

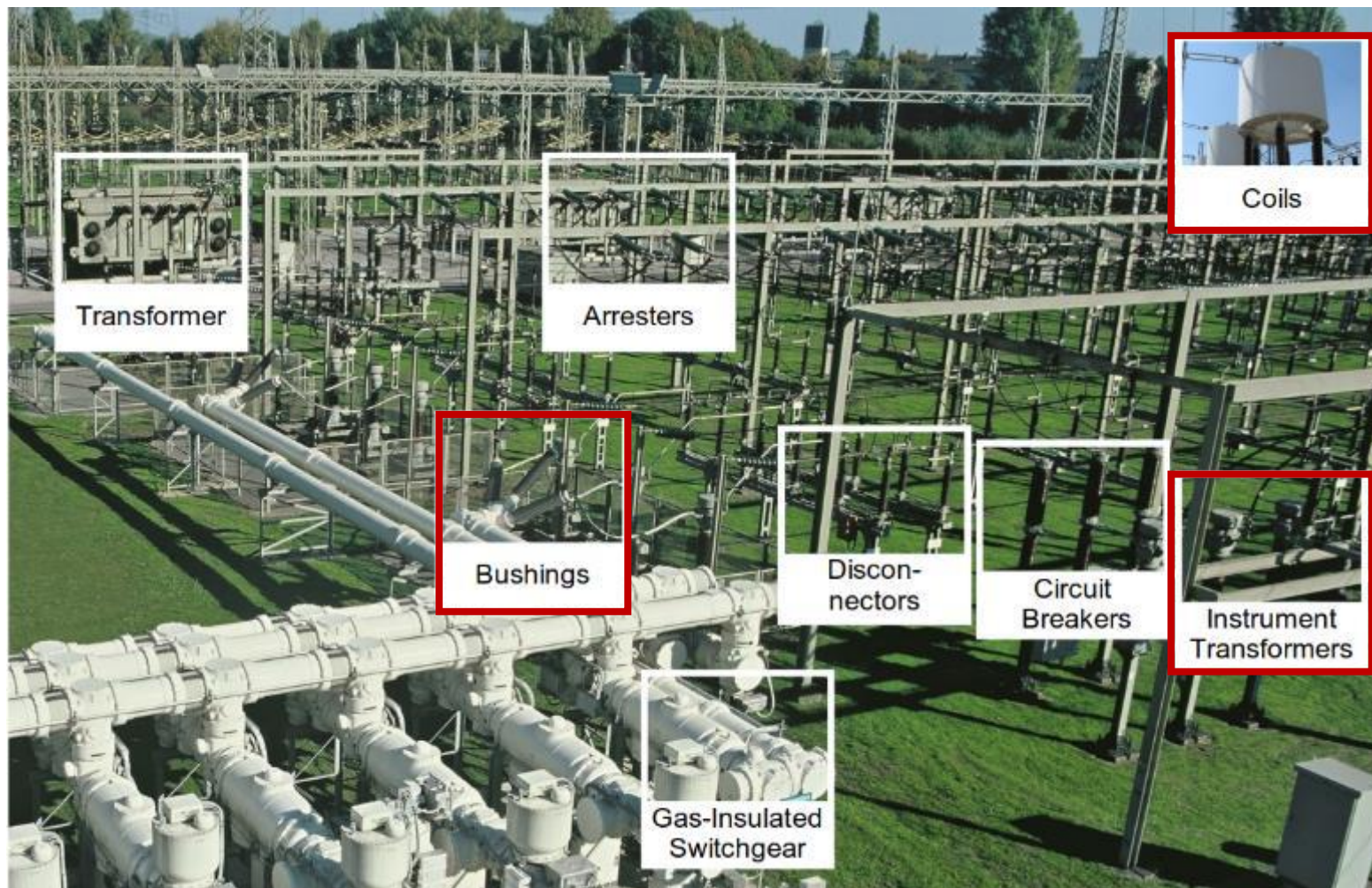
Trench and HSP Group



Bushings, Instrument
transformers and Coils



Trench and HSP - Part of the Siemens Transmission product business



Three recognized brands



TRENCH



SIEMENS

Trench and HSP are 100% Siemens owned

Trench and HSP Product Portfolio



Bushings



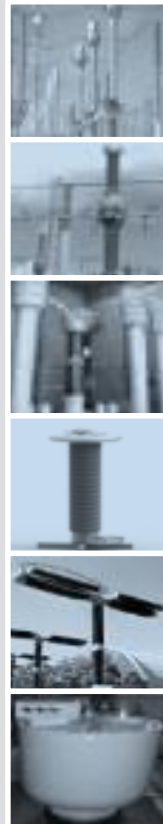
Transformer
Bushings

HVDC
Bushings

Generator
Bushings

Wall
Bushings

Instrument Transformers



Current Transformers
(Oil, SF6)

Inductive Voltage Tr.
Capacitor Voltage Tr.

