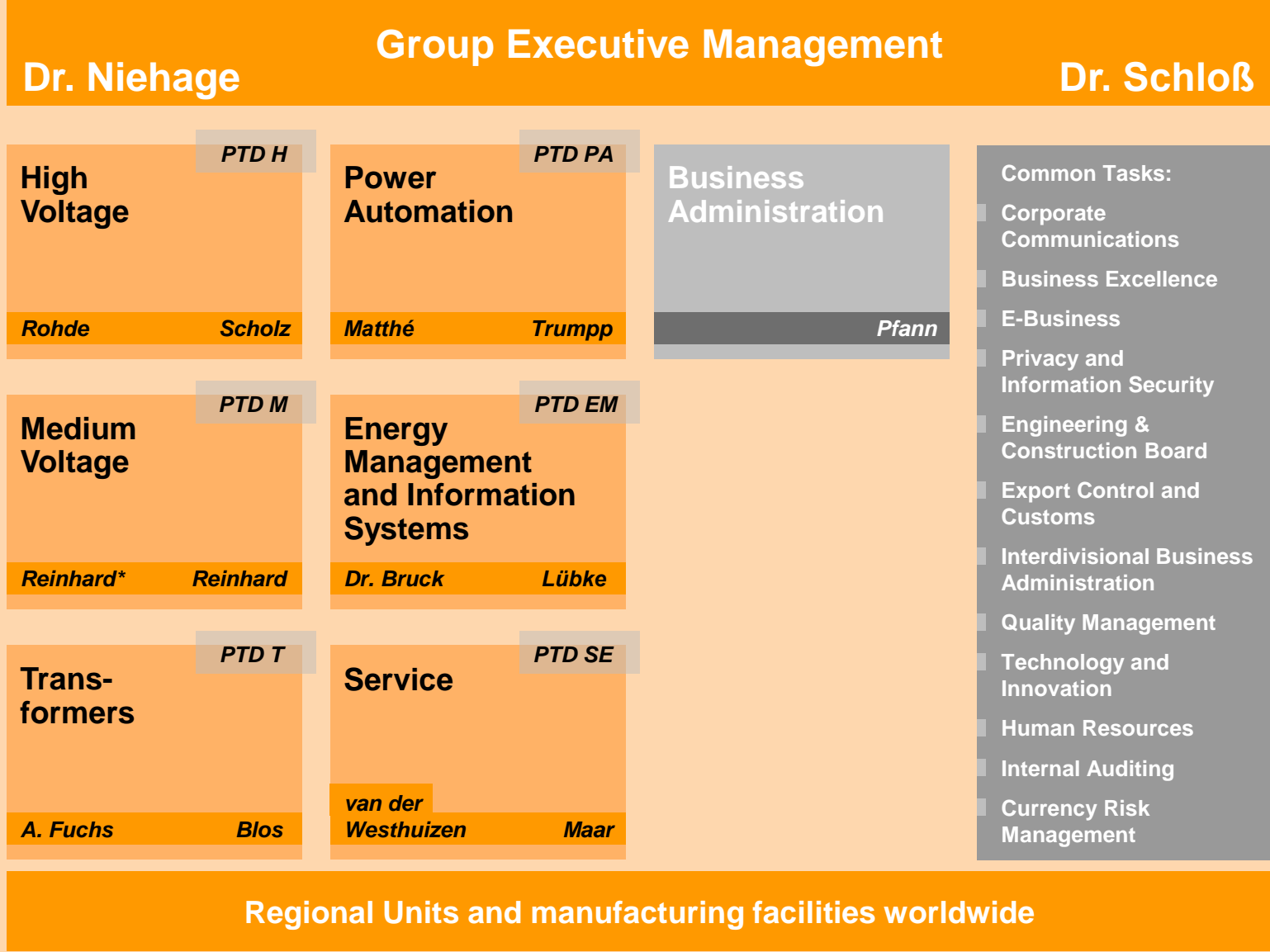
Sales structures

Europe

Overseas

References

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What we have to offer for Power Transmission and Distribution

Corporate structure

Organizational
structure

**What we have
to offer**

At a glance

Sales structures

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Products

- High-voltage components
- Medium-voltage components
- Transformers, reactors

Turnkey Systems

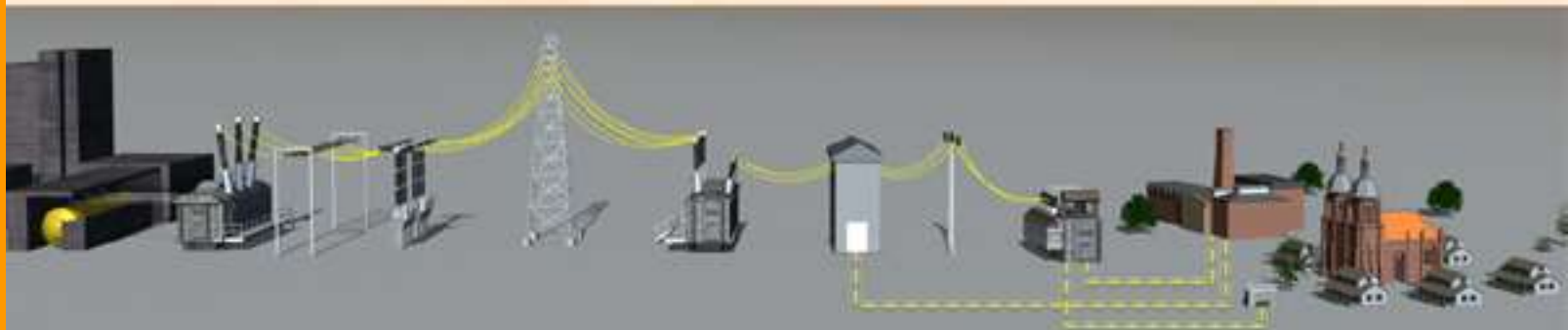
- Complete turnkey installations for power transmission and distribution
- Transformer substations
- HVDCT systems
- Power distribution systems, secondary distribution networks

Systems

- High-voltage substations
- Power factor correction systems
- Decentralized power supply systems
- Medium-voltage switchgear
- Unit substations
- Load-center substations
- Power systems control
- Substation control systems
- Protection systems
- IT solutions for power producers, transmission and distribution network operators, energy sales and trading

Services

- Network consultancy, analysis and planning
- Maintenance and repair
- Modernization (Retrofit & Upgrade)
- Metering Services
- System management
- Training
- Customer Support around the clock





Power Transmission and Distribution at a glance

Corporate structure

Organizational structure

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*Fiscal 2003 (US GAAP)**

New orders (worldwide)

€ 3.6 billion

Sales (worldwide)

€ 3.4 billion

of which international

86%

Employees (worldwide)

16,400

Investments as % of sales (worldwide)

1.9%

R&D as % of sales (worldwide)

2.9%

Manufacturing Facilities outside Germany

32

Service and Engineering locations

14

of which Manufacturing Facilities Germany

9

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*Version: 09/30/2003

PTD 09/04-15e



Sales structures (worldwide) Fiscal 2003 – Type of business

Corporate structure

Organizational
structure

What we have
to offer

At a glance

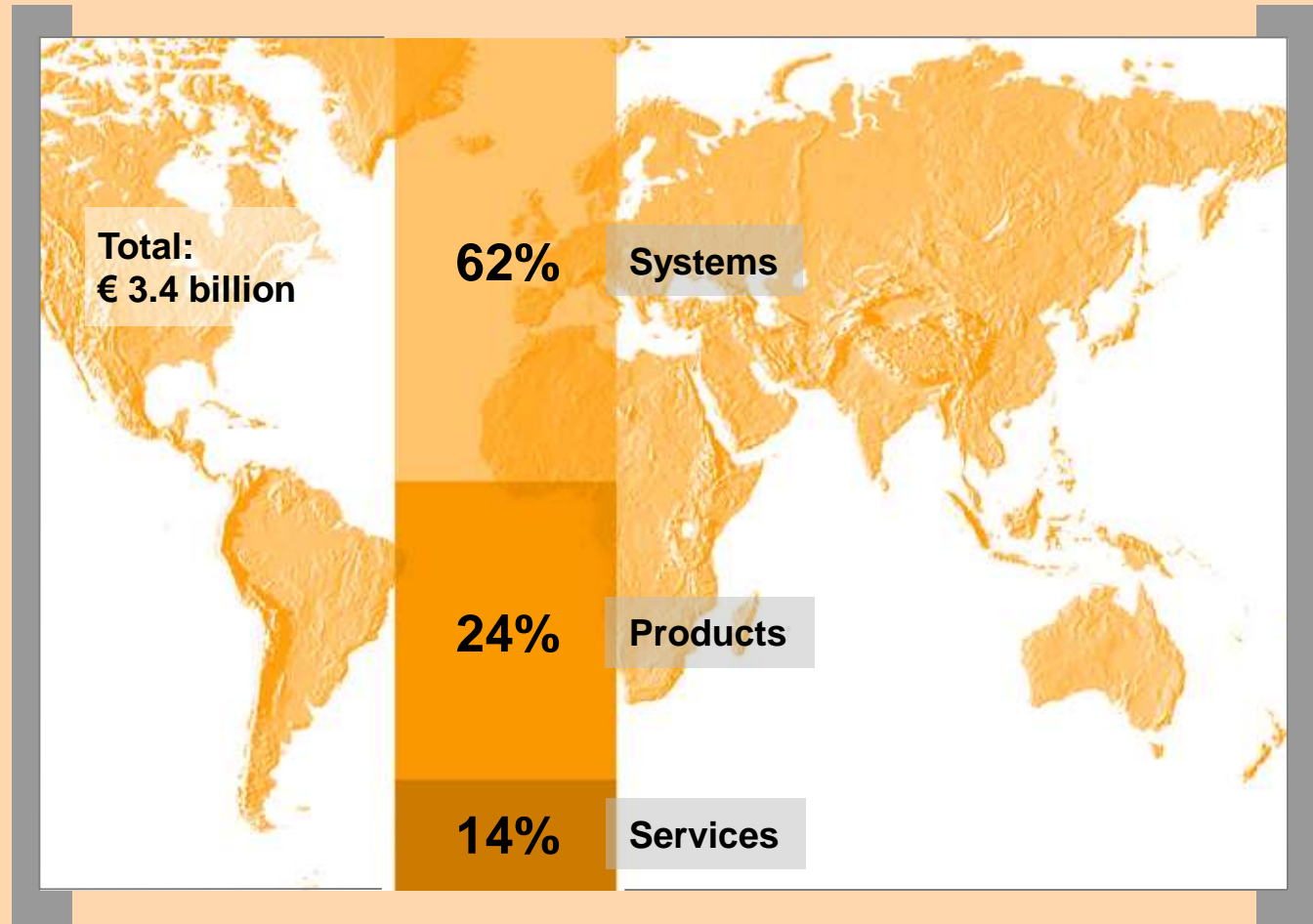
Sales structures

Europe

Overseas

References

Divisions





Manufacturing, Service and Engineering Locations Europe

Corporate structure

Organizational structure

What we have to offer

At a glance

Sales structures

Europe

Overseas

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Divisions





Manufacturing, Service and Engineering Locations Overseas

Corporate structure

Organizational structure

What we have to offer

At a glance

Sales structures

Europe

Overseas

References

Divisions



A photograph of high-voltage electrical equipment, likely a power transformer or switchgear, featuring multiple vertical insulator strings and horizontal busbars. The scene is set outdoors under a clear blue sky. The equipment is composed of dark, cylindrical components with numerous sharp points, and white insulators are visible at various points along the structure. The overall appearance is industrial and complex.

Power Transmission and Distribution

Intelligent Solutions for a Powerful Future

High Voltage

S

Corporate Structure

High Voltage

Managing Board

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Management Consulting Personnel (MCP)

Regional Organization

Regional Offices, Regional Companies, Representative Offices, Agencies

Organization Headquarters - Regional Offices Task-Sharing

High Voltage

Customer

Consulting, Planning

Engineering / Design

Project Management

Erection / Commissioning

Manufacturing Products and Systems

After Sales Service

Development

Research

Local Competence worldwide

Headquarters Berlin / Erlangen

High Voltage Division At a Glance

High Voltage

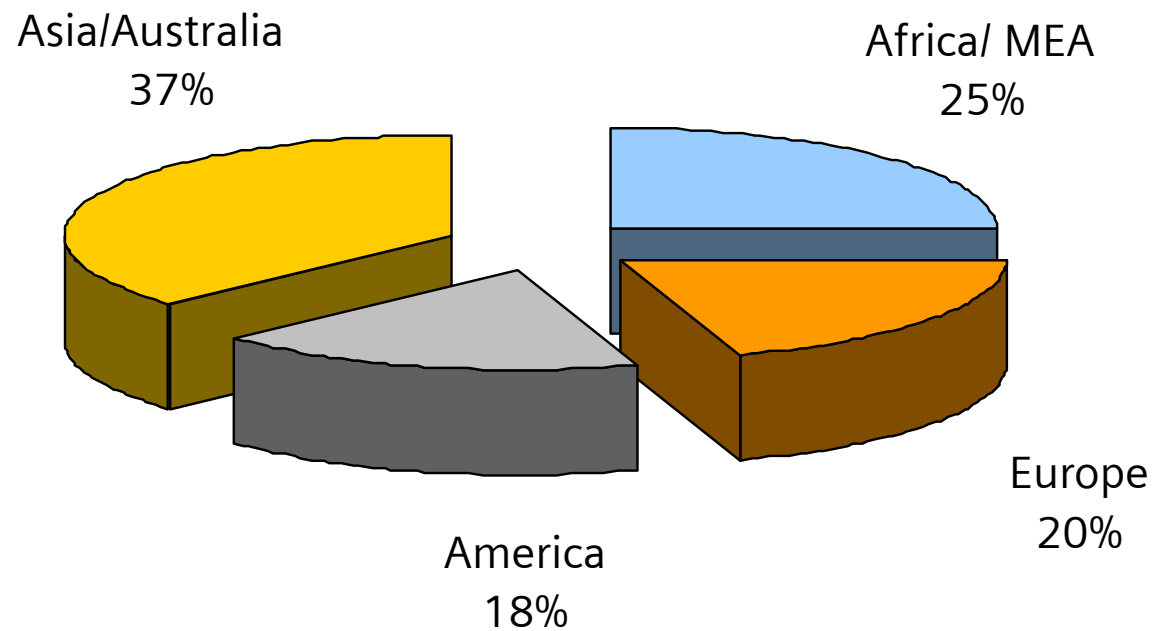
FY 2003

New orders (worldwide) thereof international business	1.5 bn € 95 %
Net sales (worldwide) thereof international business	1.4 bn € 96 %
Employees worldwide Germany	3280 1980
Investments in % of net sales R&D in % of net sales	0.9 % 0.8 %
Factories in Germany Factories in Europe and overseas	2 6
Licensees	8

PTD H - Business Volume Orders - Regional Structure, FY 2003

High Voltage

New Orders (worldwide): 1.5 bn €



An aerial photograph of a high-voltage substation. The main focus is on a row of gas-insulated switchgear (GIS) units, which are large, white, cylindrical structures mounted on metal frames. To the left, there are several large, black, cylindrical insulators. The substation is situated on a paved area with some gravel patches. In the background, there are more electrical equipment and a concrete structure. The overall scene is brightly lit, suggesting a sunny day.

Power Transmission and Distribution

High Voltage Substations

Gas-Insulated Switchgear

High Voltage

S



High Voltage

Experience

40 years experience with gas-insulated switchgear

- 1960 Start of fundamental studies in research and development of SF₆-technology
- 1964 Delivery of first SF₆-circuit breaker
- 1968 Delivery of first GIS
- 1974 Delivery of first GIL (420 kV)
- 1997 Introduction of intelligent, bay integrated control, monitoring and diagnostics
- 1999 Introduction of the current GIS generation:
smallest switchgear from 145 up to 245 kV, worldwide
- 2000 Introduction of the new switchgear concept HIS:
Gas-insulated switchgear for outdoor use

more than 7.000 bays in 750 substations installed

more than 84.000 bay-years of operation



High Voltage

30 Years SF6 Gas-Insulated High Voltage Circuit-Breakers

Operational and Service experience

25,000 outdoor circuit-breakers
7,000 GIS bays with circuit-breakers

Total 32,000 SF₆ gas-insulated high voltage
circuit-breakers

100.000 interrupter units

52.000 operating mechanisms



High Voltage

What speaks in favour of it

- Digital control and monitoring
- Minimal space requirement
- Low weight
- Customer tailored solutions due to modular design
- Environment-friendly
- Short installation and delivery times
- High efficiency through minimal maintenance effort
- High degree of safety for operating personnel
- High level of availability and long service life



High Voltage

Innovations

- Compact and space-saving design
- Digital control and monitoring
 - Process Communication Unit (PCU) with serial communication to intelligent switching equipment and innovative transformers via optical bus system
- Innovative transformers
 - Current transformer of inductive type
 - Voltage transformer RC-divider
- Pluggable cable sealing end



High Voltage

Quality

- All-encompassing state-of-the-art quality and environmental management system, certified in accordance with DIN EN ISO 9001 and ISO/DIS 14001
- Special clean room conditions in the production
- Largest, accredited, manufacturer-owned testing laboratory
- Comprehensive manufacturing inspections and routine tests on individual components and complete modules
- Tests on site according to IEC 517



High Voltage

Assembly Hall



Area 8000 m²

Clean room conditions

Assembly

Locks for material

Routine tests (IEC)

Largest, Manufacturer-owned Testing Laboratory

Member of PEHLA

High Voltage



Tests

- High voltage tests
- High-power tests
- Mechanical tests
- Environmental tests
- Temperature-rise tests

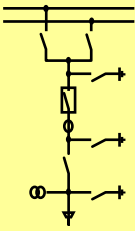
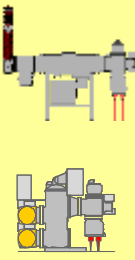
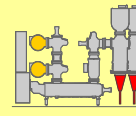
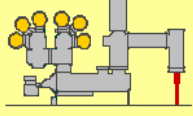
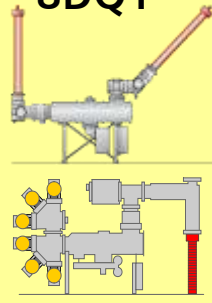
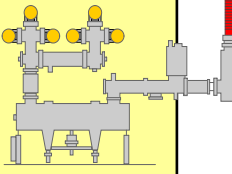
Test equipment

- HV outdoor testing laboratory
 - Power-frequency voltage generator 1.8 MV
 - Impulse voltage generator 6 MV
- HV testing hall
 - Power-frequency voltage generator 1.2 MV
 - Impulse voltage generator 3.6 MV
 - Short-circuit generator 2 x 100 kA



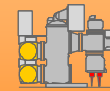
High Voltage

Product Range and Technical Data

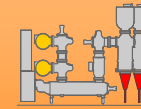
		8DN8	8DN9	8DP3	8DQ1	8DR1
						
■ Rated voltage	kV	145	245	300	550	800
■ Rated power frequency withstand voltage	kV	275	460	460	740	950
■ Rated lightning impulse withstand voltage	kV	650	1050	1050	1800	2100
■ Rated switching impulse withstand voltage	kV	-	850	850	1250	1550
■ Rated busbar current	A	3150	3150	5000	6300	8000
■ Rated feeder current	A	3150	3150	4000	4000	5000
■ Rated breaking current	kA	40	50	50	63	63
■ Rated short-time withstand voltage	kA	40	50	50	63	63
■ Rated peak withstand current (ANSI)	kA	108	135	135	170	170
■ Inspection	years	> 25	> 25	> 25	> 25	> 25
■ Bay width	mm	800	1200/1500	2200	3600	4500

Worldwide Experience of Siemens

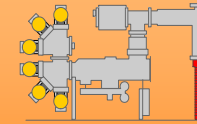
High Voltage



8DN8



8DN9



8DQ1

	8DN8	8DN9	8DQ1
Rated voltage up to	145 kV	245 kV	550 kV
Delivered bays	5,500	1,800	700
Bay-years of operation	78,000	14,000	8,000



total 100,000 Bay-years of operation

An aerial photograph of a high-voltage gas-insulated switchgear (GIS) installation. The equipment consists of several large, white, cylindrical gas-insulated units mounted on metal frames. The units are interconnected with various pipes, valves, and insulators. The installation is situated on a paved area next to a concrete wall and a grassy area. The lighting is bright, casting shadows on the ground.

