Excellence in Instrument Transformers
The Trench Group is well represented throughout the world with manufacturing plants in North America, South America, Europe and Asia having a combined expertise of more than 170 years. A worldwide sales network ensures efficient, knowledgeable communications with our customers.

TRENCH: A specialized manufacturer of high voltage electrical equipment dedicated to serving the electrical industry world-wide through engineering, service and commitment. Many reasons exist to explain why power companies, research institutes and electrical engineering companies in many nations rely on superior technologies of Trench. Our product line is based on in-depth competence in development and manufacturing. A highly significant fact in this concept is the independence of Trench in all of its key core competencies including: insulation, windings, capacitors, electronics and systems engineering technologies. We develop and master these key technologies in-house, which provides a significant quality factor and increases our ability to solve customer problems.
In instrument transformers, the expertise, experience and technology of each of the three forming companies has been brought together and focused on technology specialists acting as a team for the global market:

- the former Trench Electric focusing on capacitive products
- the former Haefely specializing in oil-insulated inductive instrument transformers
- the former MWB focusing on SF₆-insulated inductive instrument transformers.

Throughout the Trench Group, excellence is built on a foundation of:

- in-depth technical knowledge and experienced people
- close business and technical relationships built with our customers over many years
- global service
- strong innovation and quality assurance demands
- widely supported technology base.

Our collective product scope comprises instrument transformers for metering, protection and control on HV and EHV systems:

- Current Transformers
- Voltage Transformers
- Combined Instrument Transformers

All of these products are characterized by high quality standards, superior technical features and a first class price/performance relationship. Competent customer service is available worldwide.

Our customers have highest requirements regarding:

- life expectancy
- reliability
- operational security.

Our policies of design conservatism and quality assurance are a direct result of our commitment to meet or exceed these requirements.

In our day-to-day business we endeavor to always focus on the needs of our customers. We treat our customers with fairness and respect and our target is long-term partnership.

Quality remains paramount for Trench. All products are manufactured with compliance to international Quality Standard ISO 9001.
Instrument Transformer Technology

Metering, Protection and Control

Electrical instrument transformers transform high currents and voltages to standardized low and easily measurable values which are isolated from the high voltage.

When used for metering purposes, instrument transformers provide voltage or current signals which are very accurate representations of their transmission line values in both magnitude and phase. These signals allow accurate determination of revenue billing.

When used for protection purposes, the instrument transformer outputs must accurately represent their transmission line values during both steady-state and transient conditions. These critical signals provide the basis for circuit breaker operation under fault conditions and as such are fundamental to network reliability and security.

Instrument transformers used for network control supply important information as to the state of the operating conditions of the network.

For the above applications, the Trench Group supplies:

Current Transformers
72.5 kV through 800 kV and primary currents to 5000 A.

Inductive and Capacitive Voltage Transformers
72.5 kV through 800 kV.

Combined Instrument Transformers 72.5 kV through 800 kV and rated primary currents up to 4000 A.

Highest Metering Accuracy Requirements Verified by:
• CCAC in Canada
• National Grid Company in England
• EdF in France
• PTB in Germany
• SEV in Switzerland

Highest Protection Performance Requirements:

In addition to both IEC and ANSI standard protection cores, inductive current transformers can be provided with TPS, TPX, TPY and TPZ cores in accordance with IEC standards, and Class X cores in accordance with British standards.

The requirements of many other national standards are also fully satisfied on request.
Reliability and Security

Reliability of an instrument transformer refers to its ability to consistently satisfy prescribed performance criteria over its expected useful lifetime under specified operating conditions.

Security, refers to the acceptability and consequences of the instrument transformer failure mode in the event that it does fail, due either to reaching the end of its expected service life or a result of being subjected to stresses in excess of those for which it was designed.

The reliability and security characteristics of an instrument transformer are governed by the electrical and insulation design, the manufacturing and processing technology used and the specific physical arrangement.

The partial discharge performance under in-service conditions is a key determining factor in the life expectancy and long-term reliability of an instrument transformer.

IEC Standards require a P.D. value of less than 10 pC at $1.23U_{\text{max}}$.