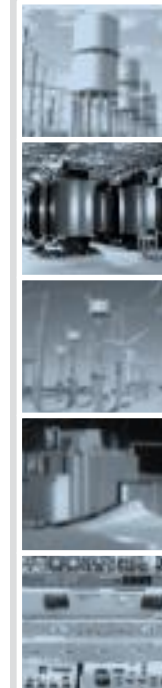
Combined Instrument
Transformers (Oil, SF6)

Non-conventional
Instrument Transformers

Special Capacitors

GIS
Instrument Transformers

Coils



Dry Type Air Core
Reactors

Special Reactors

Line Traps

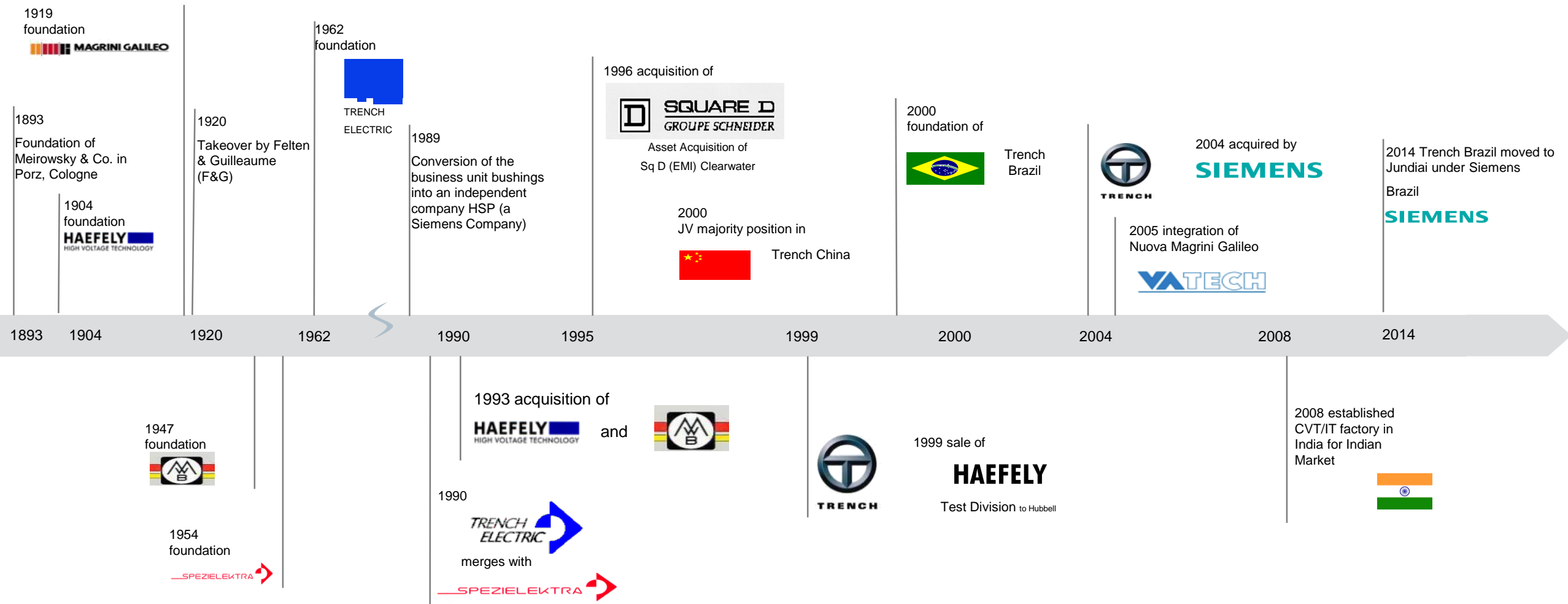
Earth Fault Protection
Systems

Power Line Carrier
Terminals

Trench and HSP Global Manufacturing Network



Trench and HSP Our History



Bushings



Overview

Bushings Products Portfolio and footprint



Transformer bushings



- Connected to oil-insulated power transformers
- Operate with different environmental media: outdoors, cable junction box-oil and gas insulated substations
- Condenser grading and a choice of active part insulation:
 - **OIP** Oil Impregnated Paper
 - **RIP** Resin Impregnated Paper
 - **RIS** Resin Impregnated Synthetics

