THE PROVEN POWER.

Trench Italia Instrument Transformers

SF6 Instrument Transformer portfolio

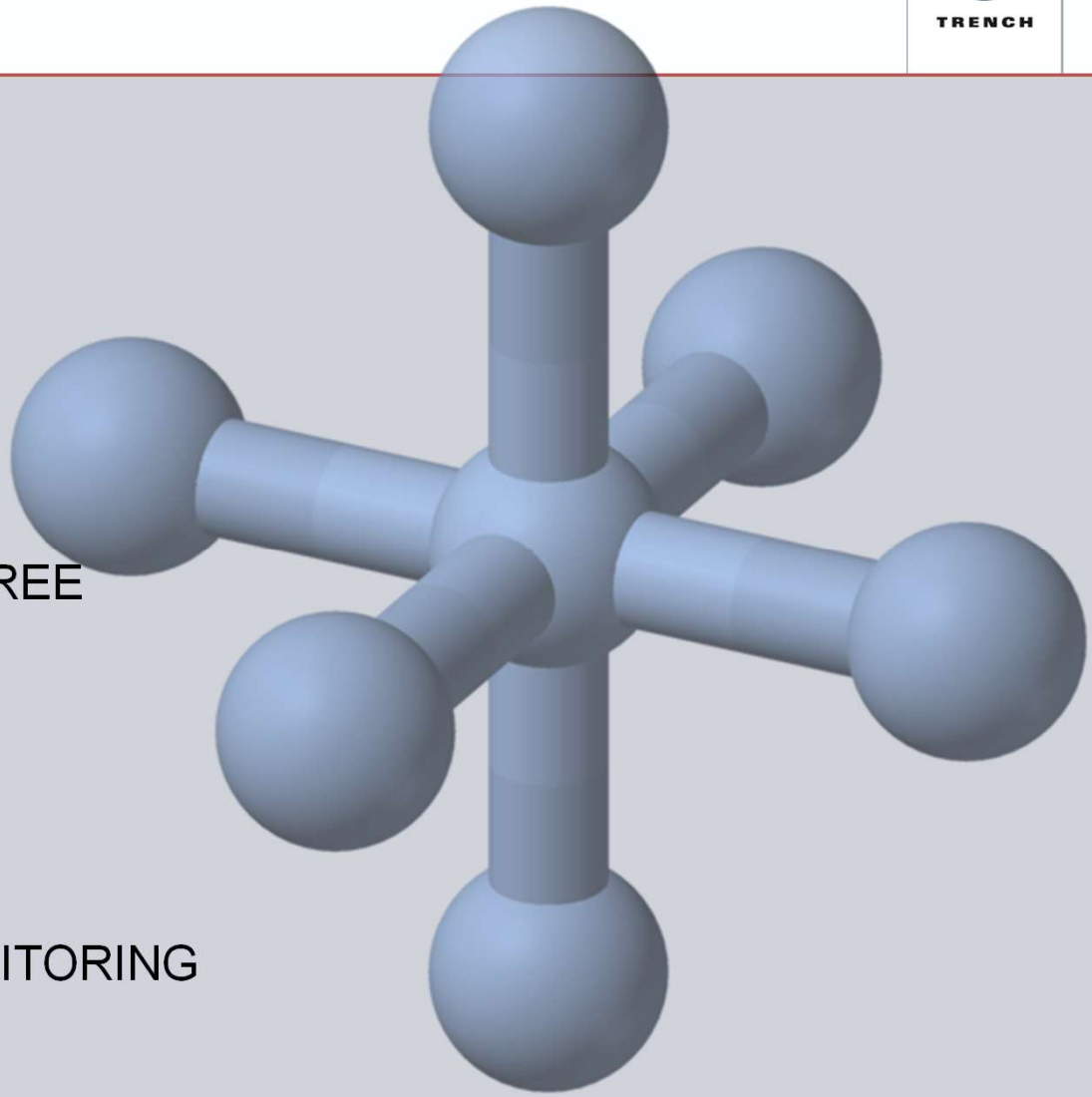
TRENCH®

SF6 Advantages

SF6 Technology

Main advantages

- NO AGEING
- NOT FLAMMABLE
- PARTIAL DISCHARGE FREE
- SLOW PRESSURE RISE
- MAINTENANCE FREE
- REMOTE DENSITY MONITORING



SF6: Trench Italia solutions

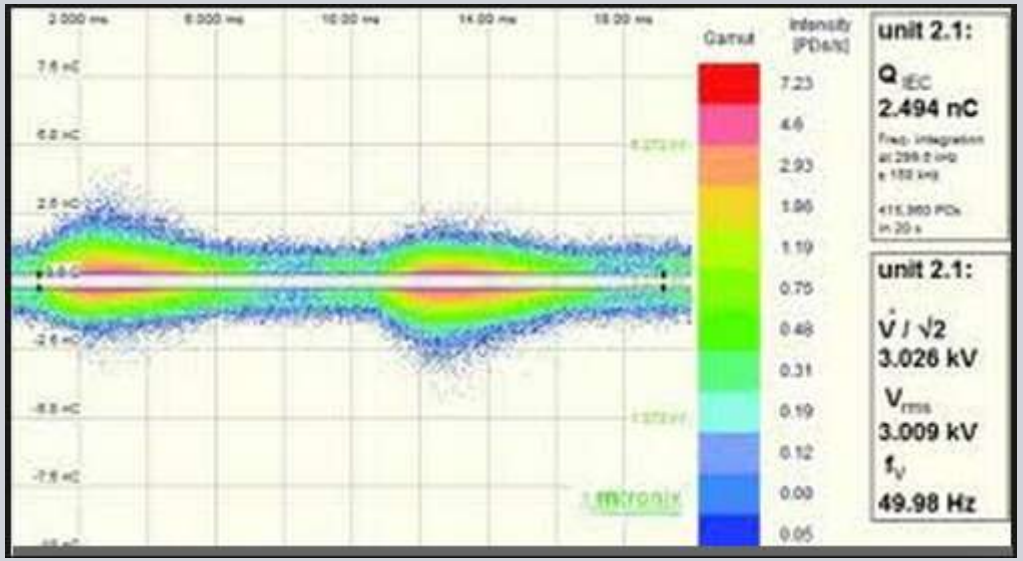
Main features

- **SAFETY** DESIGN
- **EXPLOSION PROOF** DESIGN
- LEAKAGE RATE OF 0,5 OR 0,1 %
- REMOTE CONTROLLING
- WIDE WORKING TEMPERATURE RANGE
- **SEISMIC PROOF** DESIGN
- HIGHLY **CUSTOMIZABLE**
- TYPE TESTED SOLUTION
- **PROVEN TRANSPORTATION** SOLUTIONS
- PRODUCTION TESTED EQUIPMENT

SF6: Partial Discharge free solution!

Partial discharge absence : longer life / reliability

- dominant absence of solid / organic insulating materials
- no materials modifications, no gas bubbles, no surfaces roughness or weakness to alter the electrical gradients
- well-defined geometric outline of all metallic internal components (immersed in the inert gas)
- conservation of the defined electrical gradients
- inert environment (SF6)
- absence of by-products of decomposition, SF6 is used only for its insulating property (no closing or opening the Primary current or electrical arc)



Explosion proof design

EXPLOSION PROOF DESIGN TEST (INTERNAL ARC) according to IEC 61869-1

Class II

Simulated short circuit current: 63 kA 0,5s

Leakage proof design
Level : 0,5 % or 0,1 % per year

- Available technical solution allows very low leakages : less than 0,5 or 0,1 % per year.
- Leakage test is performed on each equipment produced
- Leakage type tests were performed even at high (80 ° C) and low (-50 ° C) temperatures. Tests at -60 ° C are currently on progress.

Installations at very low temperatures are possible!