Due to the demanding requirements of today’s HV and EHV networks, the Trench Group has elected to adopt even more stringent internal requirements.

As such, Trench instrument transformers typically perform much better than required by these standards.
The reliability and security of Trench oil-insulated instrument transformers is based on the following features:

- in-service experience spanning up to 50 year
- in the event of internal insulation failure, a secure failure mode is achieved through:

**For Inductive Type**

The formation of fibre bridges in the free oil between high voltage and ground electrodes is a known potential failure mode of instrument transformers. In the Trench design this failure mode is eliminated through the use of a «barrier construction» design in the free oil section. This approach consists of inserting insulating barriers at strategic points through the free oil space, thereby preventing the formation of fibre bridges.

The behaviour of the instrument transformer in the case of overvoltage, e.g. being struck by lightning: A rupture of the housing, in particular of the hollow insulator with built-in finely graded capacitor bushing is improbable because of the overdimensioning of the bushing and the solid electrical connection between the core housing and the ground.

Should arcing occur, due to damaged insulation, the best protection against severe pressure build-up is guaranteed by the:

- very thin welded elastic housing
- metal bellows for the oil expansion

Both the welded seam, which connects the upper and lower portions of the head housing, and the metallic bellows are designed to act as pressure relief points in the event of severe internal pressure buildup.

Since the unit has a normal internal oil pressure of approximately 1 bar absolute, it is possible to design these pressure relief points to rupture at very moderate pressures.

For the ultimate in security inductive type oil-insulated instrument transformers can be equipped with a special additional monitoring systems:

**Gas Detection System GDS**

The gas detection system GDS monitors the amount of gas collected at a specific collection tank located in the head of the unit.

**For CVT's**

Pressure relief is provided by a bellows puncture pin and through the use of porcelain which is sufficiently strong as to result in any rapid pressure rise being released through the seal plates at the ends of the porcelain rather than via explosion of the porcelain itself.

Upon request oil-immersed instrument transformers can also be supplied with composite insulators.
The reliability and security of Trench gas-insulated instrument transformers is based on:

- 50 years experience as a manufacturer of instrument transformers covering epoxy-resin, oil-paper and finally gas-insulated units
- more than 10,000 gas-insulated instrument transformers in service under most different environmental conditions
- an explosion-proof design providing maximum safety due to the combination of SF6-gas with a composite insulator

**Most reliable Insulation Properties**

SF6-gas is the main insulation medium between high voltage and ground potential. This gas, due to its excellent features, is a must for all GIS manufacturers of high voltage equipment.

A stable quality can be guaranteed by the use of SF6-gas acc. to ANSI/DIN and the fact that this inert gas shows no ageing even under the highest electrical and thermal stresses. The insulation properties remain unchanged throughout its lifetime.

**Explosion-proof Design**

The present Trench gas-insulated instrument transformers are the result of the development of an explosion-proof design, which many customers asked for. Gas-insulation is particularly suitable for this, as, in the event of an internal flashover, the pressure increase will be linear and hence technically manageable.

A controlled pressure relief device at the head of the transformer (rupture disc) eliminates unacceptable mechanical stresses in the housing; i.e. only the rupture disc is released, gas escapes, but the complete transformer remains intact – no explosion occurs.

All the above features guarantee an operation period over many years without any control of the insulation condition.

**Full functional Security and Monitoring**

The guaranteed SF6-leakage rate is less than 1% per year.

The gas pressure can be checked at site or by means of a remote control device, i.e. a densimeter with contacts for remote control. In the case of loss of SF6-pressure, the transformer still operates at rated pressure.

**Environmentally beneficial under most severe conditions**

SF6-gas is physiologically absolutely safe. It bears no ecologically toxic potential and its decomposition products have no endangering effects on the environment, e.g. ground water pollution.

This SF6-gas insulation medium allows an easy waste management of the transformers.