Power Transmission and Distribution

HIS - Highly integrated Switchgear

GIS Type 8DN8

High Voltage

S



High Voltage

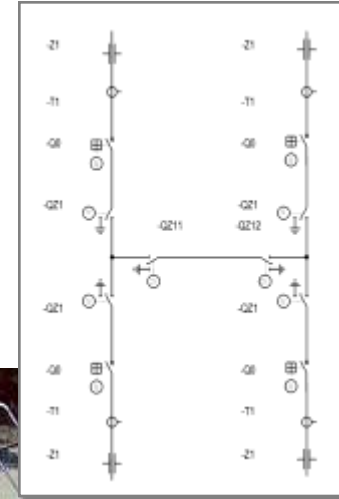
HIS - The Solution to your Switching Functions

based on GIS technology by being:

- compact
- low-cost and
- modular

for indoor as well as outdoor application

- Extension of air-insulated switchgear
- Retrofit of existing air-insulated substations
- New construction projects



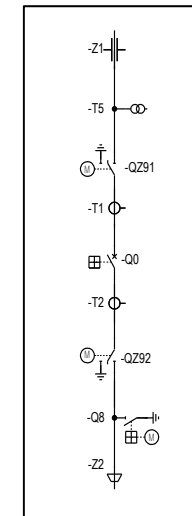
HIS - Highly Integrated Switchgear, GIS Type 8DN8

Technical Data

High Voltage



Rated voltage	up to	145 kV
Rated frequency	50/60	Hz
Rated power-frequency withstand voltage (1 min)	up to	275 kV
Rated lightning impulse withstand voltage (1.2/50 μ s)	up to	650 kV
Rated current	up to	3150 A
Rated breaking current	up to	40 kA
Rated short time current	up to	40 kA
Temperature	min.	up to -30 °C
	max.	up to +55 °C
Leakage rate per year	<=	0.5 %



HIS Solution - GIS Type 8DN8

Experience with Outdoor Applications

High Voltage

	already in use by		operational experience
	Life tank	GIS / Dead tank outdoor	
■ Temperature: -30° C up to +55° C	x	x	40 years
■ Aluminum enclosures (cast metal and Knet)	x	x	25 years
■ Outdoor-proof cubicles and operating mechanism with anti-condensation heater	x	x	40 years
■ Built-on accessories (carrier, linkages, sections)	x	x	40 years
■ SF ₆ -sealing system (O-ring, shaft gland)	x	x	40 years
■ Outdoor bushings	x	x	
Composite or porcelain insulator (40 mm/kV)			10/40 years
■ Pressure / temperature monitoring	x	x	
Sensors or density monitors with trend indication			25 years
■ Sealed built-on attachments	x	x	25 years
■ Threaded joints	x	x	40 years
■ Interrupter unit	x	x	25 years
■ Spring-stored-energy mechanism	x	x	25 years

High Voltage Switchgear Solutions by Siemens

High Voltage

Gas-Insulated Substations



Air-Insulated Substations



Gas-Insulated Switchgear GIS



Highly Integrated Switchgear HIS®



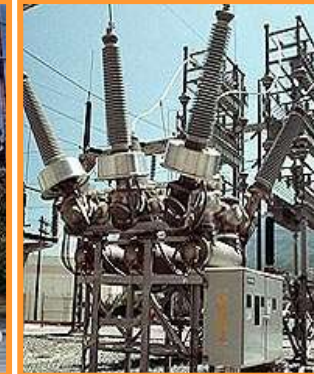
Mod. Switchgear Bay SIMOBREAKER



SIMOVER®



Dead Tank Switchgear Bay





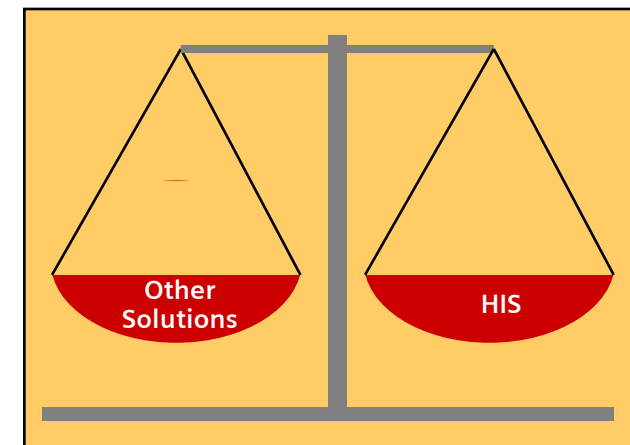
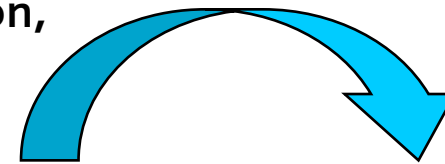
High Voltage

HIS Solution - GIS Type 8DN8

Comparison of Capital and Life-Cycle-Costs

- **Site Price**
- **Investment Costs**
 - Civil works
 - Secondary cables
 - Supporting
 - Earthing
 - High voltage equipment
 - Erection, tests, commissioning
- **Reliability, Availability, Inspection, Maintenance**
 - Retrofit
 - Reconstruction of concrete foundations
 - Painting
 - Inspections
 - Visual inspections
 - Disconnectors
 - Operating, mowing, cleaning

We would like to advise you about the comparison of different switchgear solutions



HIS Solution - GIS Type 8DN8

Life-Cycle-Costs

High Voltage





High Voltage

HIS Solution - GIS Type 8DN8

What speaks in favour of it

Cost-Effective and Versatile

- Standardized modules enable implementation of all commonly-used layouts
- Control and protection schemes ranging from conventional to digital or process-bus based
- Low life-cycle-costs
 - Low operating costs
 - Minimal maintenance
 - Long service life
- Spare parts available from current production within 24 h
- Replacement of complete bays possible at short notice



High Voltage

HIS Solution - GIS Type 8DN8

What speaks in favour of it

Low Investment Costs

- Short planning and delivery times
- Factory pre-assembled and tested units
- Simple construction, few foundations required
- Short realisation time
- Small space requirement
- Extensions of existing switchgear possible at all times, even during operation



High Voltage

HIS Solution - GIS Type 8DN8

What speaks in favour of it

Environment-friendly

- Conservation of resources
 - Material
 - Manufacturing process
 - Energy consumption during manufacturing
 - Recyclable
- Operating life > 50 years
- Space requirement less than 50 % of comparable AIS



High Voltage

HIS Solution - GIS Type 8DN8

What speaks in favour of it

Robust and Maintenance-free

- Operating life > 50 years
- Major inspection: not before 25 years
- Minimal cleaning requirement
- Corrosion-resistant
- Motor-operated self-lubricated mechanisms
- Low fault-probability / high availability
- Protected from aggressive environmental conditions
- Aseismic
- Impervious to wind and ice



High Voltage

HIS Solution - GIS Type 8DN8

What speaks in favour of it

Reliable & Safe

- Safe to touch due to earthed enclosure
- No live, air-insulated parts
- Risk-free isolation and earthing
- Minimal number of outdoor insulators
- Protected from external influences
- Layout clearly arranged in one level

HIS take the advantages of the GIS technology into the outdoor



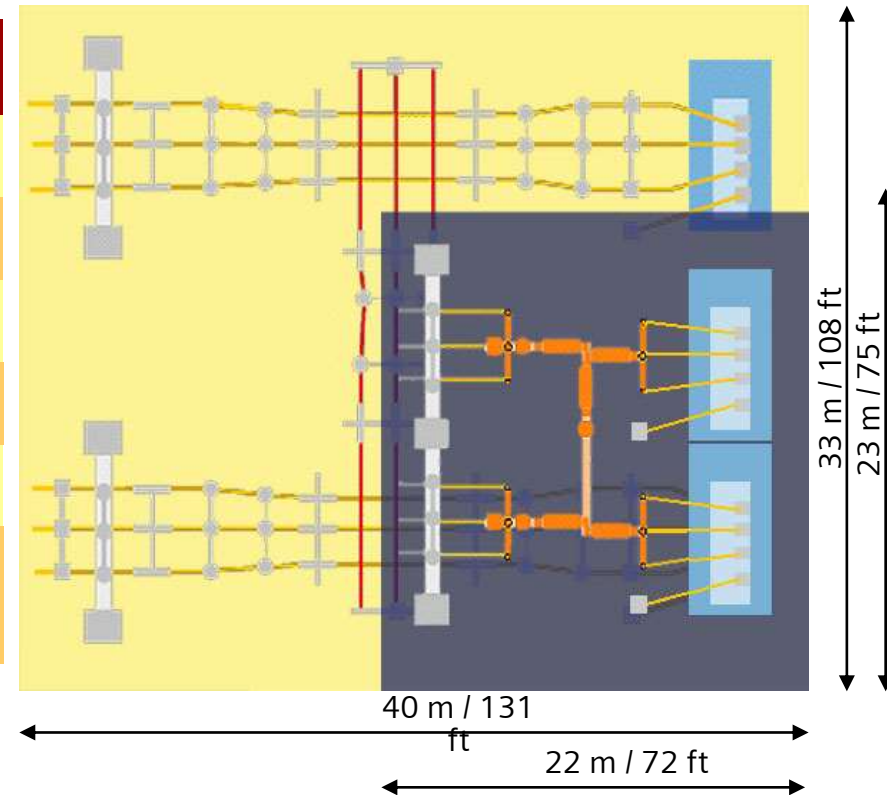
High Voltage

HIS Solution - GIS Type 8DN8

Example for Possible Savings

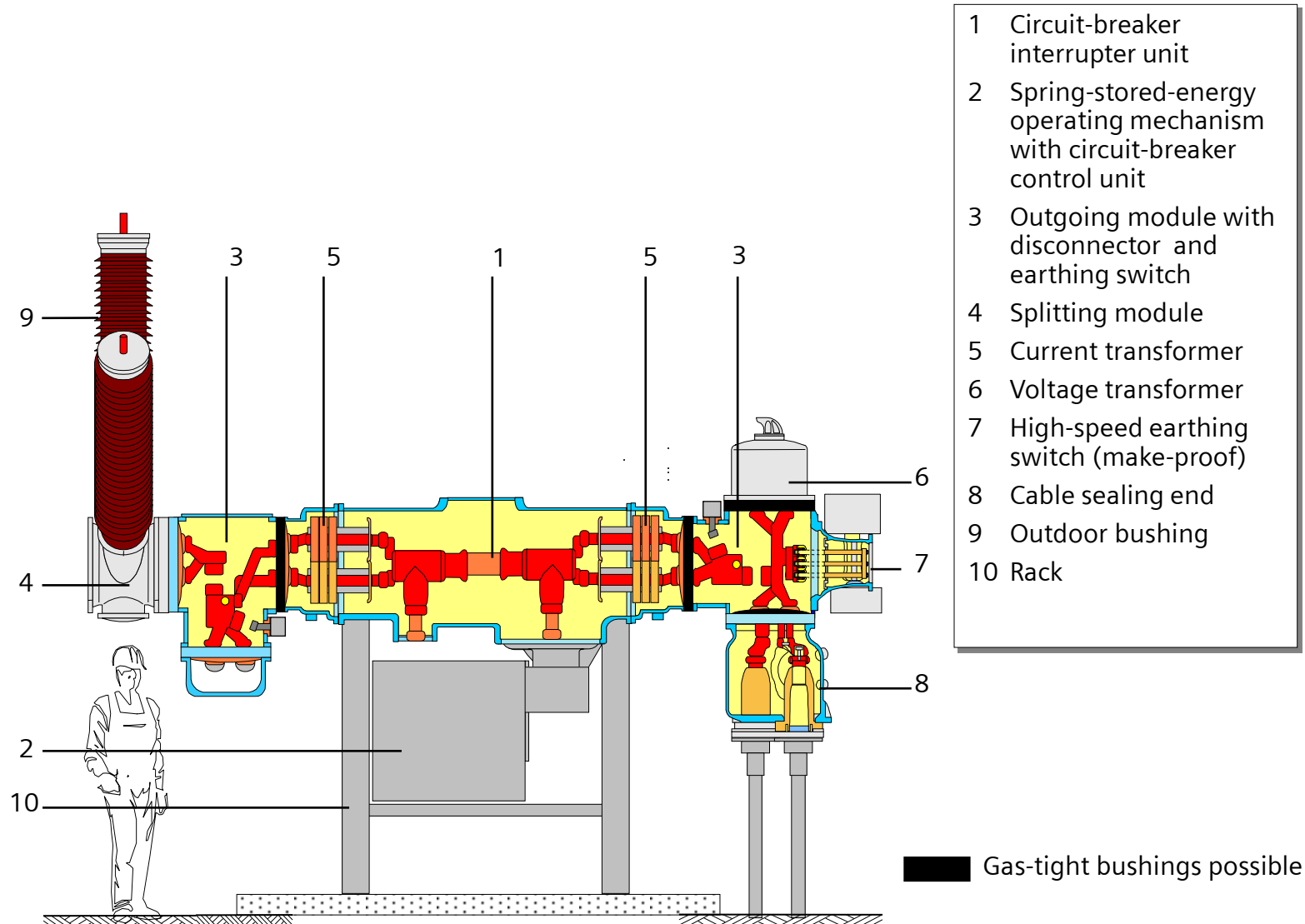
Example: Turnkey Project, H-Arrangement

	Savings HIS
Site price	60 %
Civil works	20 %
Secondary cables	35 %
Steel structures	30 %
Earthing	70 %
Erection, tests, commissioning	70 %



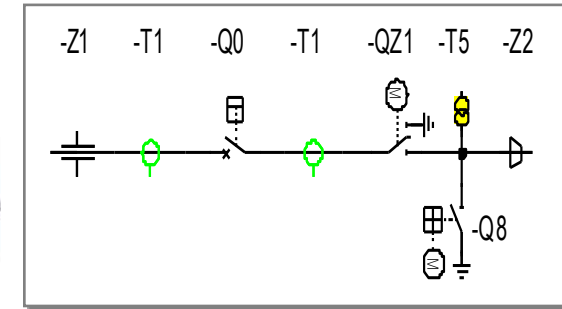
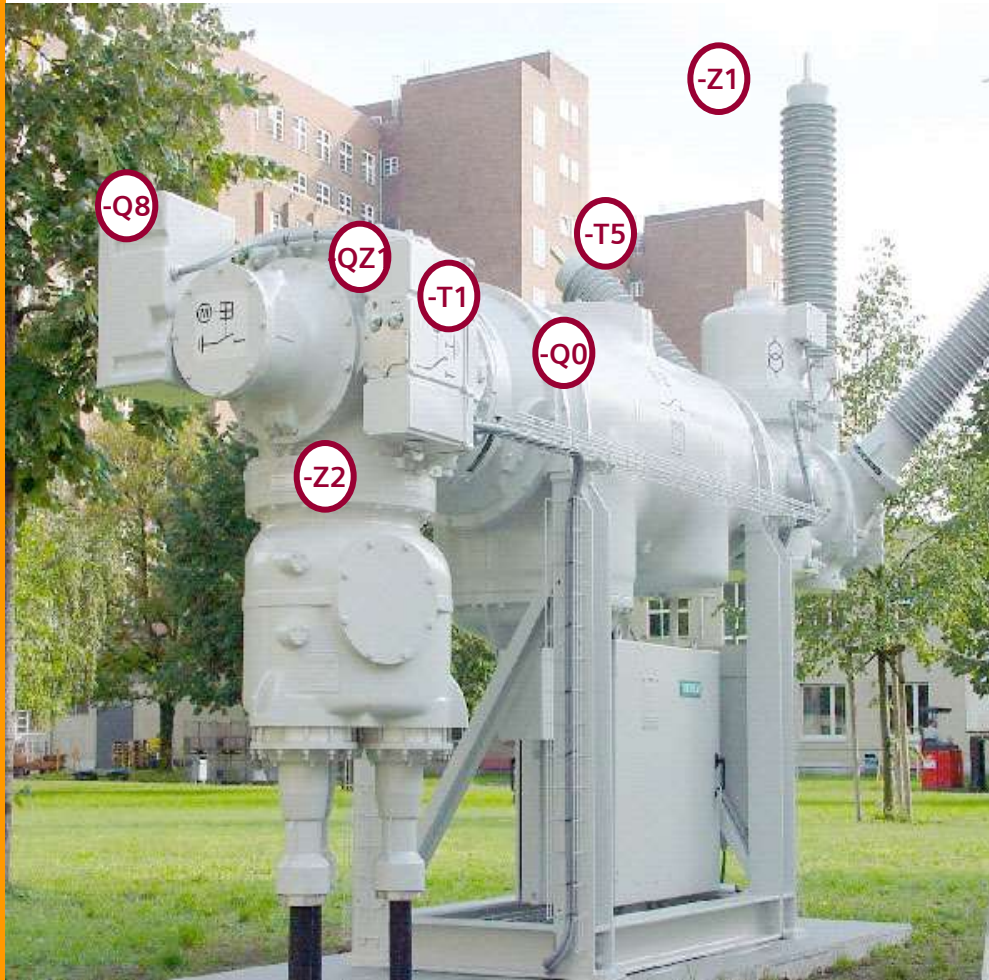
HIS - Highly Integrated Switchgear GIS Type 8DN8

High Voltage



HIS 145 kV Overhead Line Single Feeder with Cable Termination

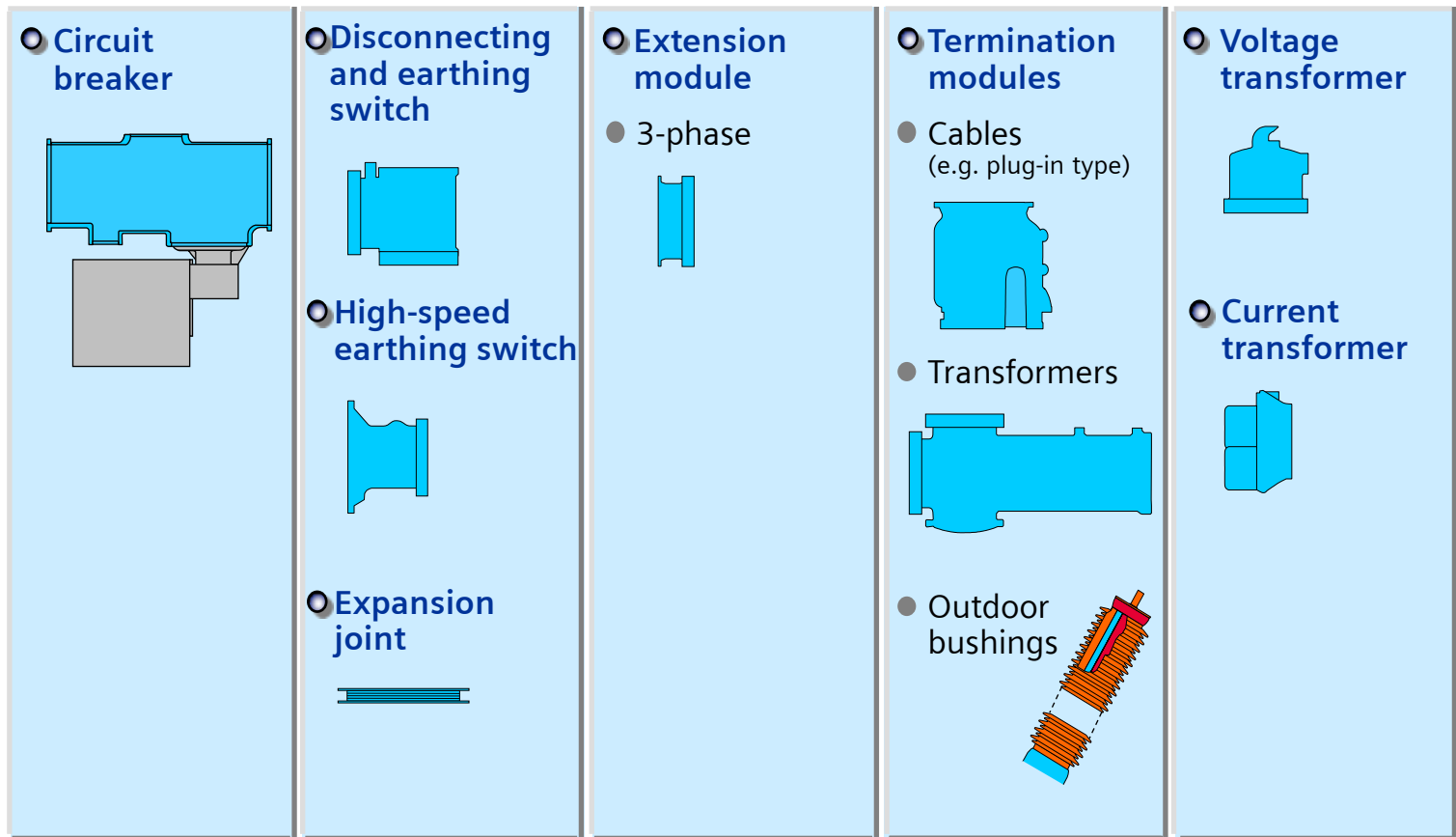
High Voltage



- Q0 Circuit Breaker
- QZ1 Disconnecter / Earthing Switch
- Q8 High Speed Earthing Switch
- T1 Current Transformer
- T5 Voltage Transformer
- Z1 OHL Connection
- Z2 Cable Connection