Available technical solution

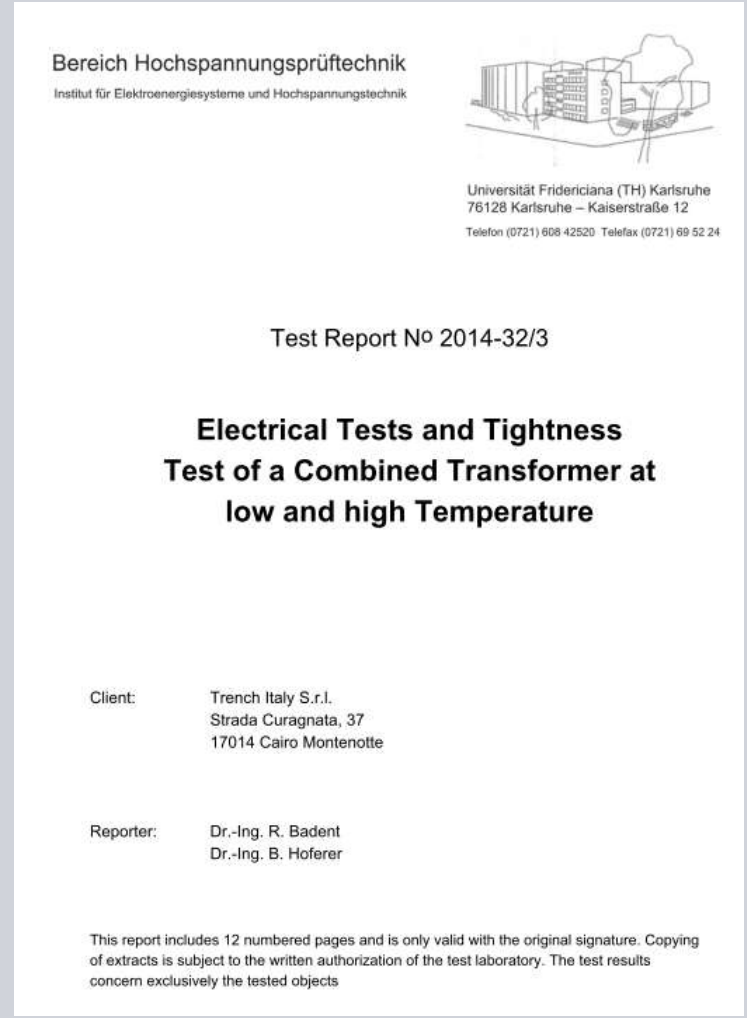
allows to ensure IT performances

even at very low temperatures

Installations at very low temperatures are possible!

- - 60 ° C tests were succesfully perfromed in Karlsruhe Institut für Technologie

2014-47-3-Trench-Temperatur-Kombi-Wandler.pdf



Bereich Hochspannungsprüftechnik
Institut für Elektroenergiesysteme und Hochspannungstechnik

Universität Fridericiana (TH) Karlsruhe
76128 Karlsruhe – Kaiserstraße 12
Telefon (0721) 608 42520 Telefax (0721) 69 52 24

Test Report Nº 2014-32/3

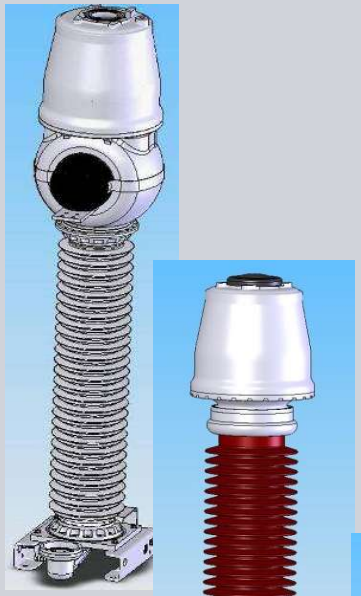
Electrical Tests and Tightness Test of a Combined Transformer at low and high Temperature

Client: Trench Italy S.r.l.
Strada Curagnata, 37
17014 Cairo Montenotte

Reporter: Dr.-Ing. R. Badent
Dr.-Ing. B. Hoferer

This report includes 12 numbered pages and is only valid with the original signature. Copying of extracts is subject to the written authorization of the test laboratory. The test results concern exclusively the tested objects