Furthermore the hydrophobic features of the composite insulator result in a problem-free service even under salt-fog or polluted conditions.
Current Transformers
Oil-immersed Type

Features

• Head type design of low weight and minimum oil volume

• excellent seismic performance as a consequence of the optimized design of flanges, porcelain and their interconnection

• short, symmetrically arranged low reactance bar-type primary conductor permits higher short circuit currents and avoids large voltage drop across the primary winding

• excellent control of internal and external insulation stresses through the use of a proprietary finely graded bushing system

• hermetically sealed by stainless steel metallic bellows

• uniformly distributed secondary windings guarantee accurate transformation at both rated and high currents

• essentially unaffected by stray external magnetic fields

• stable accuracy over a long period of time

• exclusive use of corrosion resistant materials

• Composite insulators available on request

• 1:1 A current ratio possible.
Current Transformer Gas-insulated

Features

• head type design
• explosion-proof design by the compressible insulation medium SF₆-gas and rupture disc
• excellent seismic performance due to the properties of the composite insulator
• available for the full voltage range 72.5 kV up to 800 kV and full current range 100 A up to 4800 A
• low reactance bar type primary providing optimal short-circuit performance
• optimum field grading is accomplished by a fine condenser grading system especially developed for this application
• multiple-turn primaries for small primary currents
• uniformly distributed secondary windings guarantee accurate transformation at both rated and high currents
• stable accuracy over a long period of time
• perfect transient performance
• exclusive use of corrosion resistant materials
• core changes after assembly do not require the destruction of the high voltage insulation
Inductive Voltage Transformer
Oil-immersed

Features

• Low weight and minimum oil volume
• excellent seismic performance as a consequence of optimized designs of flanges, porcelain and their interconnection
• excellent control of internal and external insulation stresses through the use of a proprietary finely graded bushing system
• essentially unaffected by stray external magnetic fields
• hermetically sealed stainless steel metallic bellows for units rated 123 kV and above
• stable accuracy over a long period of time
• perfect transient performance
• suitable for line discharging
• exclusive use of corrosion-resistant materials.
• Composite insulator available on request
Voltage Transformer
Gas-insulated

Features

• explosion-proof design by the compressible insulation medium SF6-gas and rupture disc

• excellent seismic performance due to the properties of the composite insulator

• available for the full voltage range 72.5 kV up to 800 kV

• optimum field grading is accomplished by a fine condenser grading system especially developed for this application

• wide range ferroresonance free design without the use of an external damping device (please ask for details)

• essentially unaffected by external stray magnetic fields

• stable accuracy over a long period of time

• suitable for line-discharging

• optimized high voltage coil assures identical electric stresses under both transient and steady state conditions

• exclusive use of corrosion-resistant materials
Features

- Capable of carrier coupling PLC signals to the network
- Optimized insulation system design utilizing state-of-the-art processing techniques with either mineral oil or synthetic insulating fluids
- Stability of capacitance and accuracy over a long period of time due to superior clamping system design
- Oil expansion by way of hermetically sealed stainless steel bellows assures the integrity of the insulation system over time
- Bellows puncture pin provides for release of internal pressure in the event of severe service conditions leading to internal discharges
- Extra high strength porcelains provide both superior seismic performance and the ability to mount large line traps directly on the CVT with corresponding savings in installed cost
- Maintenance-free oil filled cast aluminum basebox
- Superior transient response characteristics
- Internal company routine test and quality requirements exceed those of international standards with impulse tests and partial discharge test being performed on a routine basis
- Not subject to ferroresonance oscillations with the network or breaker capacitor
- High capacitance CVT’s, when installed in close proximity to EHV circuit breakers, can provide enhanced circuit breaker short line fault/TRV performance.
The Trench Group offers special voltage transformers for HVDC systems.

These units are primarily used to control the HV valves of the rectifiers or inverse rectifiers.

The measuring system consists of an RC voltage divider which provides inputs to a specially designed electronic power amplifier.

The High Voltage Divider can be supplied either for outdoor operation or for installation into SF6 gas-insulated switchgear (GIS).

The resulting system can accurately transform voltages within a defined burden range with linear frequency response up to approximately 10 kHz.