Insulation	Rated voltage	Current
OIP	up to 1100 kV	up to 5000 A
RIP	up to 1200 kV	up to 6000 A
RIS	up to 245 kV	up to 2000 A

Wall Bushings



- Wall bushings are designed to lead the electrical current through walls.
 - **OIP** Oil Impregnated Paper
 - **RIP** Resin Impregnated Paper

Generator, high current and GIS Bushings



HSP, Germany (RIP/RIS)

- City, Country Troisdorf, Germany
1893 founded
2007 new factory
2018 extension



Trench France (OIP)

- City, Country Saint-Louis, France
1929 founded



THVS, China (OIP and RIP/RIS)

- City, Country Shenyang, China
1995 founded

Bushings Portfolio



Transformer OIP

- 24 kV - 1100 kV



Transformer RIP

- 24 kV – 1200 kV



Wall

- 24 kV - 1000 kV



Generator & High Current

- up to 45,000 A



Gas Insulated Switchgear

- 125 kV - 1100 kV



Instrument transformers



Overview



Instrument Transformers Product Portfolio



Current Transformers

Current Transformers (CT) are used for current metering and protection in high voltage network systems. They transform the high current on the high voltage side into low current (1 or 5 A) adequate to be processed in measuring and protection instruments (secondary equipment, such as relays and recorders). A current transformer also isolates the measuring instruments from the high voltage of the monitored circuit. Current transformers are commonly used for metering and protection in the electrical power industry



Voltage Transformers

Voltage Transformers (VT) – inductive or capacitive – are used for voltage metering and protection in high voltage network systems. They transform the high voltage into low voltage adequate to be processed in measuring and protection instruments secondary equipment, such as relays and recorders. A VT isolates the measuring instruments from the high voltage of the monitored circuit. Voltage Transformer are commonly used for metering and protection in the electrical power industry.



Combined Current and Voltage Transformers

Combined Current and Voltage Transformers contain both, a VT and CT in one unit saving a lot of space. Combined Transformers, just as the individual units, have the main functions as described above for the CT and the VT. Combined Instrument Transformers are commonly used in the electrical power industry when the space at the substation is limited.



Capacitors

Capacitor Products, such as Coupling Capacitors, Energy Storage Capacitors, Transient Recovery Voltage Capacitors or Grading Capacitors are used within HV networks for various purposes. Examples are: coupling high frequency carrier signals to the power line, generating high voltage or currents pulses, as well as (in combination with CB) reducing transient over voltages, ensuring uniform voltage distribution or increasing the switching capacity of a breaker.

Trench Germany

- City, Country Bamberg, Germany
- Founded 1946



Trench Italy

- City, Country Cairo Montenotte, IT
- Founded 1919



Trench High-Voltage Shenyang

- City, Country Shenyang, China
- Founded 1995



Trench Canada IN

- City, Country Toronto, Canada
- Founded 1972



Siemens India

Instrument Transformers Product Portfolio



Current Transformers - AIS & GIS

- Oil insulated
(72,5 kV to 550 kV)
- SF₆ insulated
(72,5 kV to 800 kV)
- Low Power CTs
- SF₆ insulated
Switchgear (GIS)
(72,5 kV to 800 kV)



Voltage Transformers - AIS & GIS

- Inductive
- Oil insulated (72,5 kV to 550 kV)
- SF₆ insulated
(72,5 kV to 800 kV)
- SF₆ insulated Switchgear
(GIS) (72,5 kV to 800 kV)
- Capacitive VT (CVT)
(46 kV to 1200 kV)
- Low Power VTs



Examples for special products

GIS
CTs and VTs
(72,5 kV to 800 kV)



Test equipment
for High-Voltage
Labs and on
site testing



Non-
conventional
instrument
transformers



Combined Transformers - AIS

- Oil insulated
(72,5 kV to 145 kV)
- SF₆ insulated
(72,5 kV to 420 kV)



Capacitors

- Coupling Capacitors
(10 kV to 800 kV)
- Grading Capacitors
- Storage Capacitors
- RC-Dividers (AIS & GIS)
(10 kV to 800 kV)



Coils



Overview



TRENCH



Coil Products Product Portfolio and footprint



Dry Type Air Core Reactors



Reactors improve the overall efficiency of transmission and distribution systems through reduction of losses and fault current levels improving reliability and increasing transmission capacity.