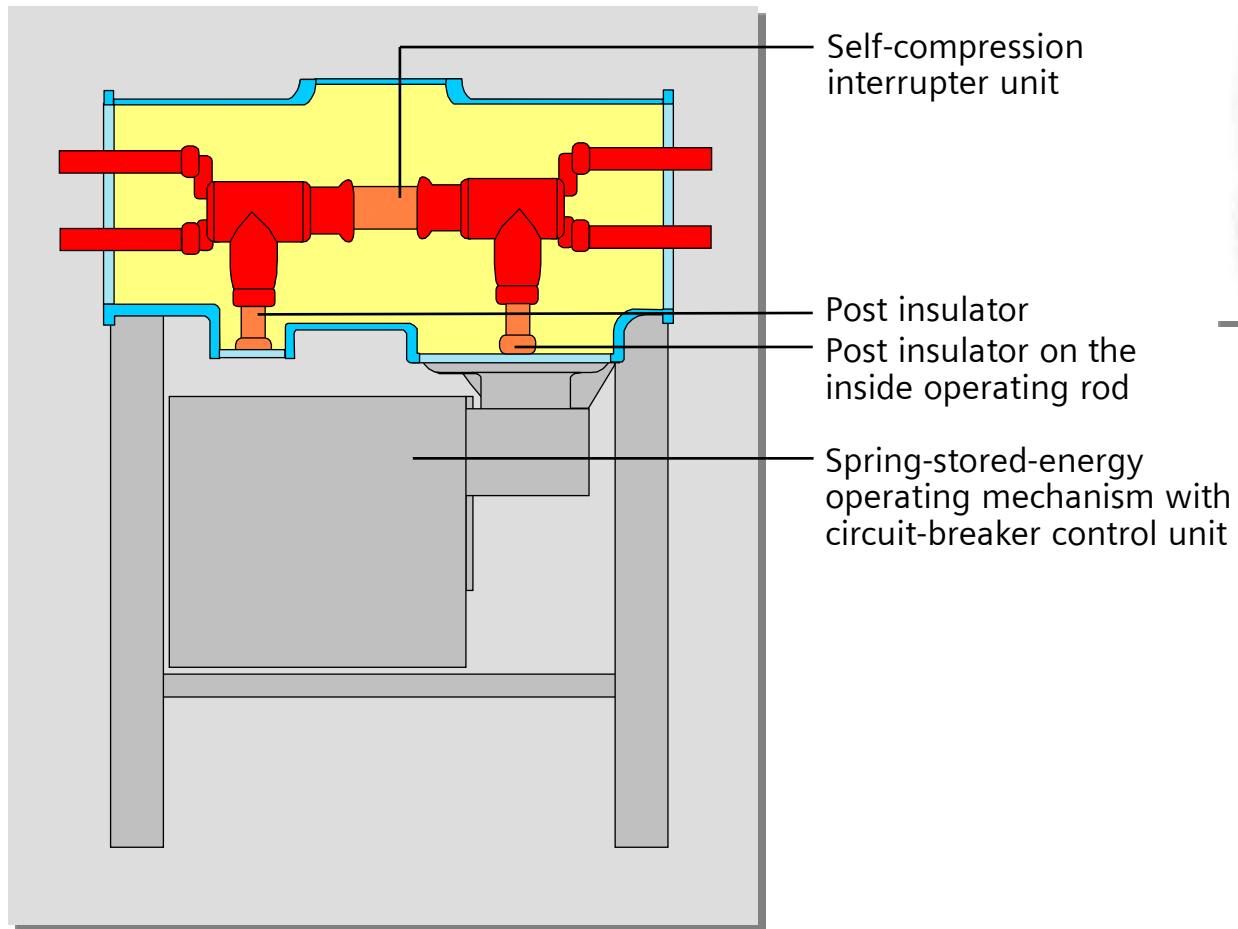
HIS Solution - GIS Type 8DN8 Modular Structure

High Voltage



HIS Solution - GIS Type 8DN8 Circuit-Breaker Module

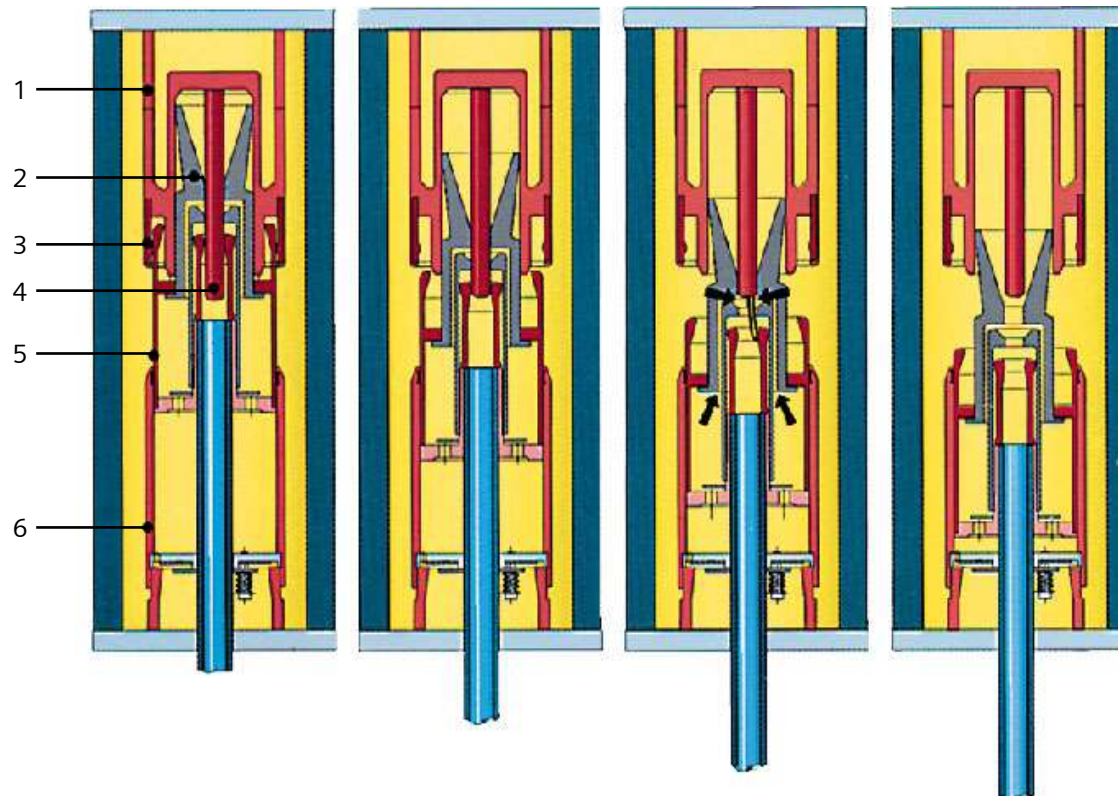
High Voltage



Self-Compression Type Interrupter Unit

Arc Quenching Principle

High Voltage



Breaker in
"on"
position

Opening:
Main contact
open

Opening:
Arcing contact
open

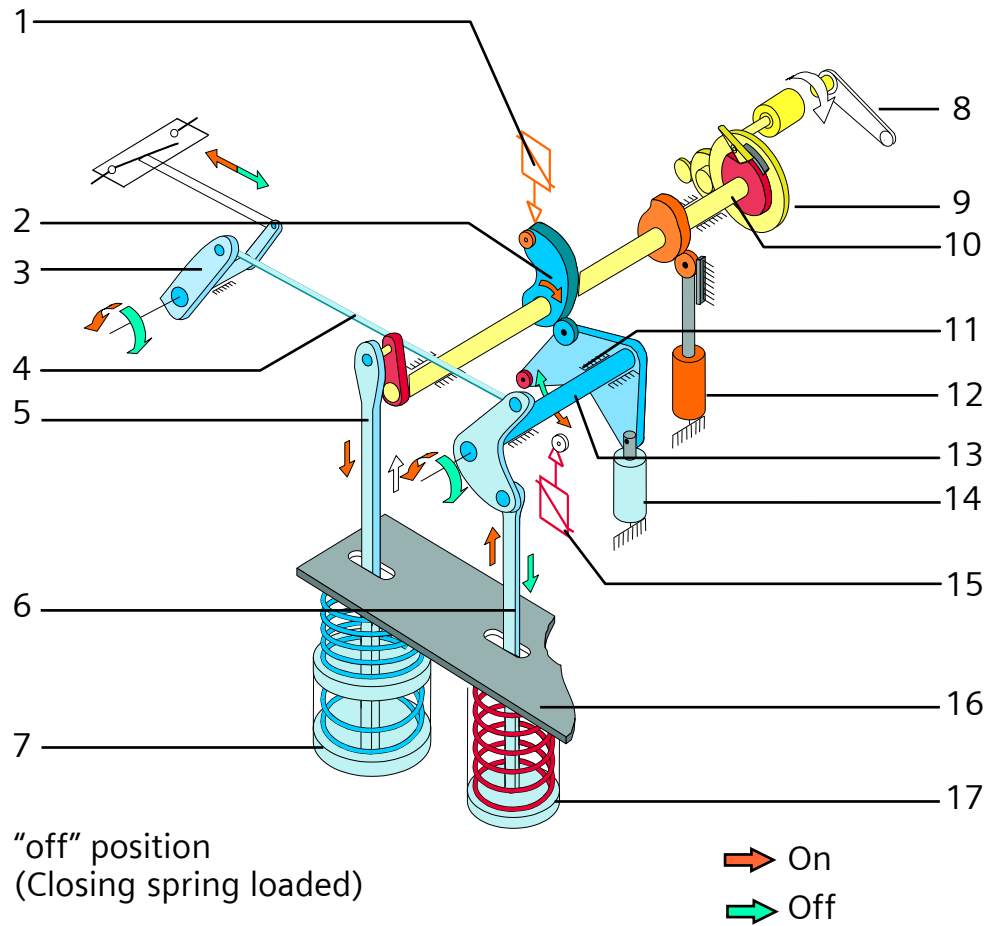
Breaker in
"off" position

- 1 Contact support
- 2 Quenching nozzle
- 3 Main contact
- 4 Arcing contact
- 5 Contact cylinder
- 6 Base

HIS Solution - GIS Type 8DN8

Spring-Stored-Energy Mechanism

High Voltage



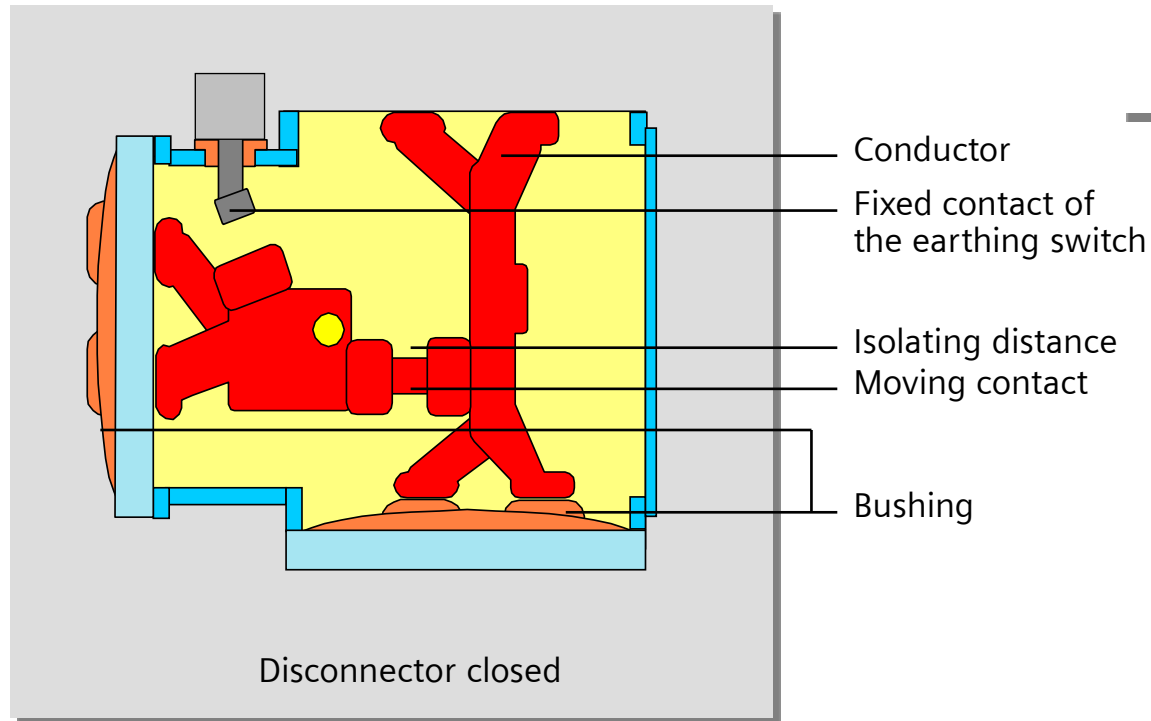
- 1 Closing release
- 2 Cam plate
- 3 Coupling linkage
- 4 Operating rod
- 5 Closing spring connecting rod
- 6 Opening spring connecting rod
- 7 Closing spring
- 8 Hand-wound mechanism
- 9 Charging mechanism
- 10 Charging shaft
- 11 Roller lever
- 12 Closing damper
- 13 Operating shaft
- 14 Opening damper
- 15 Opening release
- 16 Mechanism housing
- 17 Opening spring



High Voltage

HIS Solution - GIS Type 8DN8

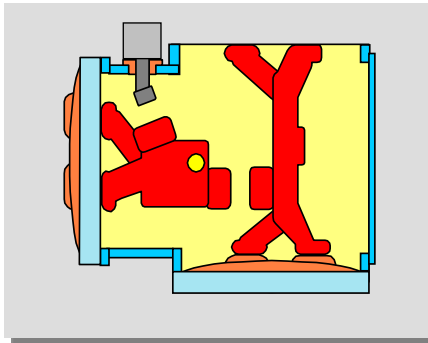
Universal Cross Module with Disconnecter and Earthing Switch



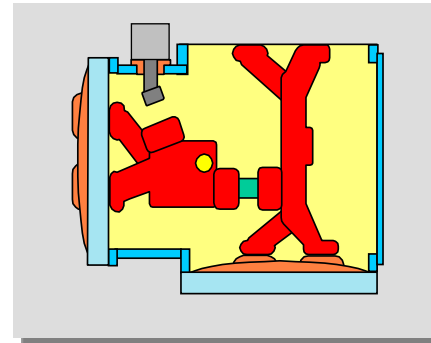
HIS Solution - GIS Type 8DN8

Principle Disconnecter and Earthing Switch

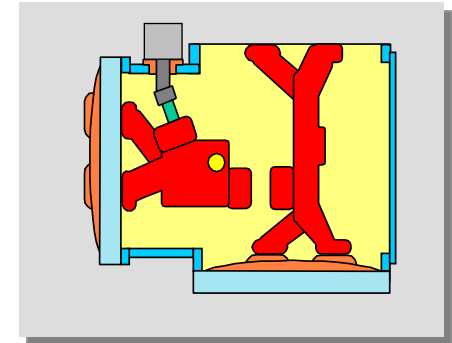
High Voltage



Neutral position



Disconnecter closed

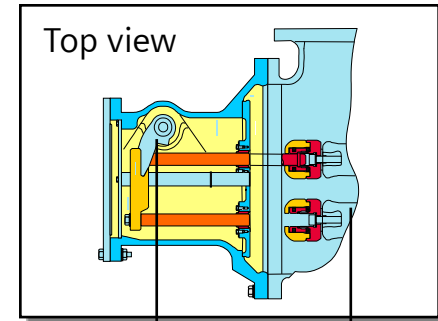
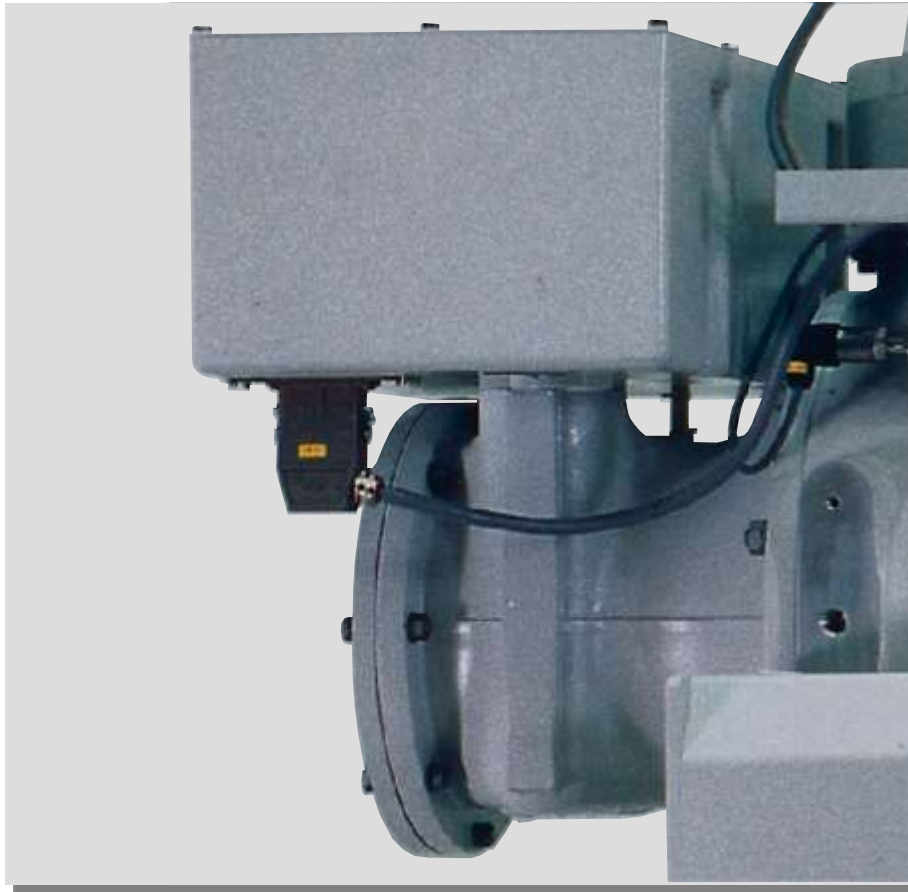