As such, the system is ideal for measurement for dynamic and transient phenomena and harmonics associated with HVDC systems.
Combined Instrument Transformer
Oil-immersed

Features
• Low weight and minimum oil volume
• Short symmetrically arranged low reactance bar-type primary conductor permits higher short circuit currents and avoids large voltage drop across primary winding
• Excellent control of internal and external insulation stresses through the use of a proprietary finely graded bushing system
• Excellent seismic capability as a consequence of optimized design of flanges, porcelain and their interconnection
• Hermetically sealed by stainless steel metallic bellows
• Only one foundation required in the switchyard as a consequence of combining the voltage and current sensing functions in one transformer
• Uniformly distributed secondary windings guarantee accurate transformation at both rated and high current
• Essentially unaffected by stray external magnetic fields
• Stable accuracy over a long period of time
• Perfect transient performance
• Suitable for line discharging
• Exclusive use of corrosion-resistant materials.
• Composite insulators available on request
Features

- Head type design with voltage transformer section located on top of the current transformer
- Low weight and compact SF₆-design
- Explosion-proof design by the compressible insulation medium SF₆-gas and rupture disc
- Excellent seismic performance due to the properties of the composite insulator
- The single-section high voltage coil (not cascaded) of the voltage transformer section enables a product range for combined instrument transformers up to 800 kV
- Optimum field grading is accomplished by a fine condenser grading system especially developed for this application
- Wide range ferroresonance free design without the use of an external damping device (please ask for details)
- Low reactance type primary conductor allows for high short-circuit currents and covers all core standards
- Less foundation space required compared to the use of individual current transformers and voltage transformers
- Suitable for line-discharging
- Essentially unaffected by external stray magnetic fields
- Exclusive use of corrosion-resistant materials
Instrument Transformer
for GIS Switchgear

Inductive Type
• in addition to the measurement of the voltages and currents best discharge capabilities for HV-lines
• custom-designed instrument transformers for each specific application and extended function designs comply with dimensional restrictions, flange sizes and insulator requirements
• standard designs for single- and three-phase units
• meets all national and international standards with regard to pressure vessel codes
• prevention of occurrence of stable ferroresonances by integrated ferroresonance suppression
• shielded against transient overvoltages in accordance with IEC standards. Special additional shielding is available.

RC Type
• guaranteed SF6-leakage rate of less than 1% per year
• equipped with pressure relief disc and deflection device
• all components are designed and tested for mechanical stress to withstand up to at least 20 g
• accuracy classes in accordance to DIN VDE 0414, IEC 60044, ANSI: IEEE C57.13, AS 1243 (other standards or classes on request)
• shock indicators warning against inadmissible acceleration during transportation

• RC divider for voltage measurements
• conform to microprocessor based secondary technology
• ferroresonance free
• able to sustain voltage test on site
• 1 phase or 3 phase system
• significant size and weight reduction

Voltage transducer 145 kV series RCT (active part) for HV GIS
The low power current and voltage transducers can be used for a wide range of medium and high voltage applications where they replace the conventional measuring transformers for measurement and protection purposes.

- The Voltage Transducers are based on resistive as well as resistive-capacitive dividers
- The Current Transducers are based on an iron core or an air core design and provide a secondary voltage which represents the primary current
- Standard cables and connectors; twisted pair and double shielded cable
- Connection capability for multiple protection and measuring devices
- Metalclad housing ensuring operator safety
- Immune to all methods of on-line switchgear and cable testing
- Current Transducers provide a linear transmission up to short circuit current
- Completely EMC shielded, immune to RFI/EMI

Advantages
- System conforms to low power digital microprocessor based technology for protection and metering
- Simple assembly with compact size and low weight
- No secondary circuit problems; Voltage Transducers are short circuit proof, Current Transducers can have an open secondary
- Voltage Transducers are ferroresonance free
- Environment friendly (no oil)
The Trench Group is your partner of choice for electrical power transmission and distribution solutions today; and for the development of your new technology solutions of tomorrow.

The Trench Group is your partner of choice for electrical power transmission and distribution solutions today; and for the development of your new technology solutions of tomorrow.

www.trenchgroup.com

E 210.10
Subject to change without notice (07.2010)
Printed in Canada.