Low temperature solutions - Pure SF6 or Mixture SF6/N2



DOWN TO -45 ° C → PURE SF6

-50 ° C → PURE SF6 only for 123 kV

-50 ° C → MIXTURE SF6 / N2

-55 ° C → MIXTURE SF6 / N2

-60 ° C → MIXTURE SF6 / N2

Remote Monitoring Design: diagnostic / lower maintenance

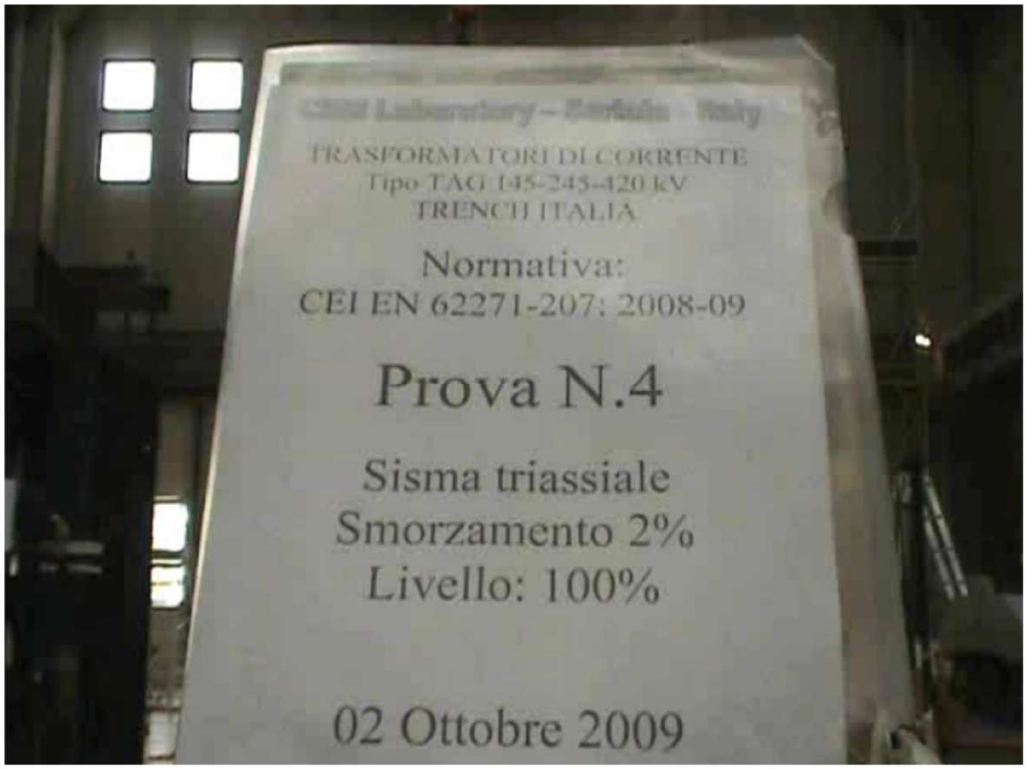
WIKA Germany Densimeter

- Available on each gas insulated transformer
- Continuous remote monitoring of the internal gas density
- Easily readable on site on the densimeter scale
- A temperature compensation is provided
- Remote Monitoring by means of:
  - ✓ by means of electrical contacts (pre calibrated thresholds).
  - ✓ Analogic transducer

Seismic proof Design

- SF6 Instrument transformers are designed to be seismic-resistant at earthquake level of :
  - AF5 or AG5
  - 7 ° Richter
  - IX degrees MSK scale
- Several tests were performed in CESI shaker-table laboratory, with successful results.

CESI



Transportation Tests and proven transportation solutions

- Tested packages against impacts and transportation simulations
- Proven transportation solutions