Earthing switch closed

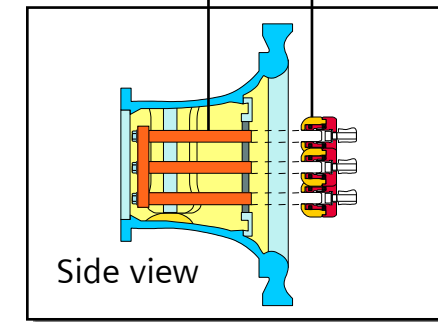


High Voltage

HIS Solution - GIS Type 8DN8 High-Speed Earthing Switch



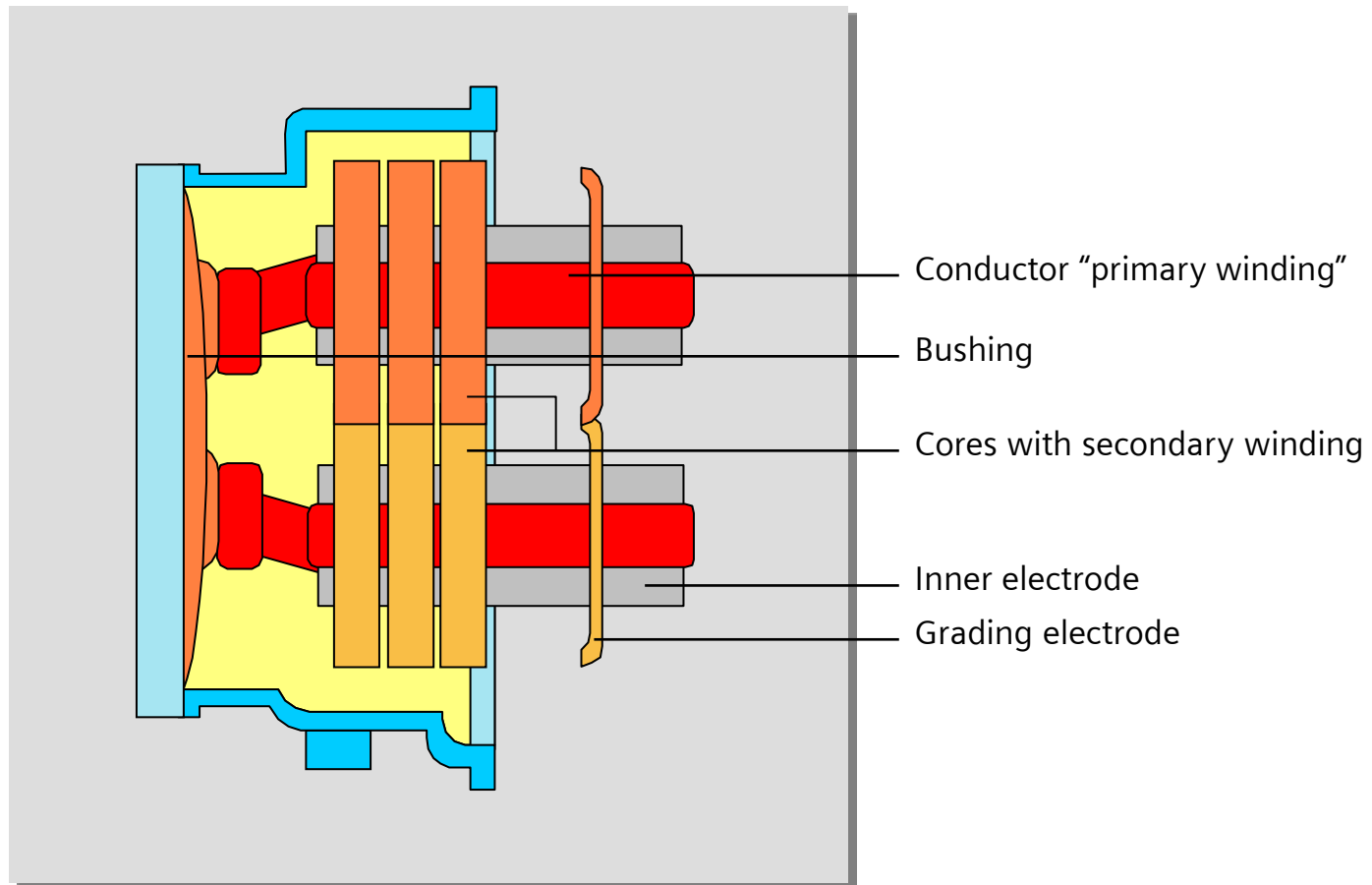
3 2 1 4



- 1 Fixed contact
- 2 Contact pin
- 3 Operating shaft
- 4 Conductor

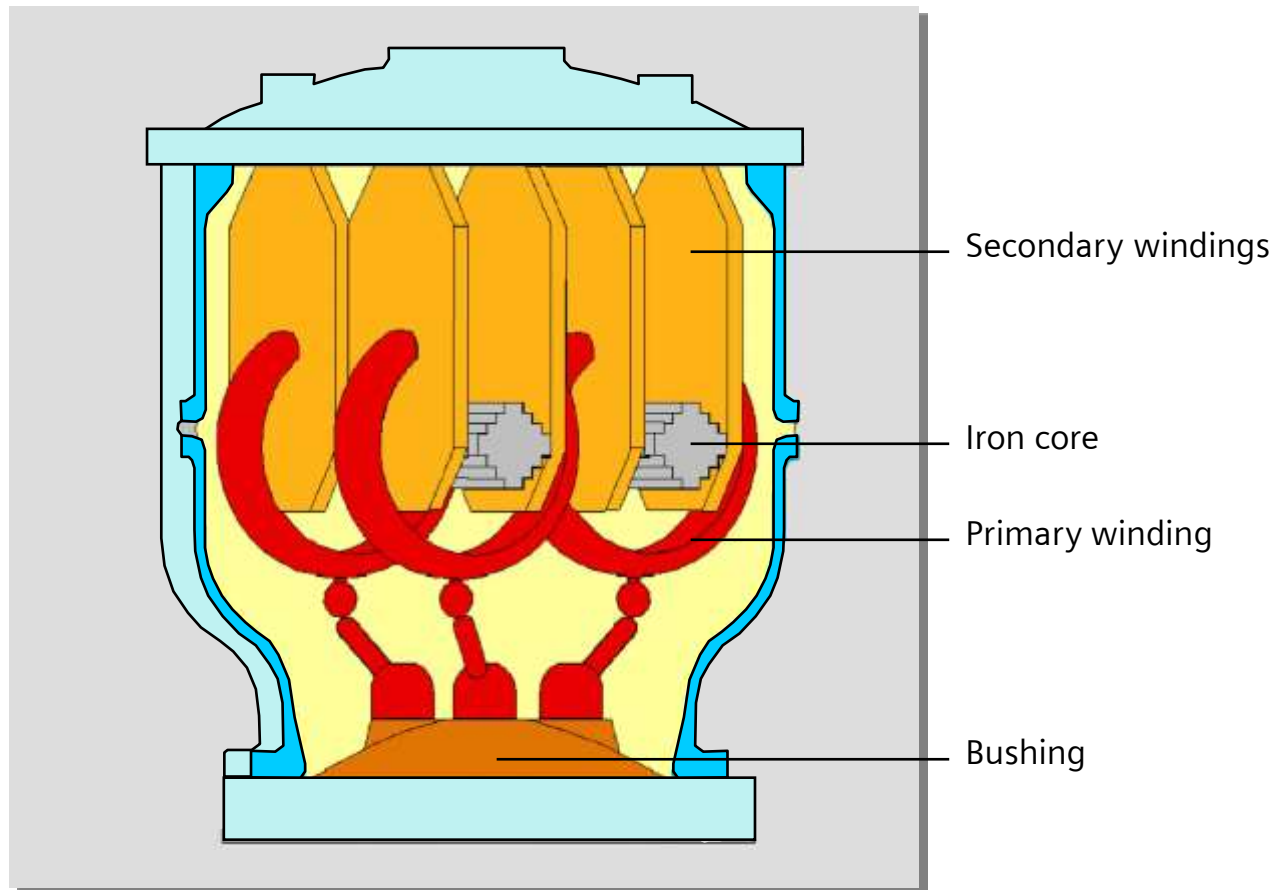
HIS Solution - GIS Type 8DN8 Current Transformer Module

High Voltage



HIS Solution - GIS Type 8DN8 Inductive Voltage Transformer Module

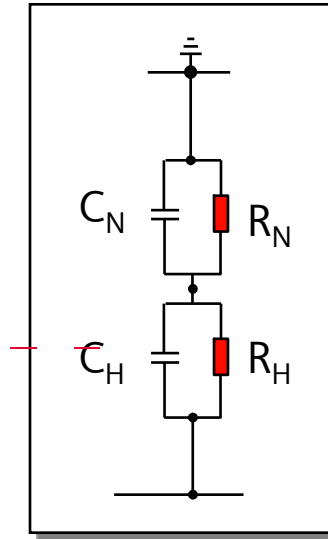
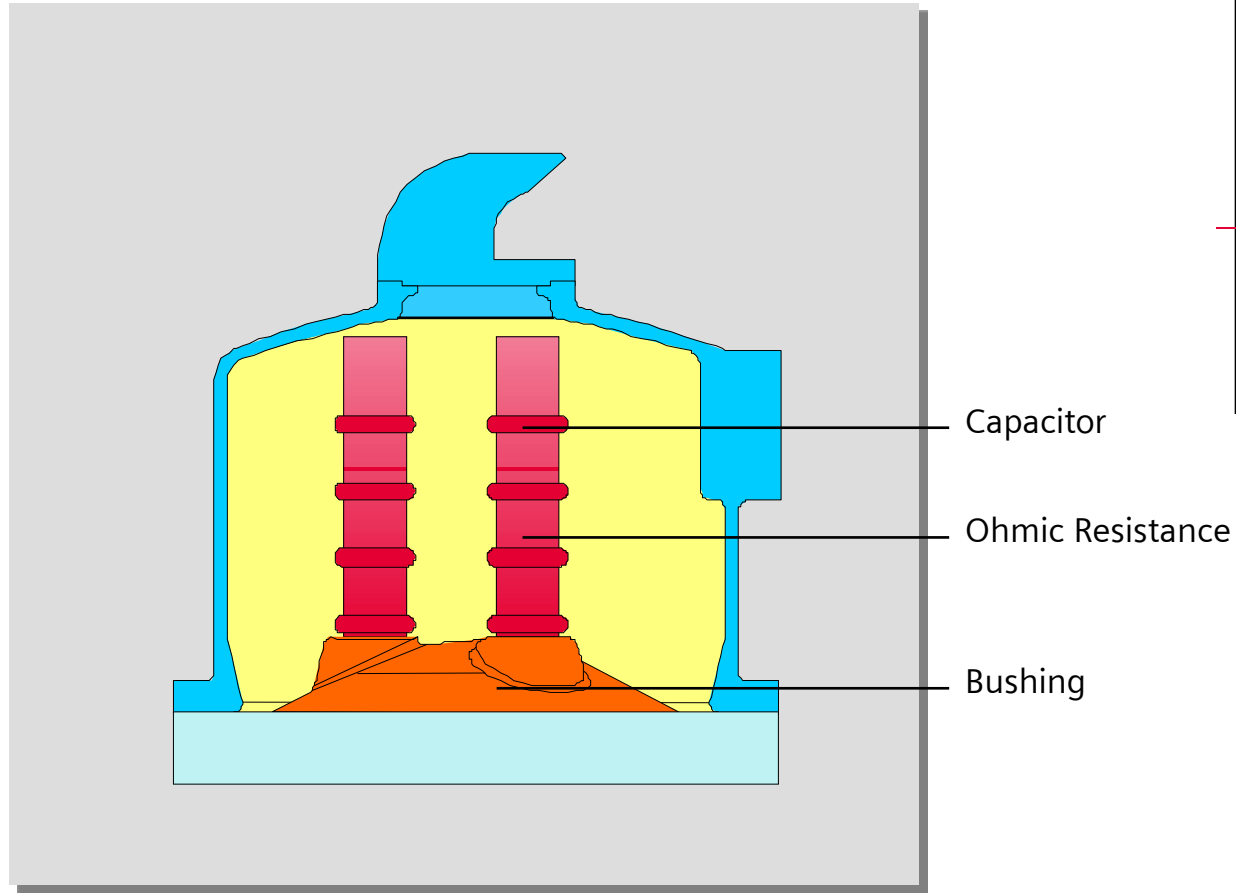
High Voltage



HIS Solution - GIS Type 8DN8

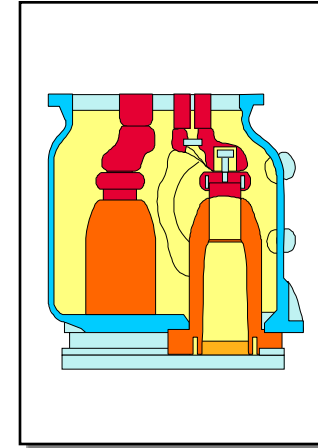
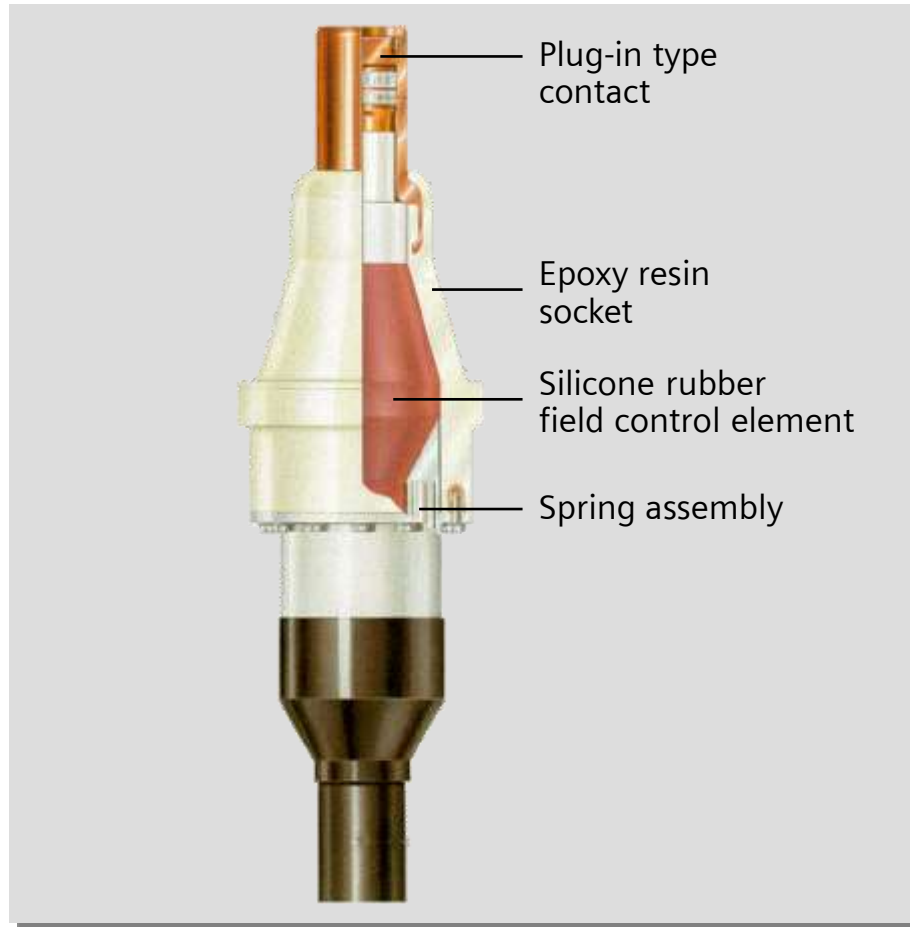
Voltage Transformer Module (Optimized-Burden Type)

High Voltage



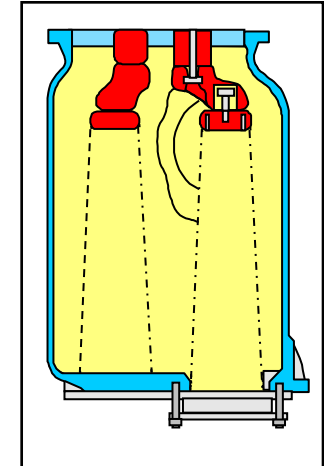
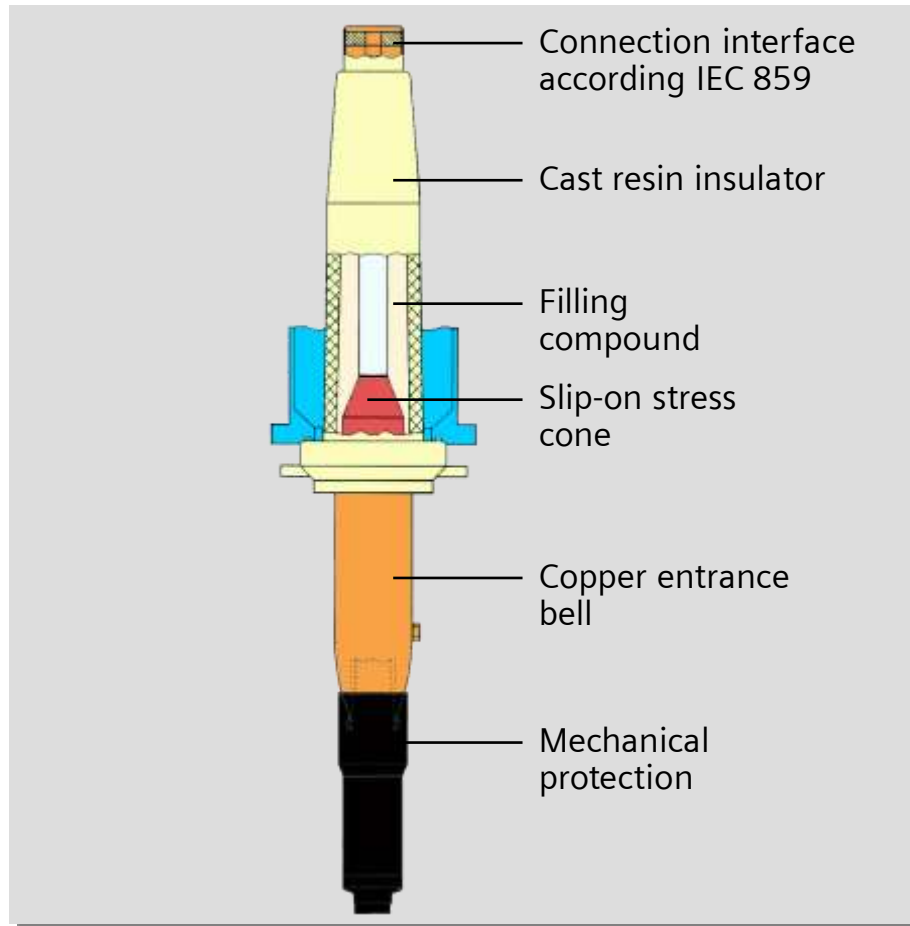
HIS Solution - GIS Type 8DN8 Plug-in Type Cable Termination

High Voltage



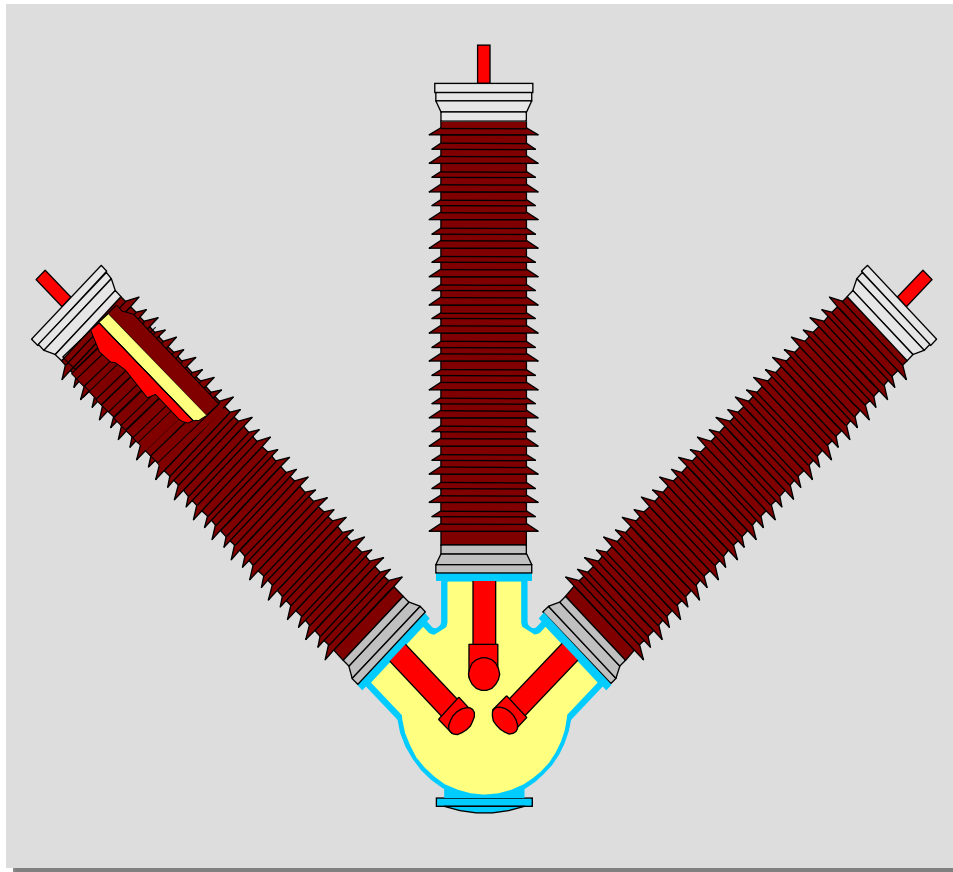
HIS Solution - GIS Type 8DN8 Conventional Cable Termination Module