Applications are Current Limiting, Capacitor Reactors and Harmonic Filter Reactors, as well as Shunt Reactors providing reactive Power compensation, Power Flow Control Series Reactors and HVDC Smoothing Reactors utilized in an HVDC.

Line Traps



Line Traps form part of the Power Line Carrier communication scheme. It's function is to present a high impedance at the carrier frequency band while introducing negligible impedance at the power frequency.

Special Reactors and Earth Fault Protection System



Trench offers a far range of Special Reactors, such as Dry Type Iron Core Reactors, Variable Oil-Immersed Shunt Reactors or Earth Fault Protection Systems (Arc Suppression Coils).

Arc Suppression Coils are intended to compensate single-phase to ground faults. This way they enable to continue with the power supply of the other two phases even during a ground fault.



Trench Canada

- City, Country Toronto, Canada
- Founded 1962, 2009 expansion



Trench Austria

- City, Country Linz-Leonding, Austria
- Founded 1954



Trench Brazil

- City, Country Jundiaí, Brazil
- Founded Founded in 2000 in Contagem and moved to Jundiaí in 2014

Dry Type Air Core Reactors Portfolio



Voltages:

600 V to 1000 kV (Series) 600 V to 345 kV (Shunt)

Power:

5 kVAr to 600 MVar (60 Hz Equivalent)

Inductance:

0.01 mH to 10 H

Current:

up to 75 kA_{RMS}
up to 320 kA_{peak}

Note:

Modern Dry Type Air Core Reactors are Custom Designed to the application. There are no "standard" ratings.

HVDC Reactors

HVDC Smoothing Reactors
up to 800 kV,
600 MVar
(incl. seismic design)



Current Limiting & Power Flow Control Reactors

for Transmission Systems

up to 765 kV



Shunt Reactors

up to 345 kV,
up to 100 MVar/phase



Thyristor Controlled Shunt Reactors

up to 100 MVar / phase



Electric Arc Furnace Reactors

up to 4000 A



Current Limiting Reactors

for Distribution Systems



Filter Reactors



Capacitor (Damping) Reactors



Test Reactors

built according to specific customer's requirements



Line Traps



Line Traps and Power Line Carrier (PLC)

- Line traps are inserted into high voltage AC transmission lines to prevent undue loss of carrier signal power (40 kHz to 500 kHz) under all power system conditions.
- Line Traps for Power Line Carrier (PLC) communication systems represent a significant application segment for high voltage inductors.
- Power Line Carrier (PLC) is a common method of Power System Communication, such as teleprotection, voice and data communication. It has developed the reputation of being one of the most economical and reliable forms of communication and versatile in its application.

Main function

- The main function of the Line Trap is to present a high impedance at the carrier frequency band while introducing insignificant impedance at the power frequency. The high impedance limits the attenuation of the carrier signal within the power system by preventing the carrier signal from being:
 - Dissipated in the substation
 - Grounded in the event of a fault outside the carrier transmission path and
 - Dissipated outside of the main transmission path

Special Reactors and Earth Fault Protection System



Dry Type Iron Core Reactors

- Trench offers special reactors incorporating iron cored reactors with air natural, air forced or water cooling.
- The application for such iron cored reactors may range from smoothing reactors, shunt reactors, energy storage reactors, to name just a few.

Variable Shunt Reactors

- VSR are used for applications requiring a wide reactive power range with a non-dynamic regulation (e.g. wind farms)
- Functions which may be achieved by VSRs:
 - Maintain steady-state voltage limit conditions
 - Keep reactive power flow within predefined limits
 - Maintain a desired power factor

Earth Fault Protection System

- Trench offers equipment (Arc Suppression Coil) and services for high impedance (resonant or compensated) systems.
- This type of grounding is mainly used in Central Europe, Eastern Europe and Scandinavia, but due to a variety of technical advantages over other solutions, the resonant grounding is considered as future solution also in other countries.

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