Beyond The Standard Generale R3.mp4

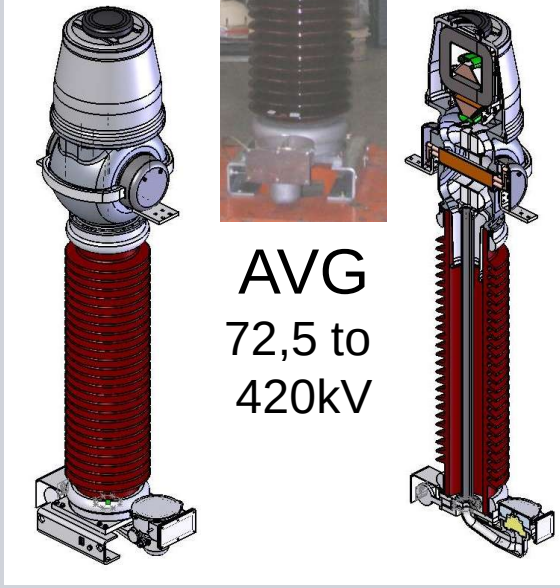
SF6 Instruments Transformer Portfolio

SF6 Instrument Transformers
Trench Italia Portfolio

VOLTAGE TRANSFORMER

TVG
72,5 to
550kV

COMBINED TRANSFORMER



AVG
72,5 to
420kV

CURRENT TRANSFORMER

TAG
72,5 to
550kV

SF6 Instrument Transformers
Trench Italia Portfolio

TVG

Common voltage transformer

Common base and insulator

Ceramic or Polymeric

AVG

Common current transformer

TAG

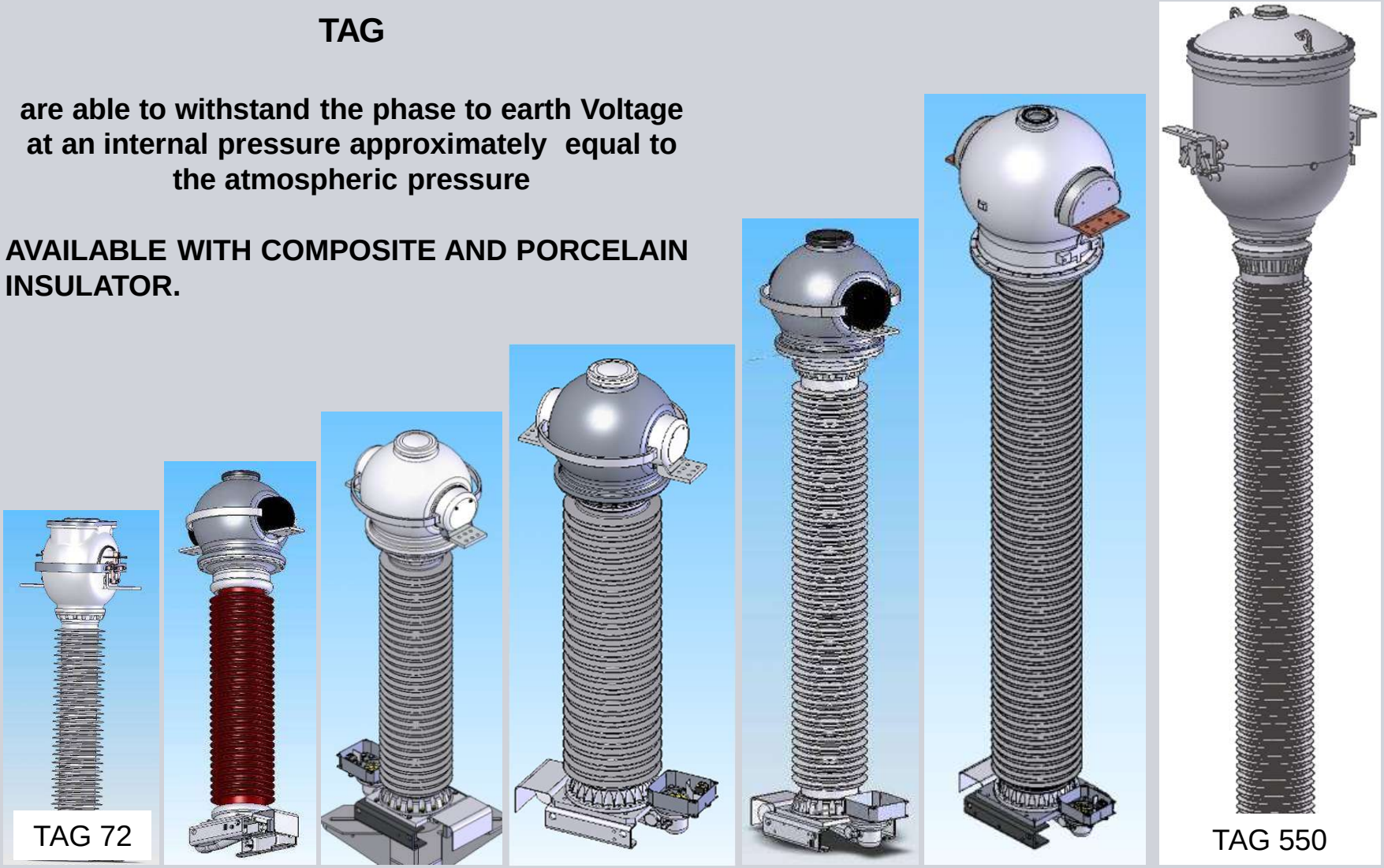
SF6 Current Transformer type TAG

SF6 Instrument Transformers
Trench Italia Portfolio
Current Transformer type TAG 72 - 550

TAG

are able to withstand the phase to earth Voltage at an internal pressure approximately equal to the atmospheric pressure

AVAILABLE WITH COMPOSITE AND PORCELAIN INSULATOR.



SF6 Instrument Transformers
Trench Italia Portfolio – Enhanced reliability project
Current Transformer type TAG

TERNA enhanced reliability project

In consequence of destructive failures of some CTs on the network, some of our customers (driven by Terna, the major Italian network operator) decided to introduce new CTs realized with structural precautions, technologies and solutions to increase the reliability and the safety of existing SF6 insulated ITs.

INTERNAL INSULATION

- 0 bar dielectric strength
- Increased insulation level
- Internal arc test performed as type test on each rated voltage

EXTERNAL INSULATION

- Polymeric insulators, explosion proof solution

GAS TIGHTNESS

- Less than 0.1% per year

Insulation level	145	170	245	420
Power frequency (kV)	325	360	510	680
BIL (kV)	750	850	1150	1550