High Voltage

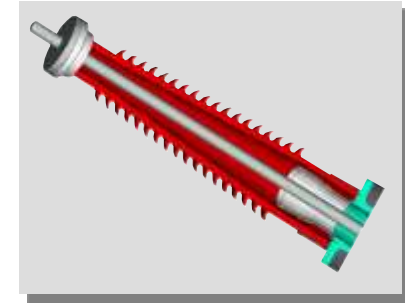


HIS Solution - GIS Type 8DN8 SF₆ / Air Termination

High Voltage



Example: SF₆/air termination with composite insulator

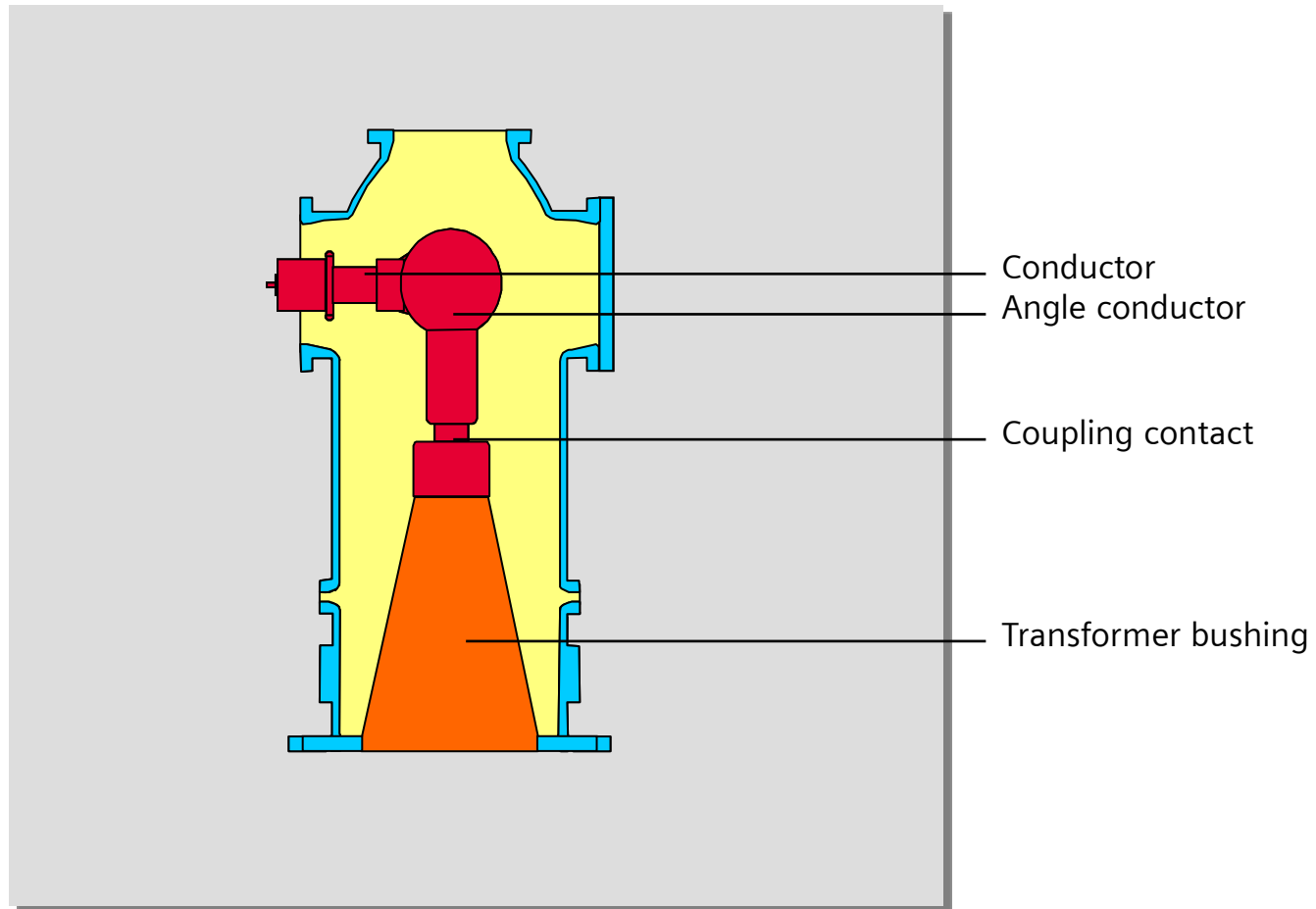


Example: Porcelain insulator

- Composite insulator
- Porcelain insulator

HIS Solution - GIS Type 8DN8 Transformer Termination

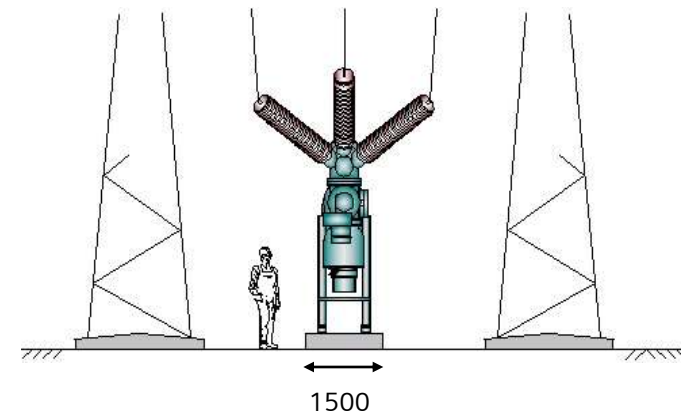
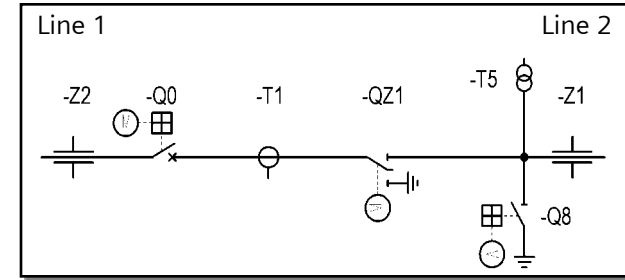
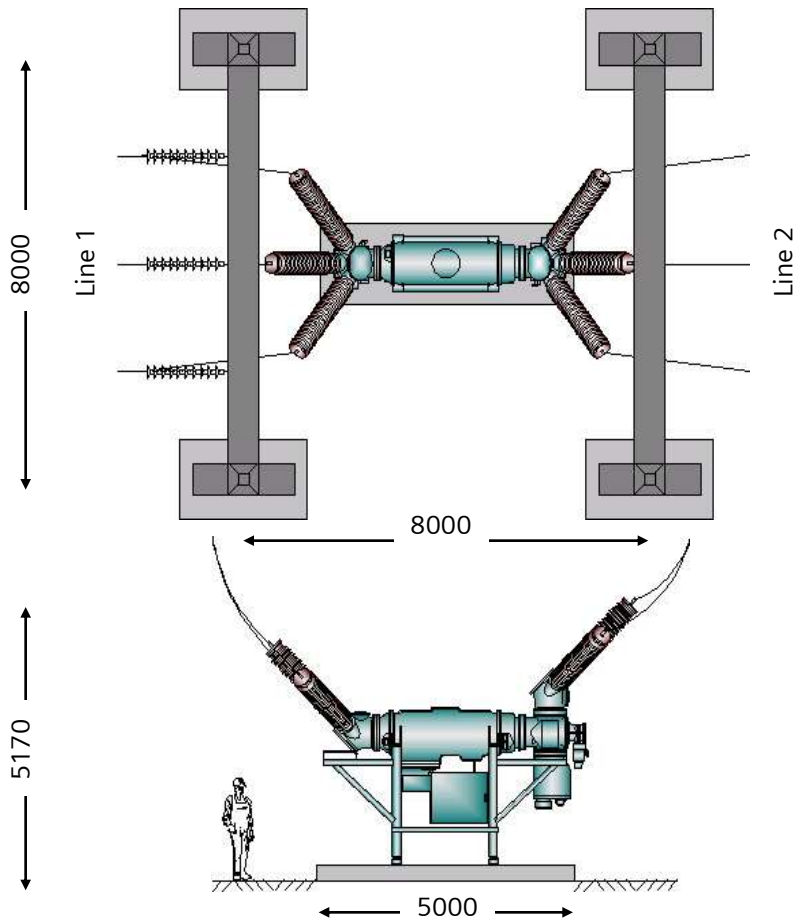
High Voltage





High Voltage

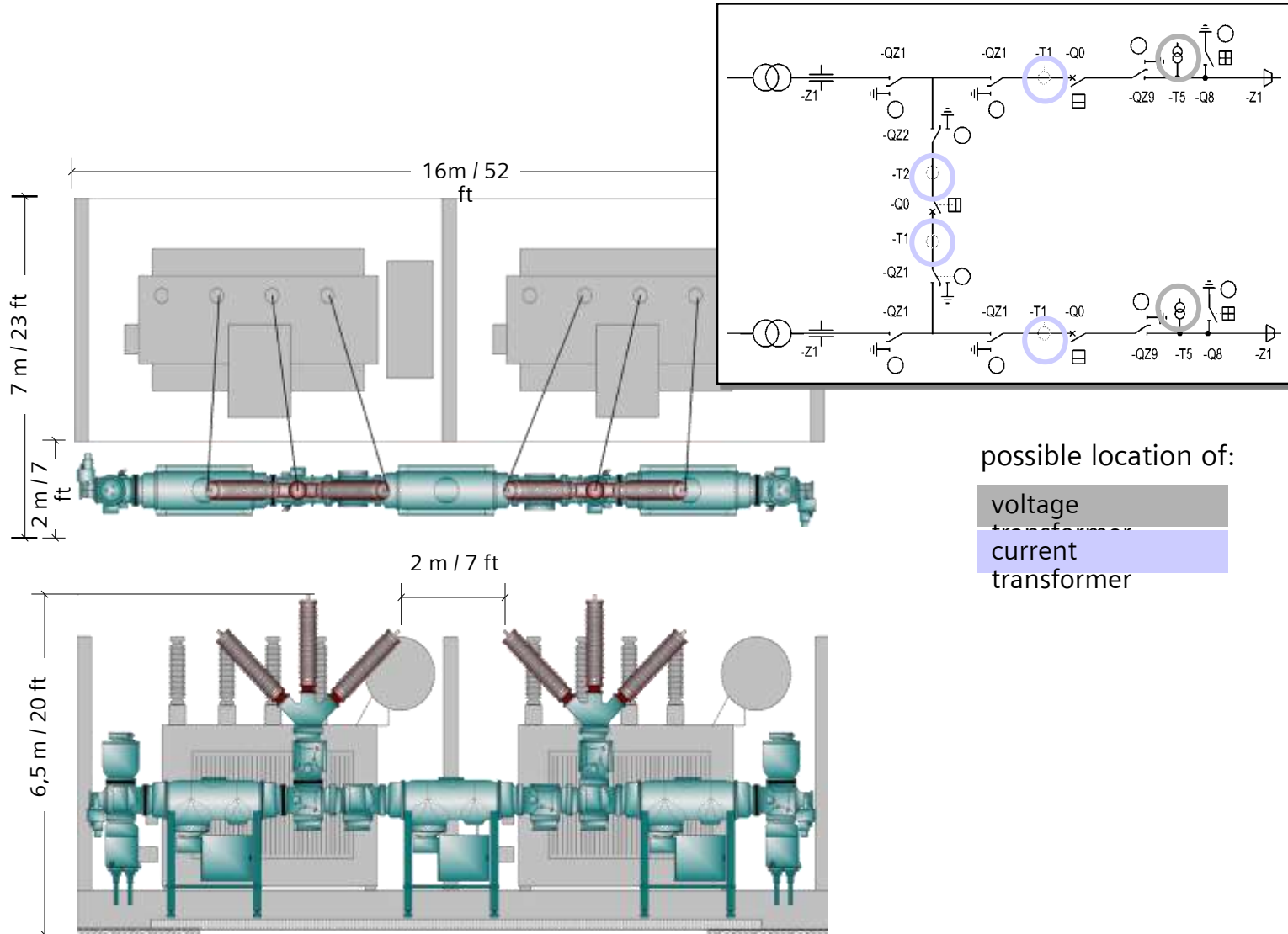
HIS Solution - GIS Type 8DN8 Single Feeder with SF₆ / Air Termination





High Voltage

HIS Solution - GIS Type 8DN8 3 CB H-Arrangement

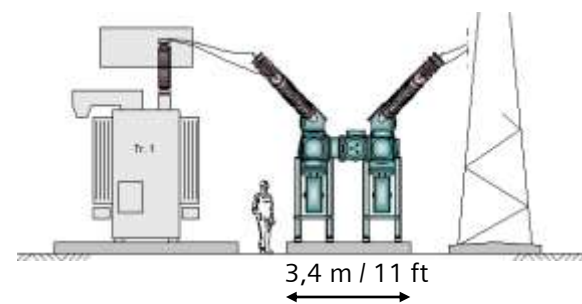
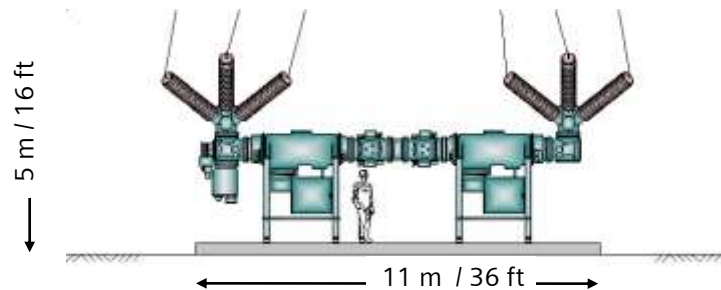
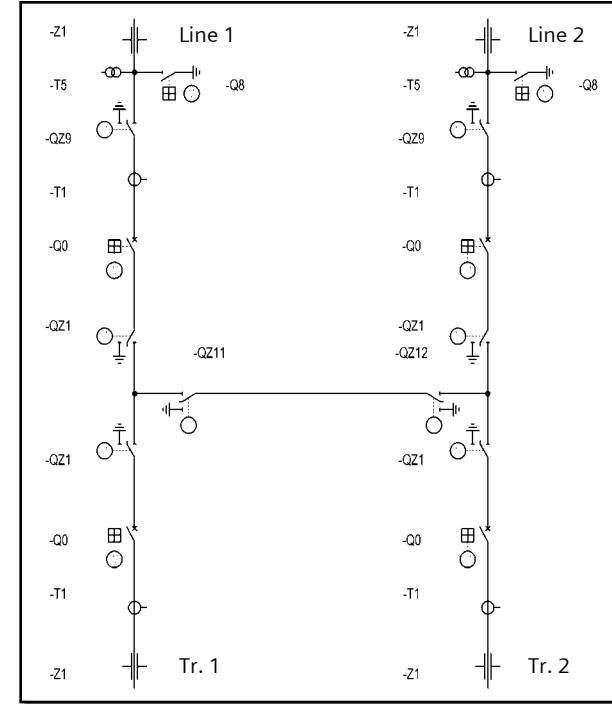
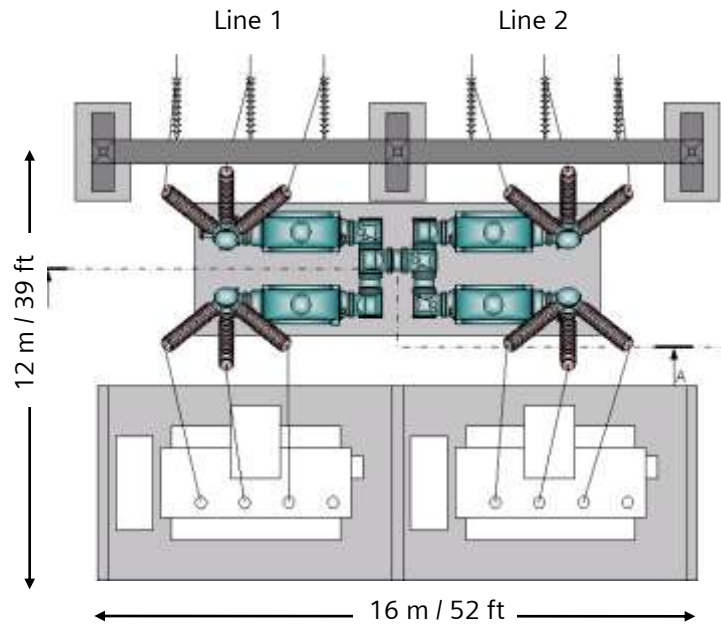


possible location of:
 voltage transformer
 current transformer



HIS Solution - GIS Type 8DN8 4-CB H-Arrangement

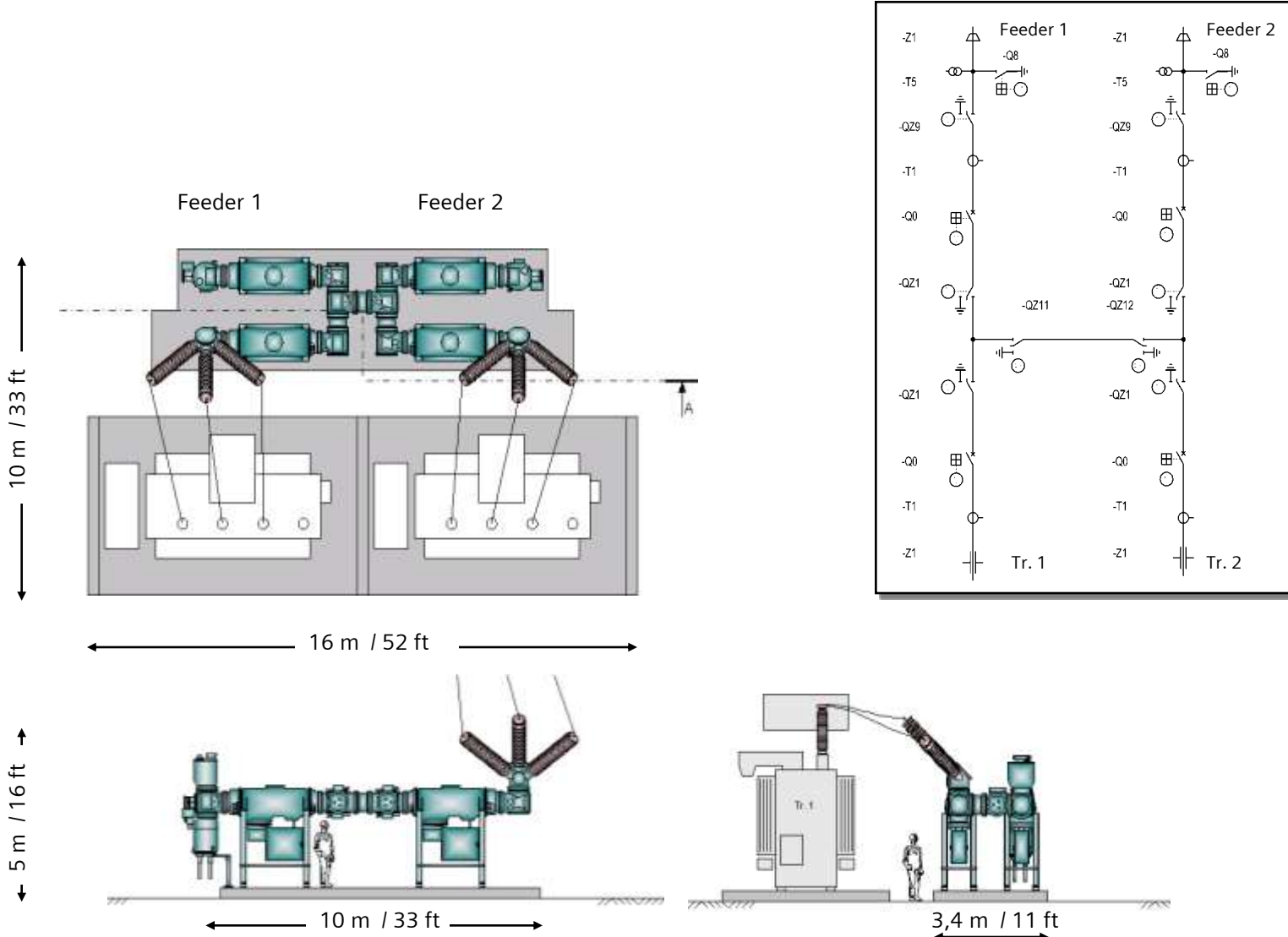
High Voltage





HIS Solution - GIS Type 8DN8 4-CB H-Arrangement

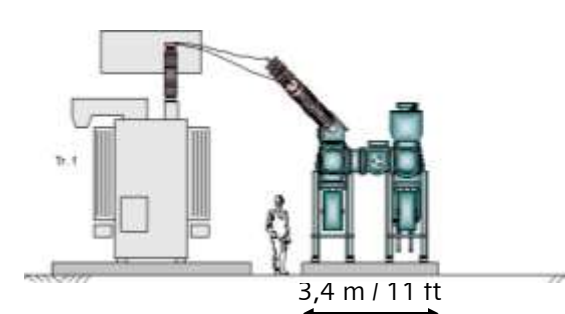
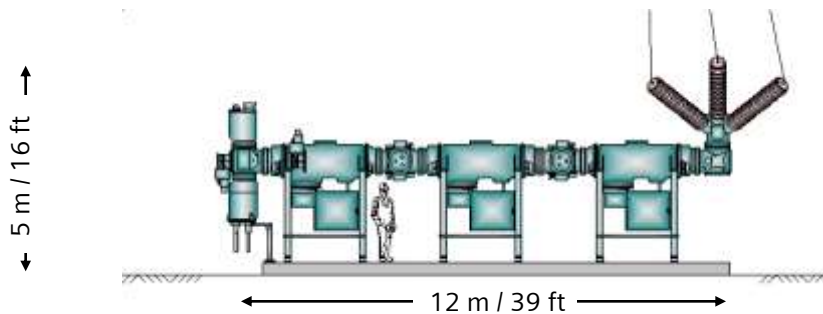
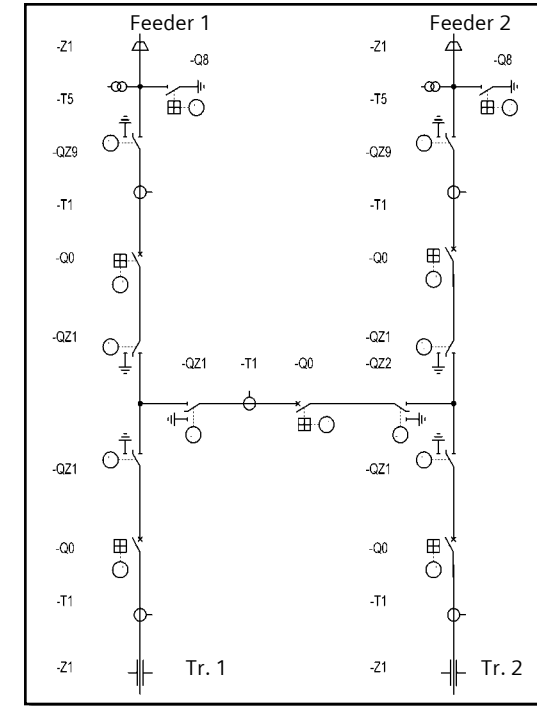
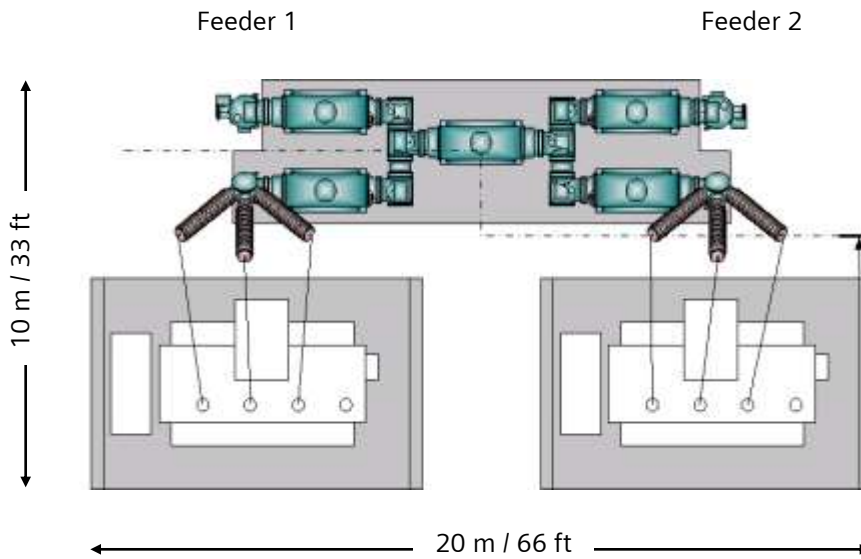
High Voltage





High Voltage

HIS Solution - GIS Type 8DN8 5-CB H-Arrangement



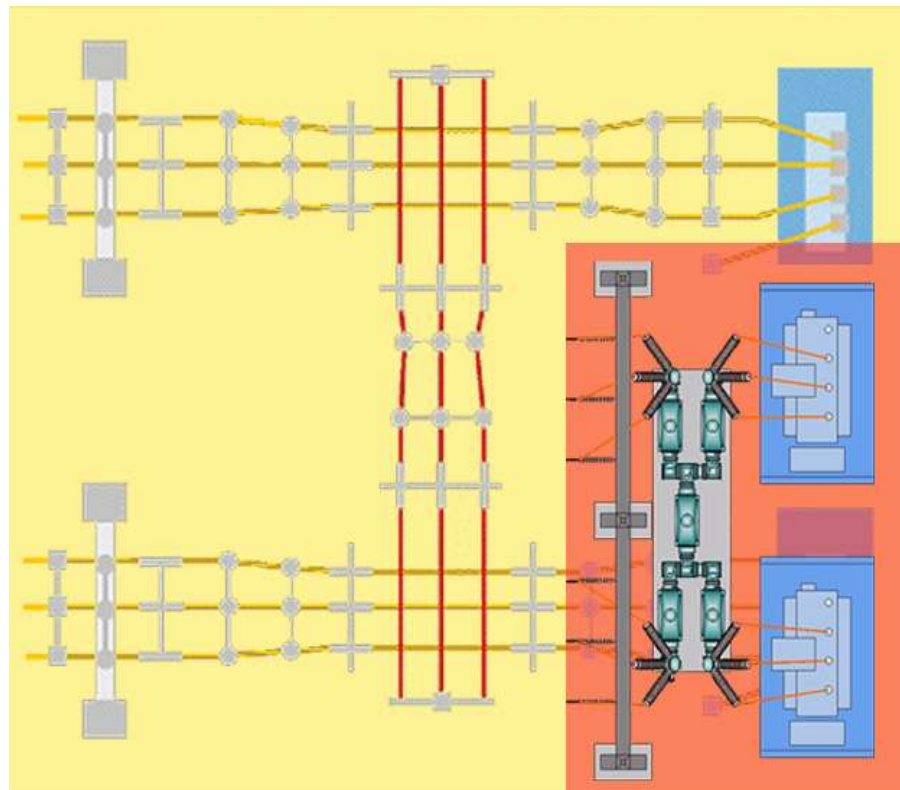


High Voltage

HIS Solution - GIS Type 8DN8

Comparison of 5-CB H-Arrangement AIS - HIS

Space Saving > 70%



40 m / 131 ft

16 m / 52 ft

33 m / 108 ft

23 m / 75 ft

AIS 1300 m²

HIS 360 m²

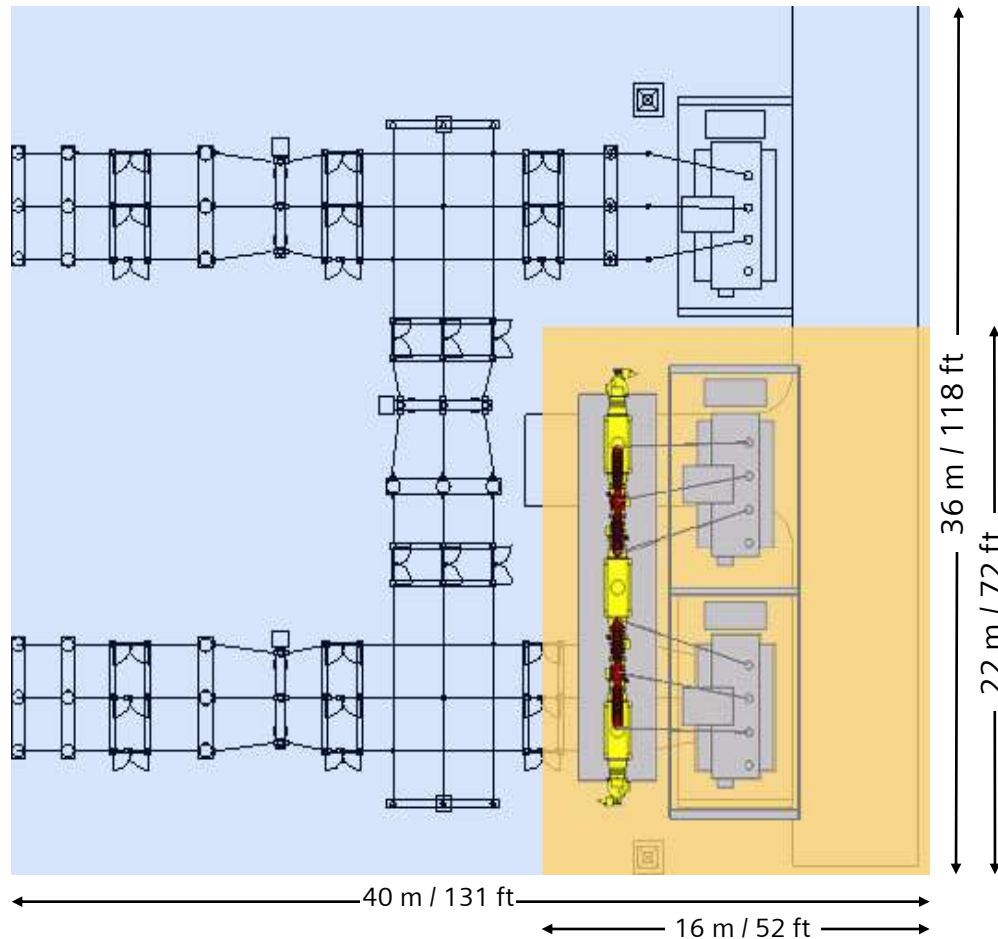


High Voltage

HIS Solution - GIS Type 8DN8

Comparison of 3-CB H-Arrangement AIS - HIS

Space Saving 80%



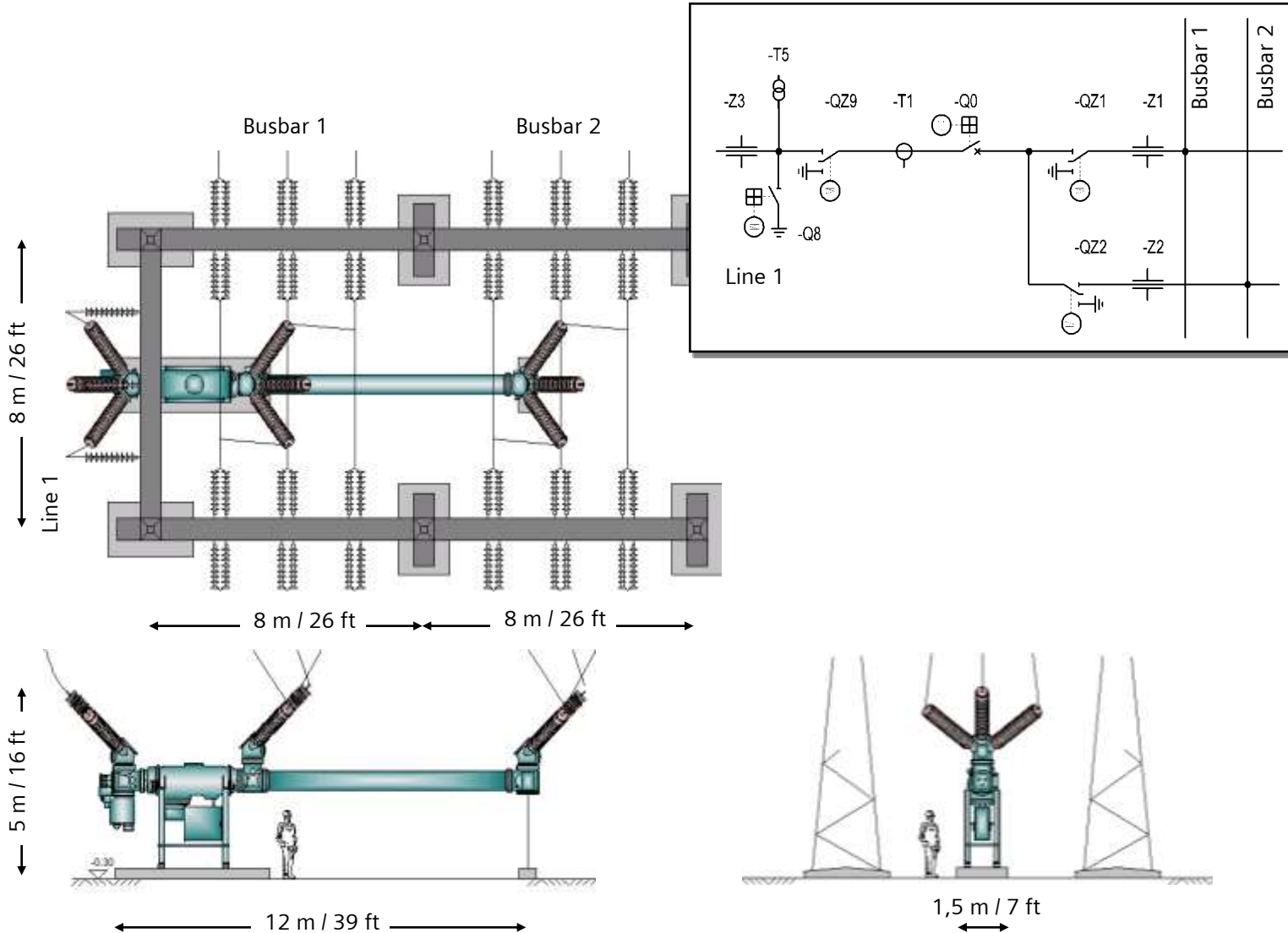
AIS 1450 m²

HIS 350 m²



High Voltage

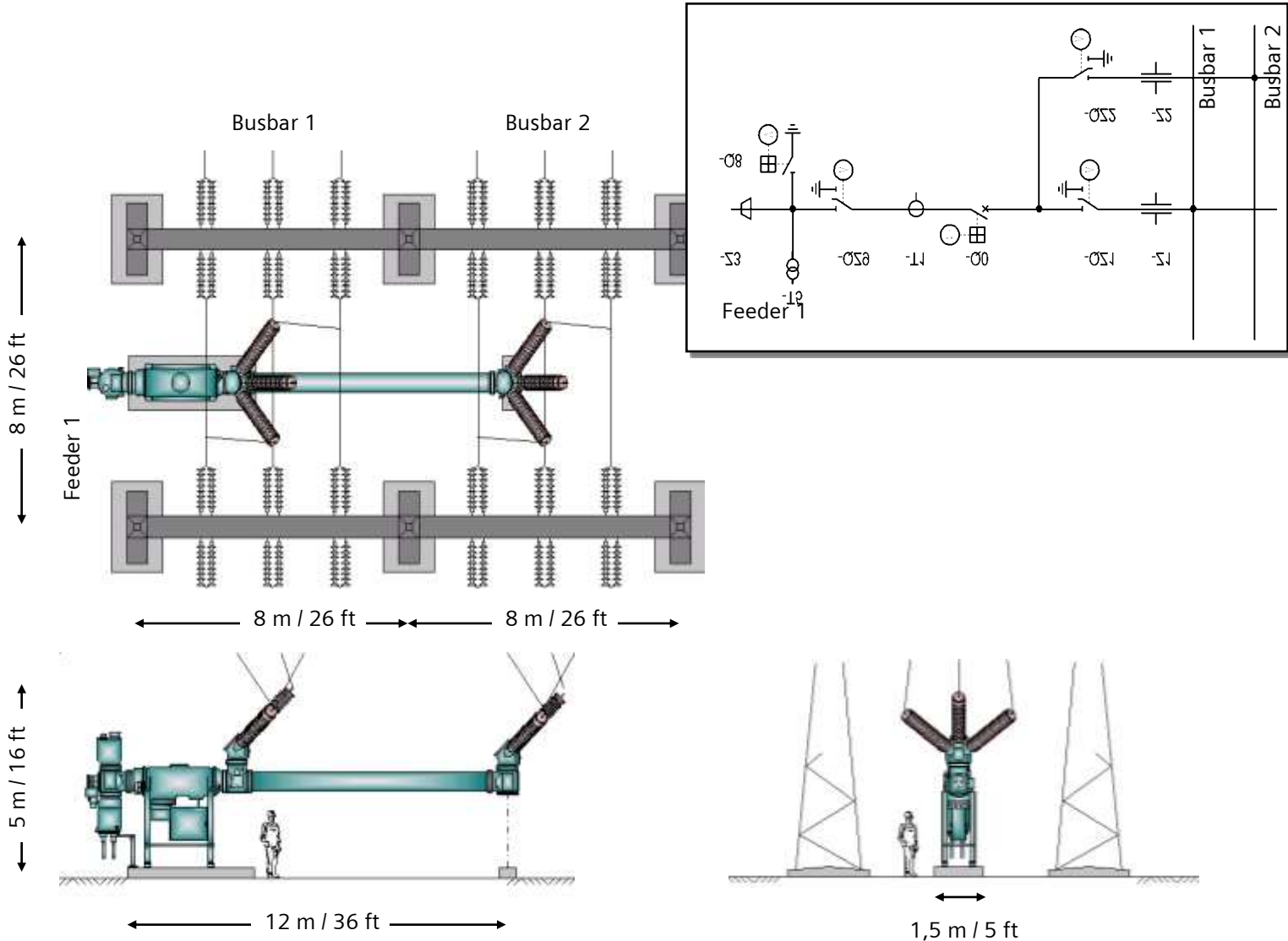
HIS Solution - GIS Type 8DN8 Duplicate Bus System