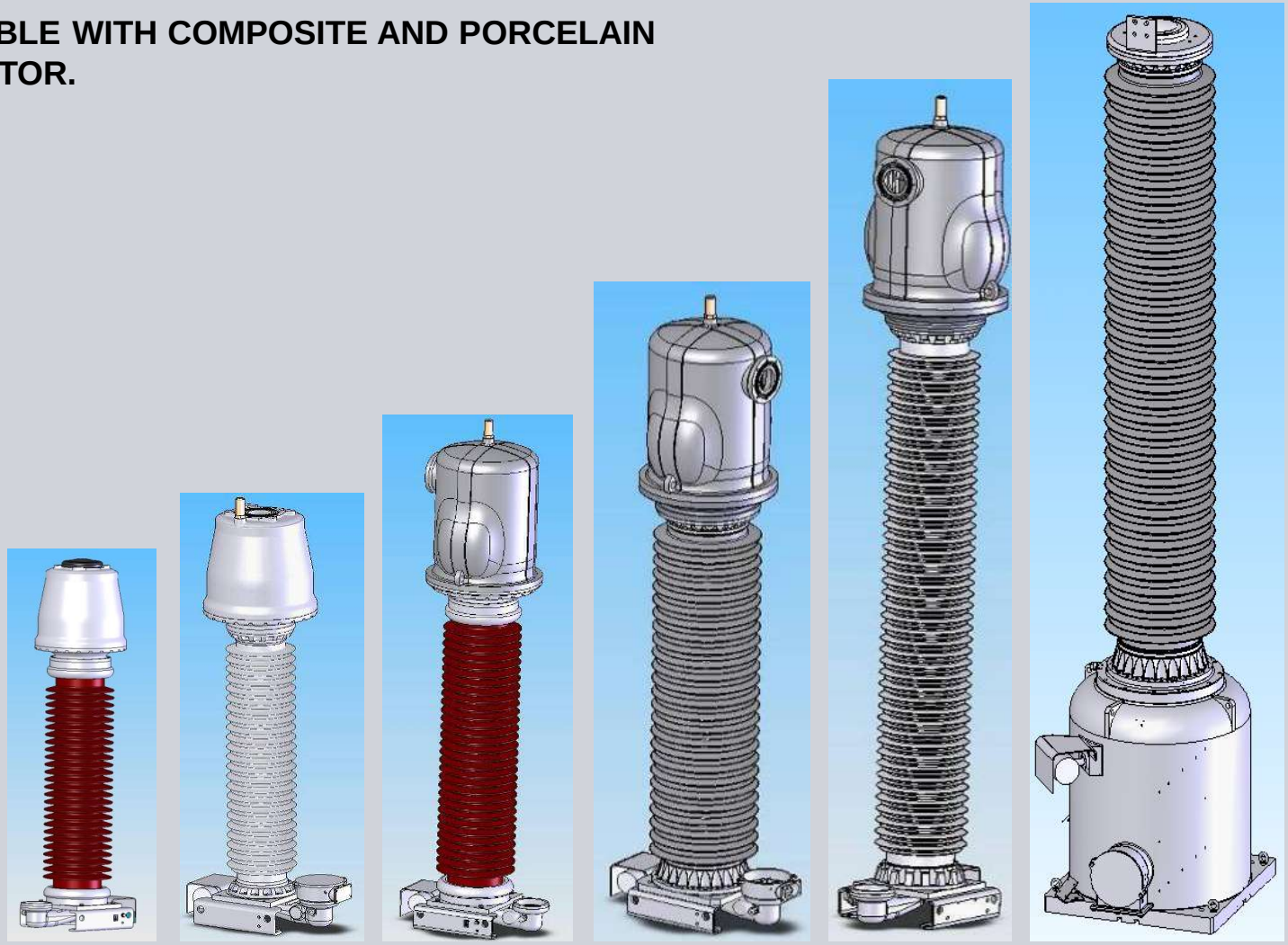
OPERATION CONDITIONS

- Current overloading (150%)
- Special service conditions (+ 55 ° C environment)
- Extra high mechanical load resistance

SF6 Voltage Transformer type TVG

SF6 Instrument Transformers
Trench Italia Portfolio
Voltage Transformer type TVG 72 - 550

AVAILABLE WITH COMPOSITE AND PORCELAIN INSULATOR.



SF6 Combined Current/Voltage Transformer type AVG

SF6 Instrument Transformers
Trench Italia Portfolio
Combined Current/Voltage Transformer Advantages

1 Combined Transformer = 1 CT + 1 VT

Substation space saving + Cost saving:

One set of mounting pads

One support structure

Installation time reduced

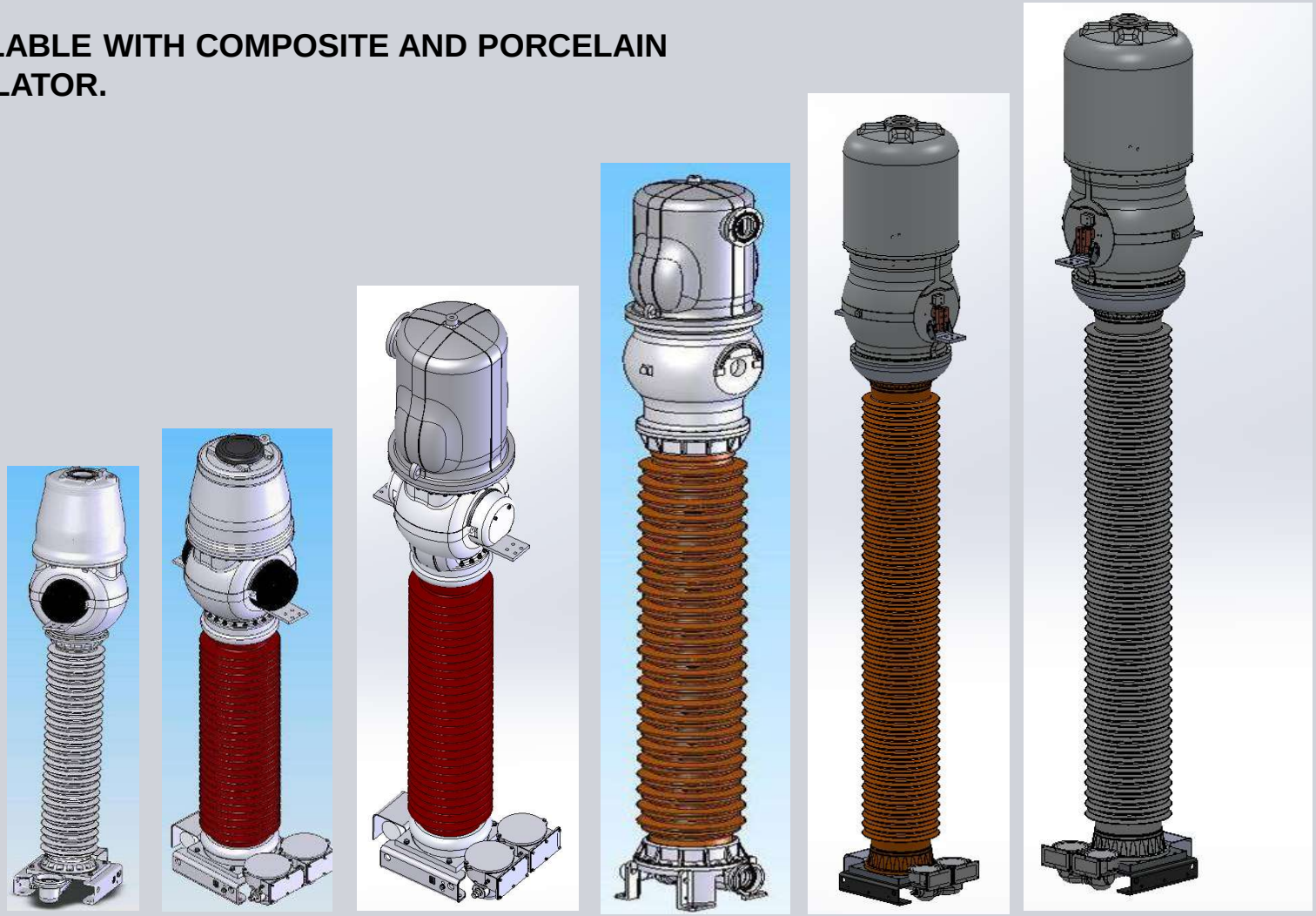
Reduced transportation freights

Reduced maintenance costs during lifetime

Other technical advantages (SF6 technology) and considerations (Head size, Burden, etc.) are the same of Current and Voltage Transformers

SF6 Instrument Transformers
Trench Italia Portfolio
Combined Current/Voltage Transformer type AVG 72-420

AVAILABLE WITH COMPOSITE AND PORCELAIN INSULATOR.



SF6 Instrument Transformers
Trench Italia Portfolio
Main references

Europe

UK	NGC, Scottish Power
Iceland	Landsnet
Poland	PSE, Tauron, PGE, KWK Energa
The Netherlands	TenneT
Bulgaria	NEK
France	EDF, RTE
Norvegia	Statkraft
Romania	Transelectrica, ENEL, Electrica
Russia	Several Utilities
Ukraine	Ukrenergo + other Utilities
Switzerland	ATEL, Ofima, BKW, AET, KWO, Repower
Czech Rep	CEPS, CEZ
Slovakia	Transpetrol, ZSR
Hungary	Mavir, MOL
Latvia	LET
Spain	GNUF, Enel Pro, REE
Turkmenistan	CALIK ENERJI SANAYI
Kazakhstan	KEGOC
Estonia	Elering
Belarus	MinskEnergo
Italy	TERNA, ENEL, Edison, RFI, other utilities
Montenegro	EPCG
Turkey	Several Utilities

America

Brazil	Furnas,CTEEP, Eletrononorte, Elettrosul
Argentina	Transener
Venezuela	Cadafe, Edelca
Paraguay Ande	
Perù	REP
Colombia EPM	
United States	Reliant Energy
Chile	TERNA Plus
Rep. Dominicana	ETED

Middle East

Pakistan	WAPDA
Jordan	NEPCO
Iraq	MoE
Saudi Arabia	SEC
Yemen	PEC

In service since 1990

Far East

Thailand	EGAT
Vietnam	EVN
Indonesia	PLN
China	China Electric Power
Philippines	NGPC