High Voltage

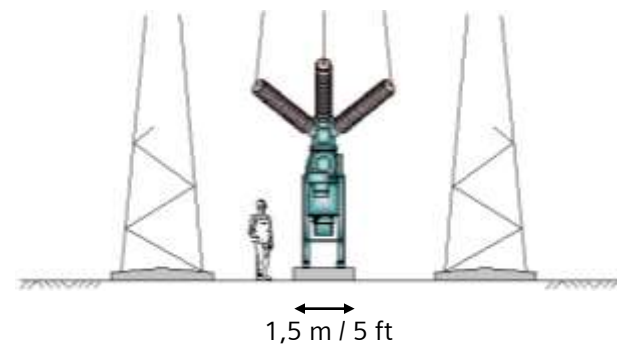
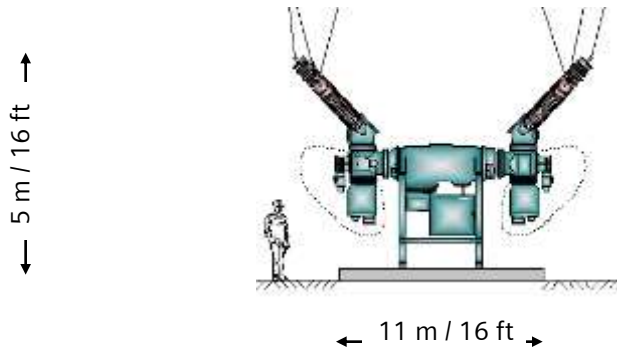
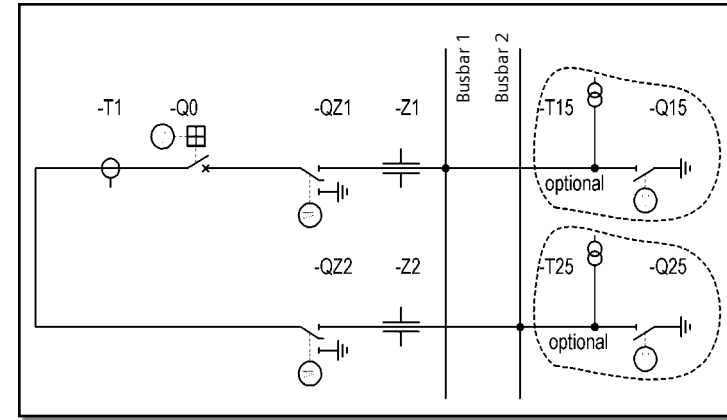
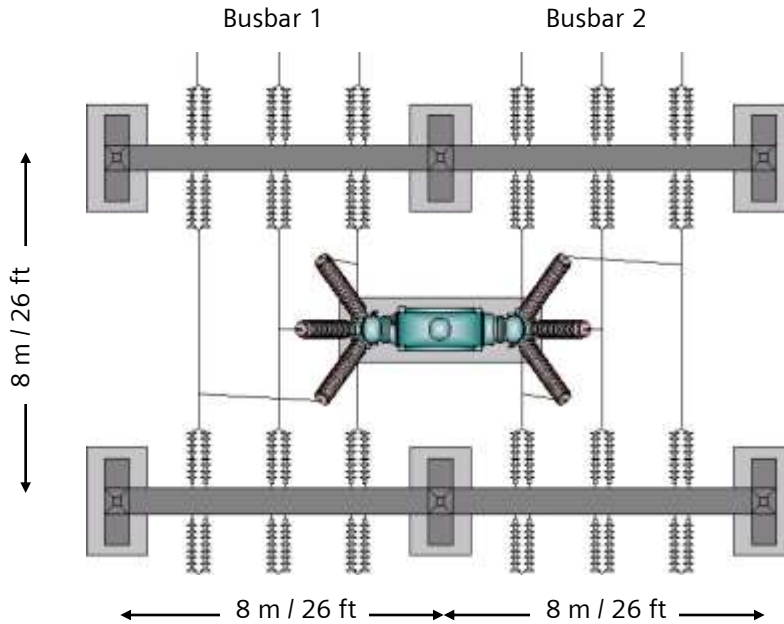
HIS Solution - GIS Type 8DN8 Duplicate Bus System





High Voltage

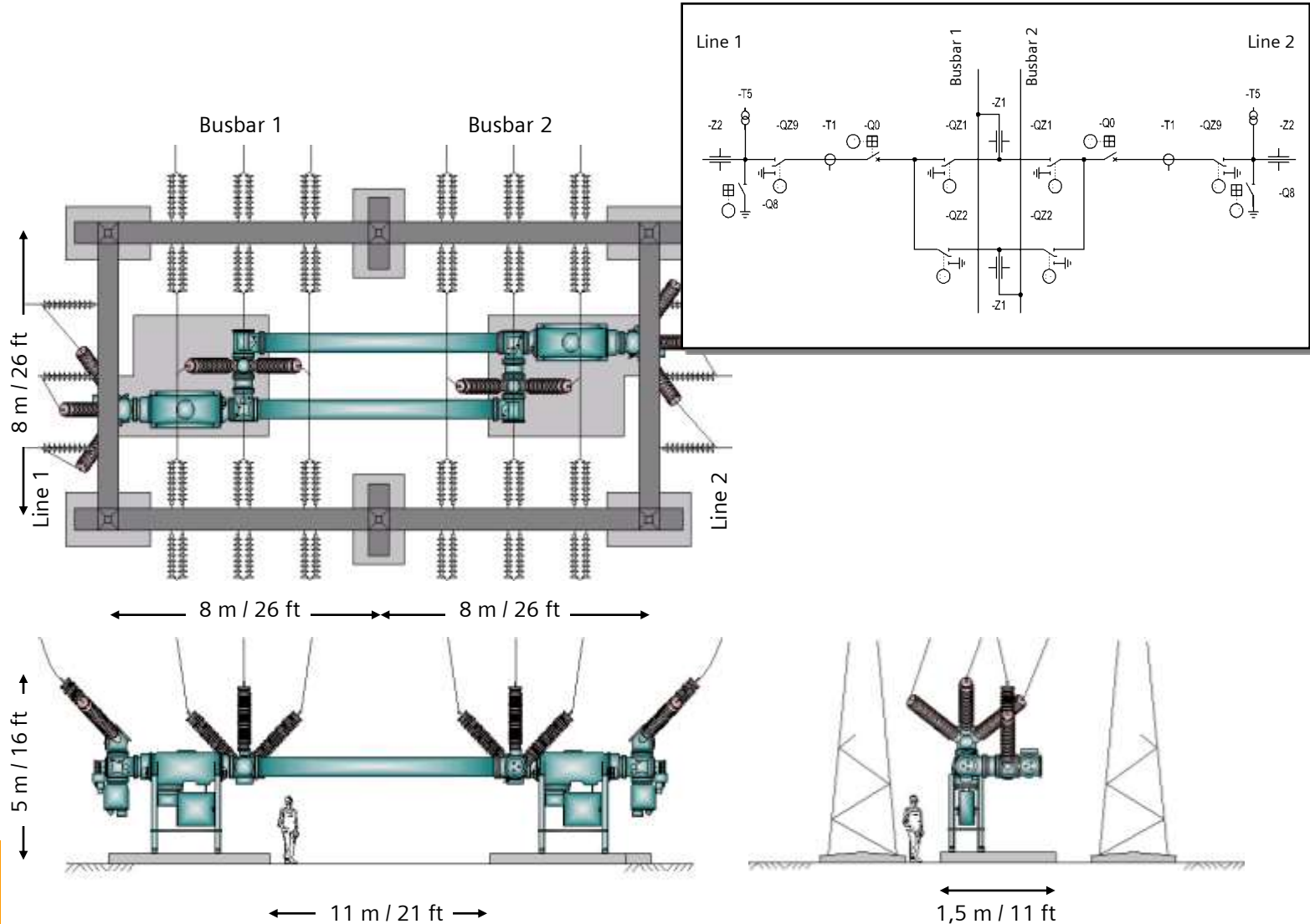
HIS Solution - GIS Type 8DN8 Duplicate Bus System