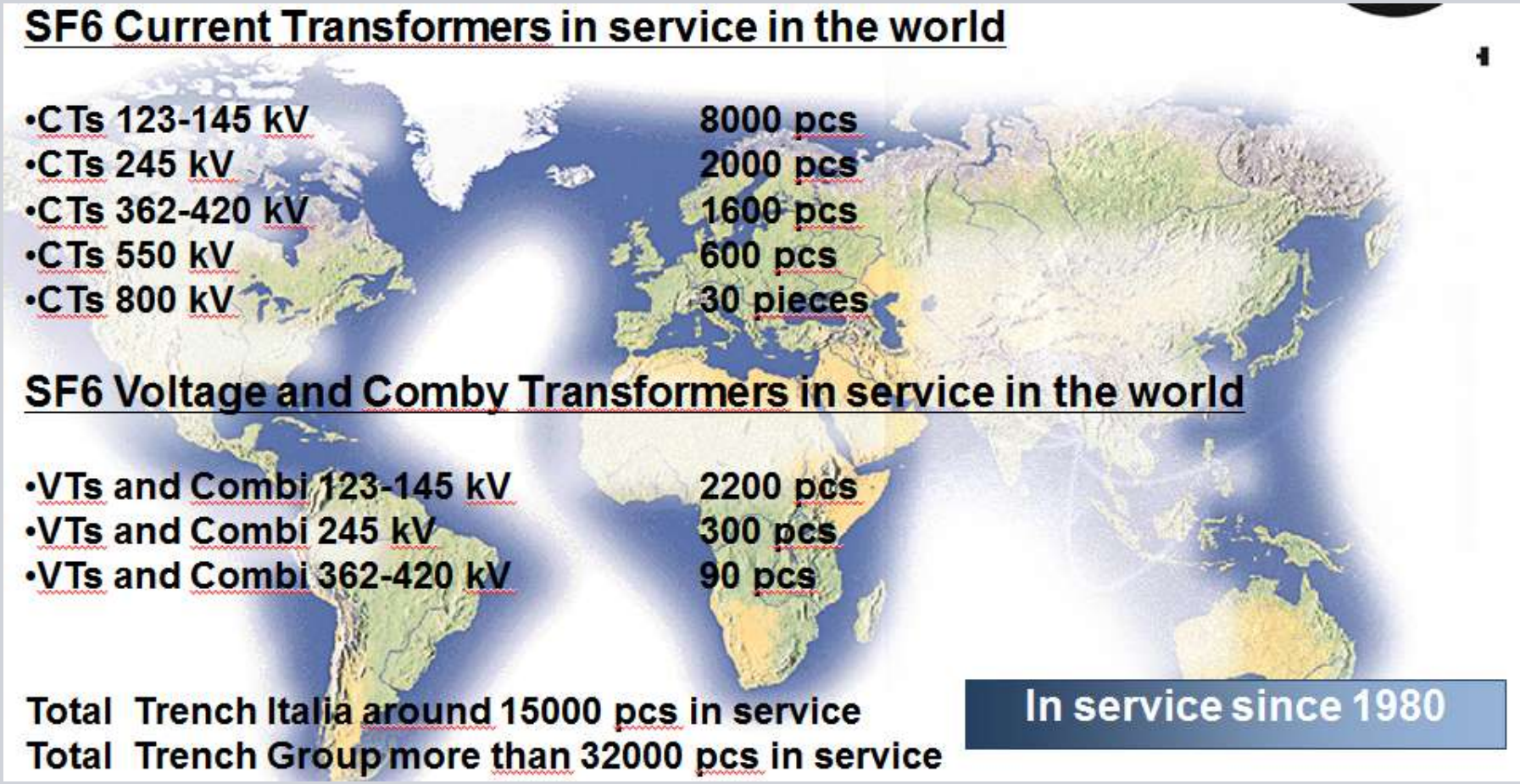
Oceania

Australia	Powerlink
New Caledonia	Enercal

Africa

- Ethiopia	Eepco
- Cameroon	AES
- Nigeria	PCHN
- Kenya	Ketraco
- Namibia	Nampower
-South Africa	CCT
- Lybia	GECOL

SF6 Instrument Transformers
Trench Italia and Trench Group
Main references and some numbers



SF6 Instrument Transformers
Trench Italia Portfolio
Installed equipment pictures

SF6 Instrument Transformers
Trench Italia Portfolio
Installed equipment pictures

Trench Italia srl
Strada Curagnata 37
17014 Cairo Montenotte(SV) - Italy

Phone: +39 – 0195161 111
Fax: +39 – 0195161 401

www.trench-group.com

THE PROVEN POWER.

TRENCH®