HIS Solution - GIS Type 8DN8 Duplicate Bus System

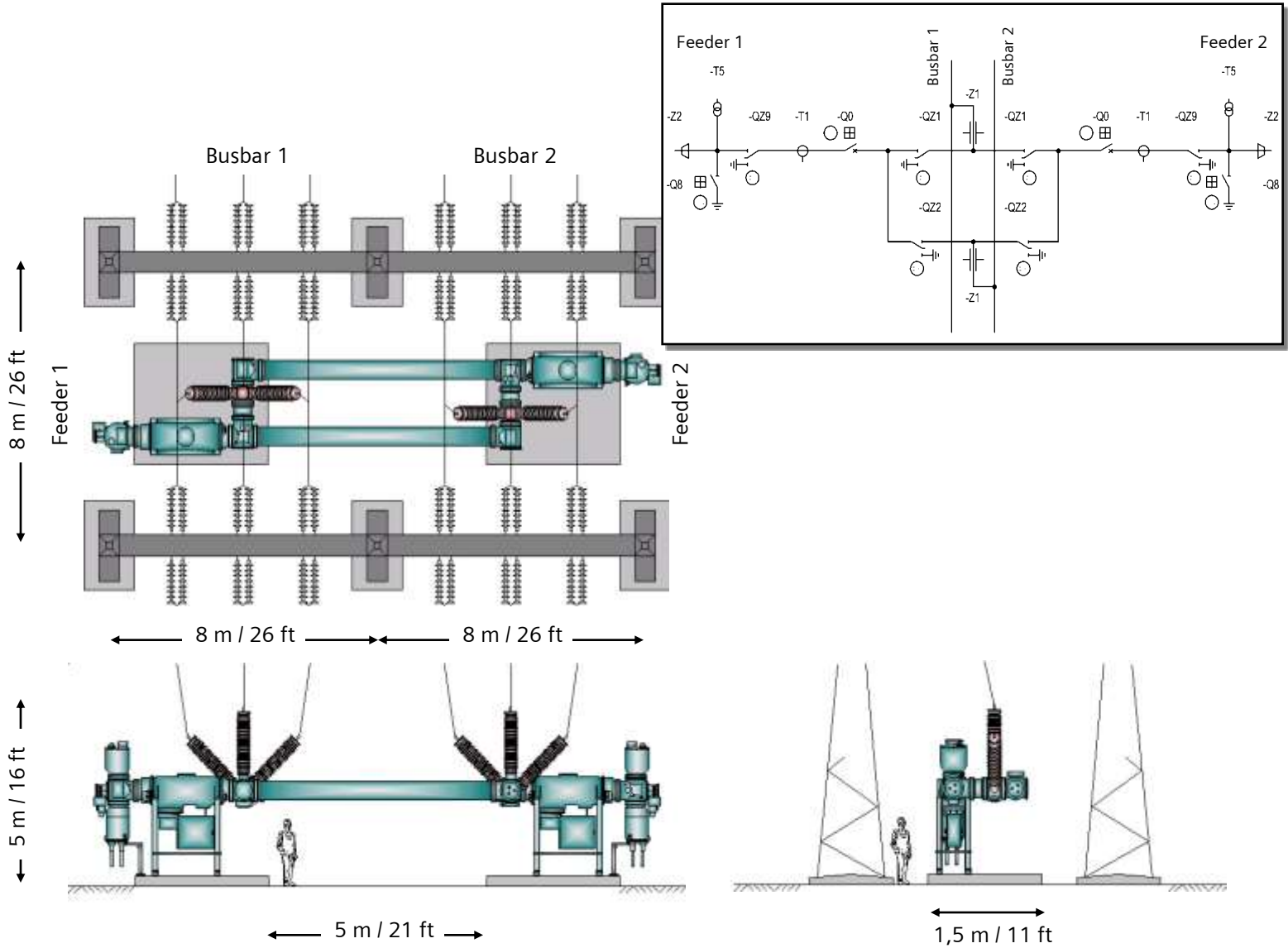
High Voltage





HIS Solution - GIS Type 8DN8 Duplicate Bus System

High Voltage



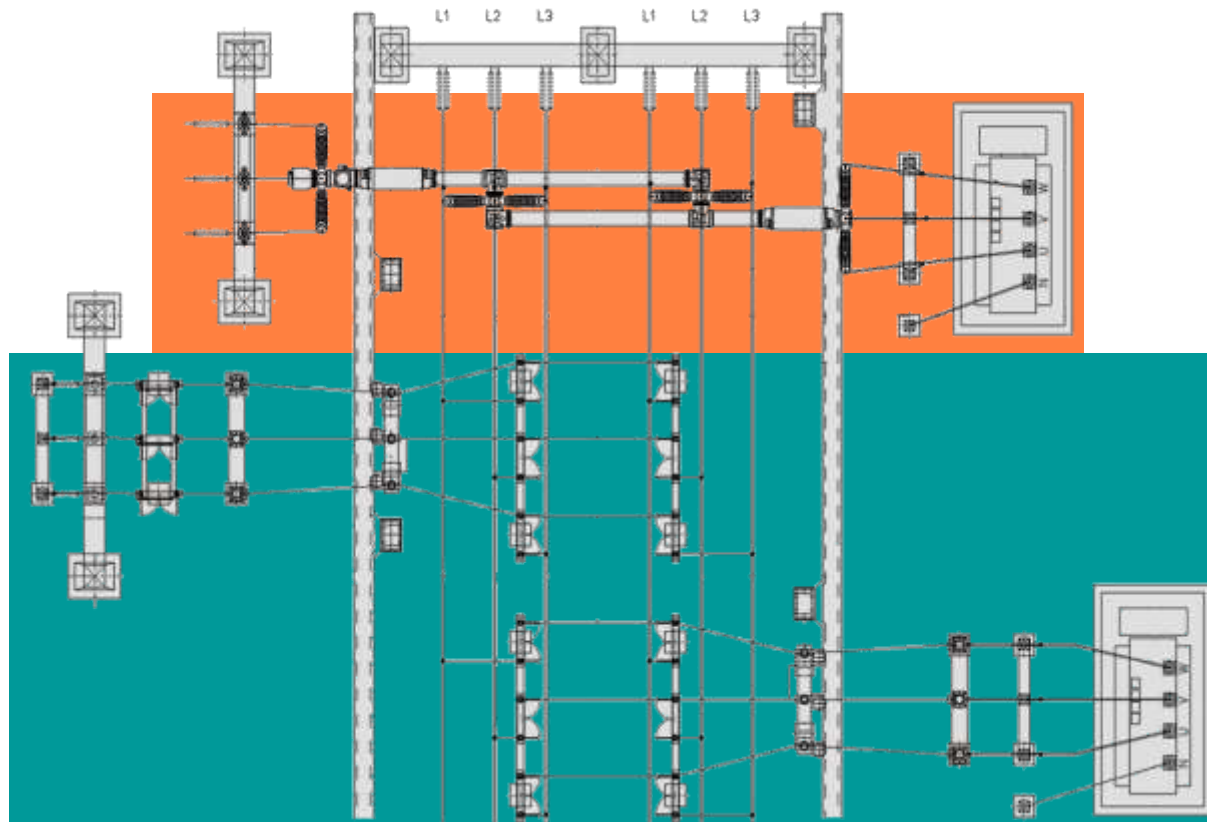


High Voltage

HIS Solution - GIS Type 8DN8

Comparison AIS - HIS Duplicate Bus System

Space saving > 50%



2 Feeder
HIS-Equipment

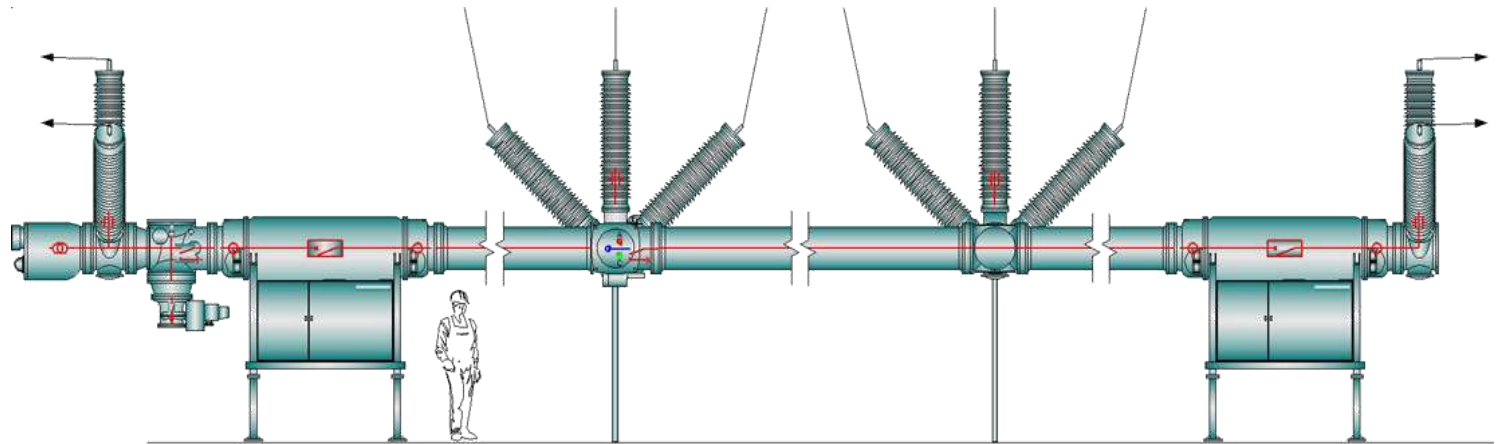
2 Feeder
Conv. AIS



High Voltage

HIS Solution - GIS Type 8DN8

Extension of AIS Duplicate Outgoing Feeder

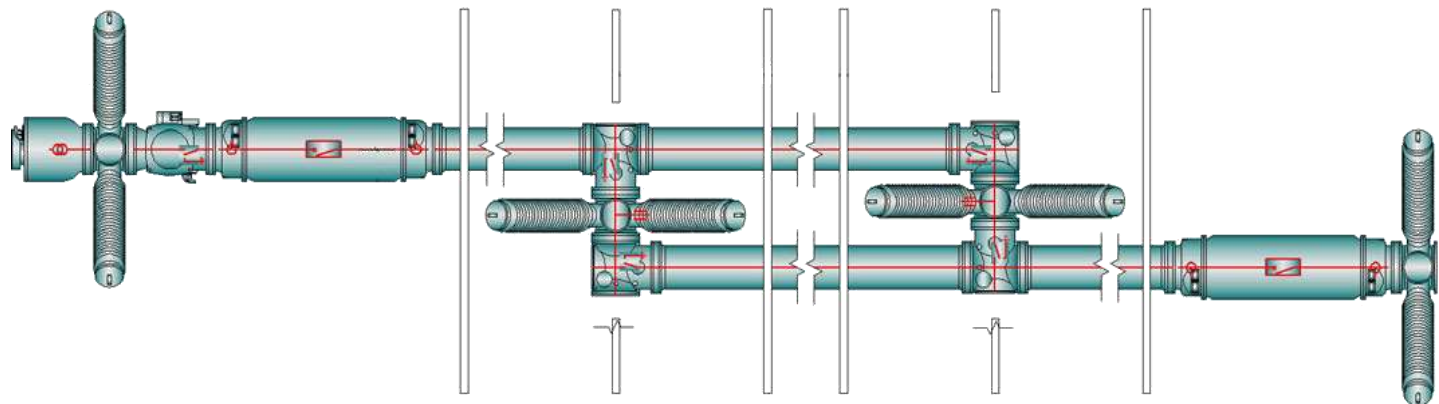


Line

Air-Insulated Busbar 1

Air-Insulated Busbar 2

Transformer

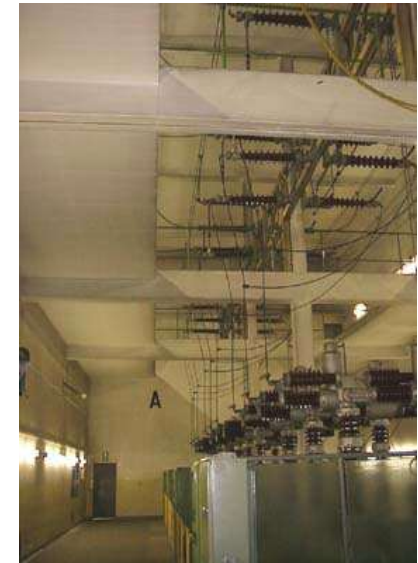




High Voltage

HIS Solution - GIS Type 8DN8

Example Air-Insulated Indoor Substation



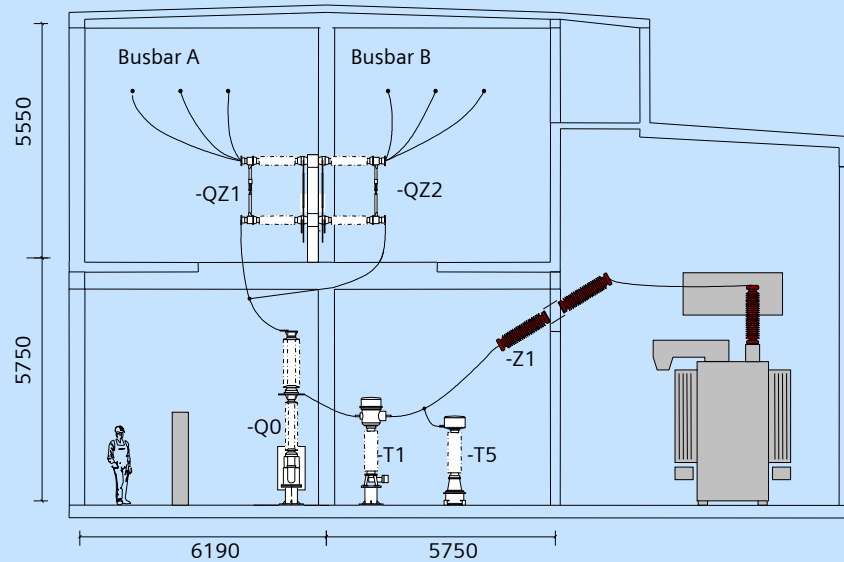


High Voltage

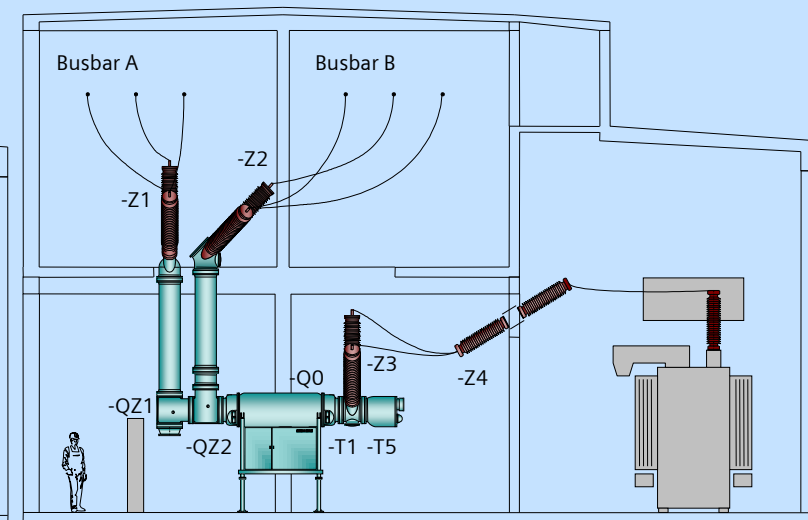
HIS Solution - GIS Type 8DN8

Replacement of an Air-Insulated Indoor Substation

Before: Air-Insulated Design



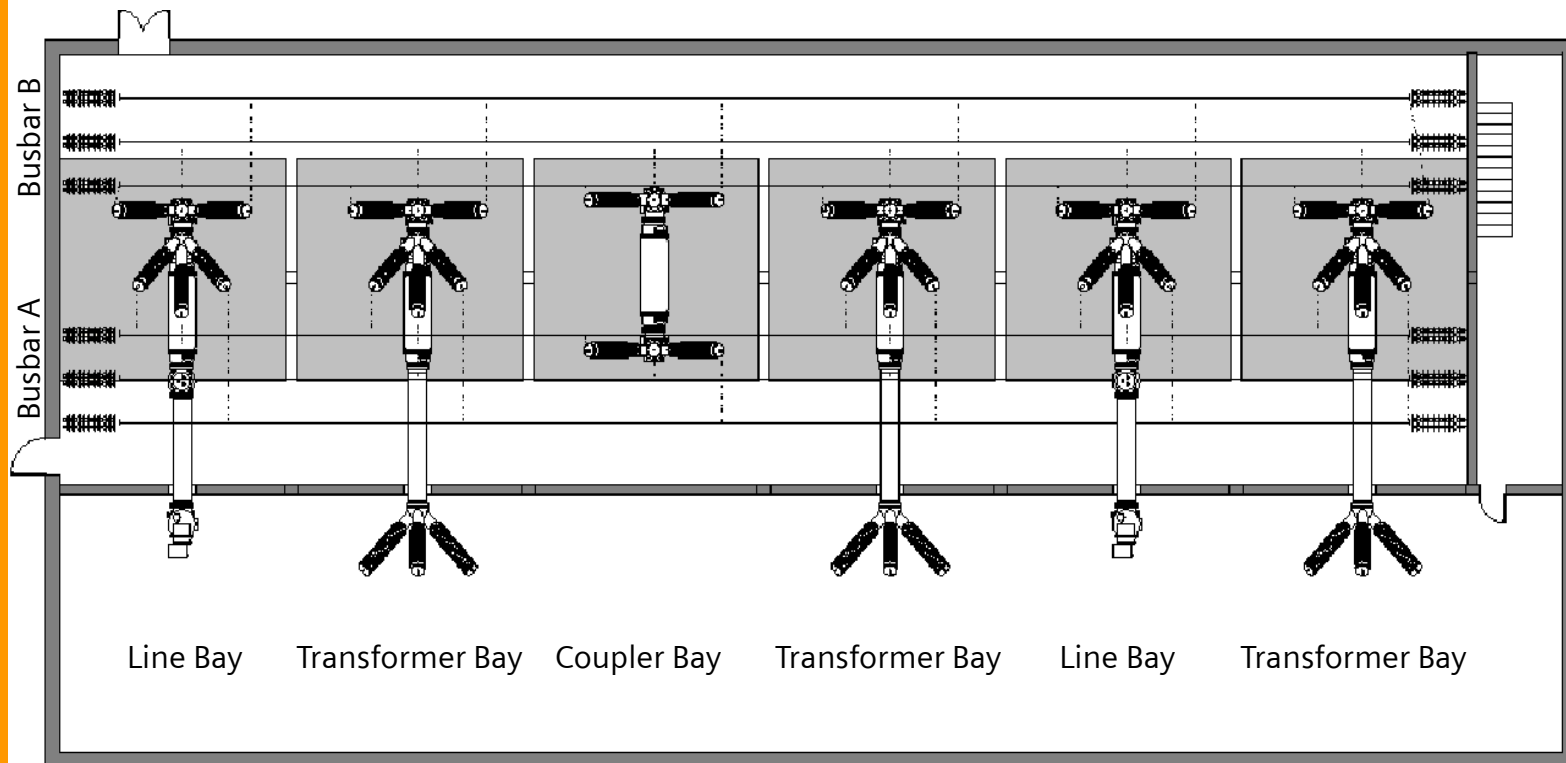
Later: HIS - Solution



HIS Solution - GIS Type 8DN8

Example: Upgrade of an Air-Insulated Indoor Substation

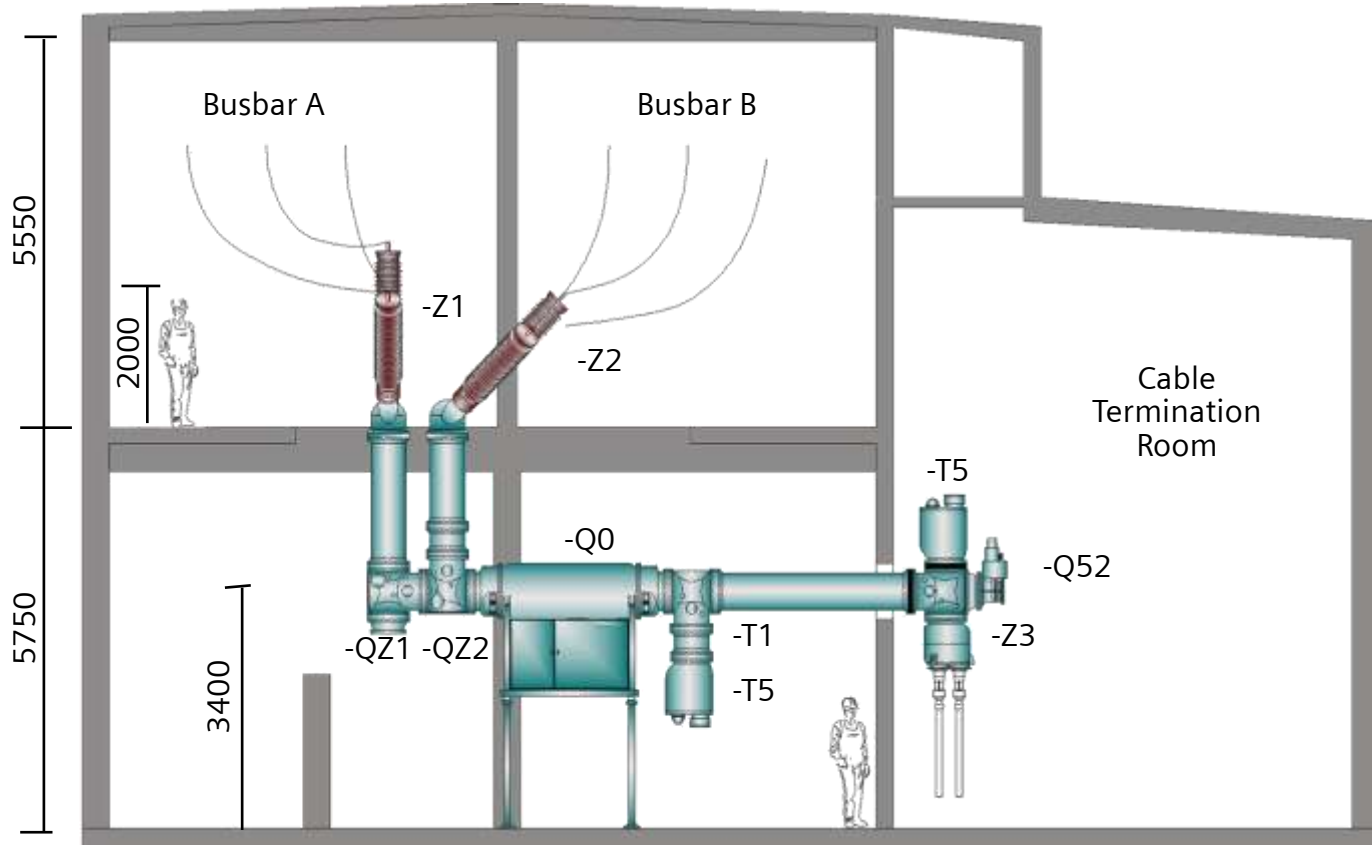
High Voltage





High Voltage

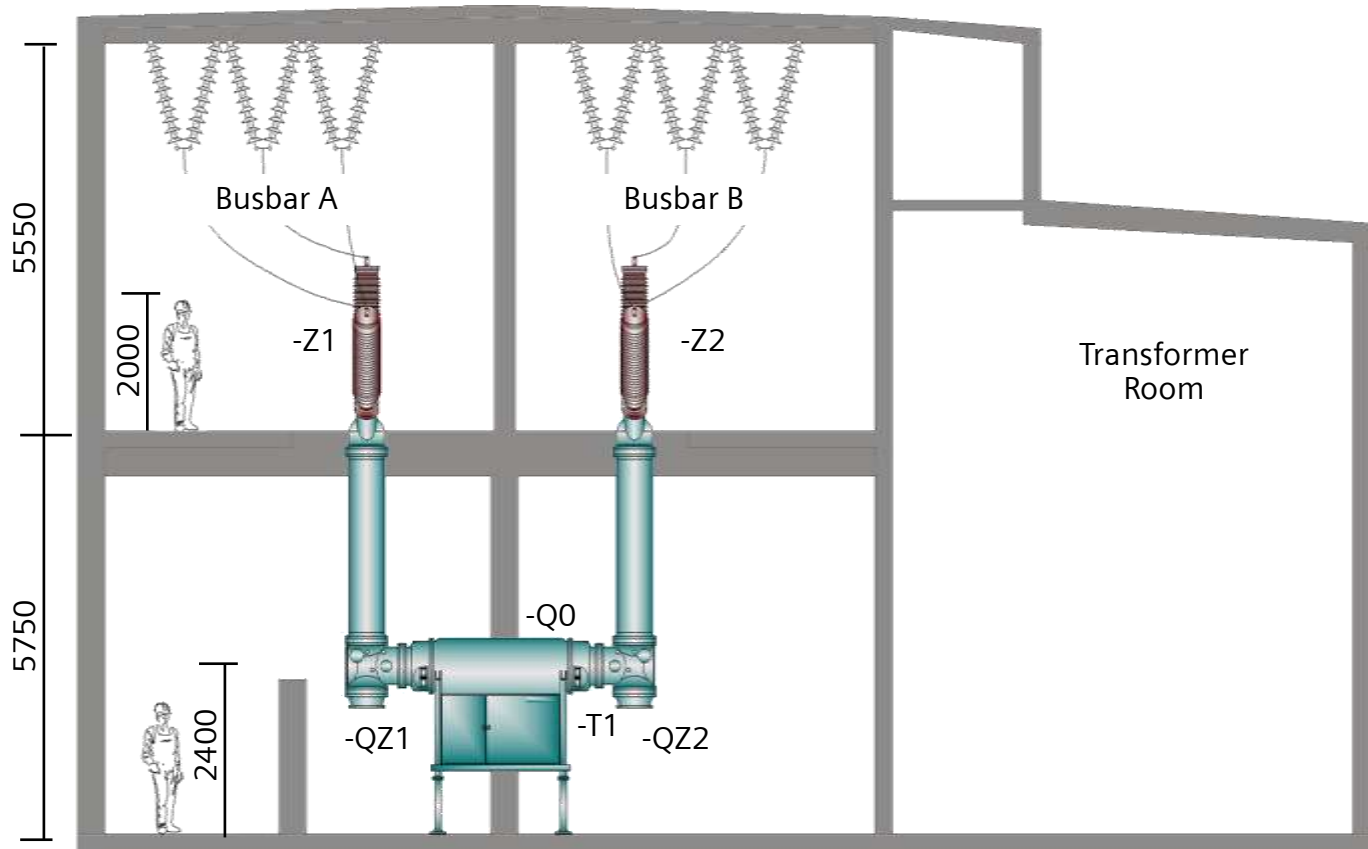
HIS Solution - GIS Type 8DN8 Indoor Substation, Line Bay





High Voltage

HIS Solution - GIS Type 8DN8 Indoor Substation, Coupler Bay



HIS - Highly Integrated Switchgear, Type 8DQ1

Technical Data

High Voltage

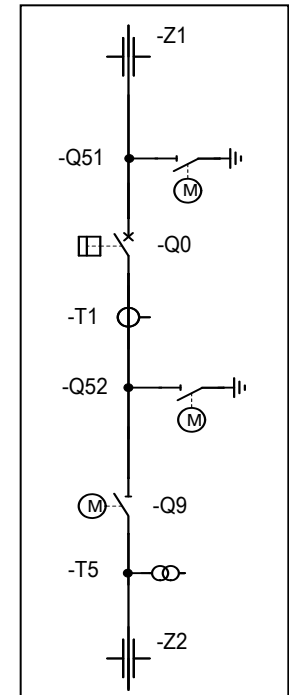
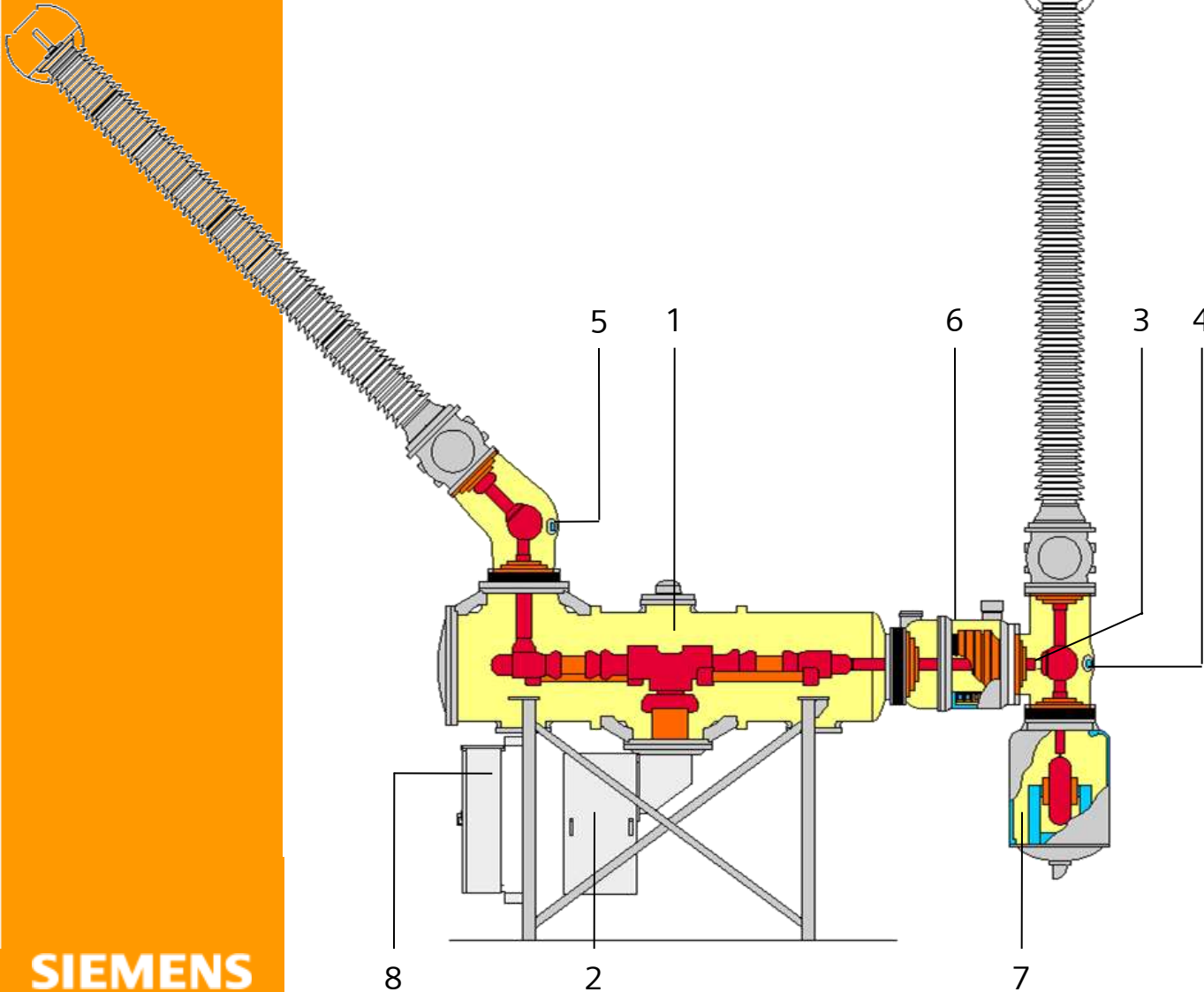


Rated voltage	up to 420 kV
Rated frequency	50/60 Hz
Rated power-frequency withstand voltage (1 min)	up to 740 kV
Rated lightning impulse withstand voltage (1.2/50 μ s)	up to 1800 kV
Rated current	up to 4000 A
Rated breaking current	up to 63 kA
Rated short time current	up to 63 kA
Temperature min.	up to -30 °C
max.	up to +55 °C
Leakage rate per year	\leq 0.5 %

HIS - Highly Integrated Switchgear Type 8DQ1

High Voltage

- 1 Circuit-breaker interrupting unit
- 2 Spring-stored-energy operating mechanism with circuit-breaker control unit
- 3 Outgoing module with disconnecting switch
- 4 Earthing switch
- 5 Earthing switch
- 6 Current transformer
- 7 Voltage transformer
- 8 Transformer terminal box



HIS – Highly Integrated Switchgear, Type 8DQ1

Extension of existing Air-Insulated Substation

High Voltage



Project Ostiglia Power Plant, Italy

Customer	ENEL Power
Arrangement	3 bays in-/out
Voltage	420 kV
Breaking current	50 kA
Rated current	3150 A
Ordered	2002

HIS – Highly Integrated Switchgear, Type 8DQ1

Extension of existing Air-Insulated Substation

High Voltage



Project Sermide, Italy

Customer	ENEL Power
Arrangement	5 bays in-/out
Voltage	420 kV
Breaking current	50 kA
Rated current	2000 A
Ordered	2002