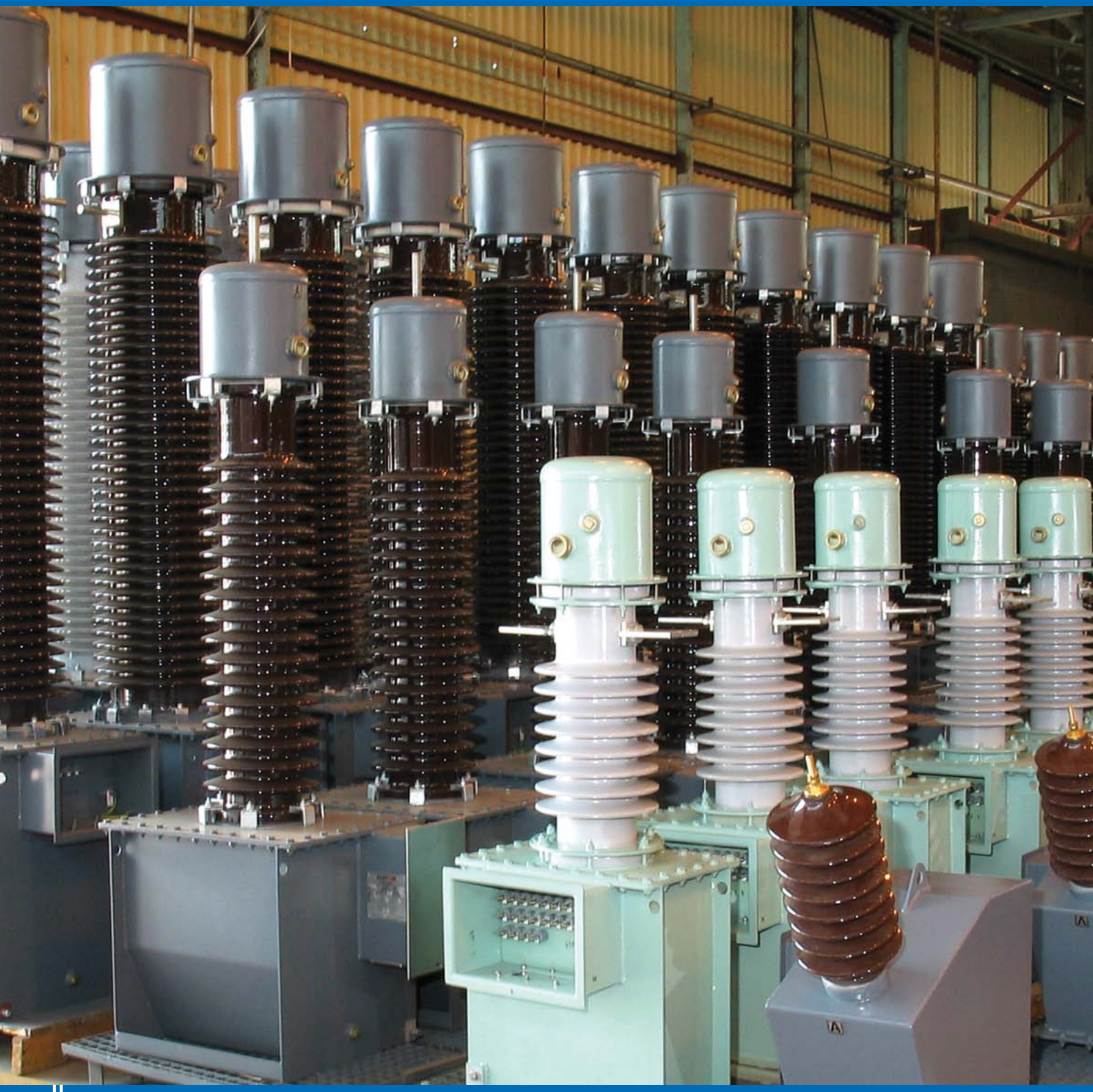
OUTDOOR AIS INSTRUMENT TRANSFORMERS



Current and Voltage Transformers

HIGH VOLTAGE EQUIPMENT
A division of ACTOM (Pty) Ltd

ACTOM

ACTOM OUTDOOR INSRUMENT TRANSFORMERS

CURRENT TRANSFORMERS - BENEFITS:

- Reliable track record due to conservative design parameters
- Three year comprehensive guarantee
- All gaskets under oil, enabling early detection of a compromise in the hermetical seal
- ISO 9001:2015 accredited by Bureau Veritas
- Primary earth lead termination to allow for condition monitoring
- Conservator expansion filled with dry air.

CONSTRUCTION OF CURRENT TRANSFORMER

- ACTOM's current transformers (CT's) are of a post type hairpin and oil filled design, which is well proven with over 10 000 units in service ranging from 11kV to 132kV.
- The CT's are manufactured according to IEC or AS specifications.
- The main components are the secondary cores, primary insulator and the steel tank.
- The CT's are hermetically sealed and do not require any maintenance.
- ACTOM's CT's are flexible in design and can be manufactured to accommodate ratio's as low as 5A to a maximum current rating of 2500 A.
- ACTOM CT's are also developed to accommodate a high seismic withstand of 0.7g.

SECONDARY CORES

- The cores are made from High Grade grain orientated silicon steel (grade M0H) wound in a toroid. The build up of the core is dependent on the ratio, burden and class of accuracy.
- The core is annealed at 800 ° C
- After the core has been processed and allowed to cool down, it is covered with insulation material and desired number of turns are wound around the core.
- The core is then tested for accuracy and magnetising current

To correctly specify a secondary core the following information is required:

- Ratio
- Burden (5 P, 10 P, 0.2, 0.5 etc)
- Knee point Voltage (Px, TPS)
- Class of accuracy
- Resistance (Px, TPS)
- Maximum magnetising current (Px, TPS)

PRIMARY WINDING

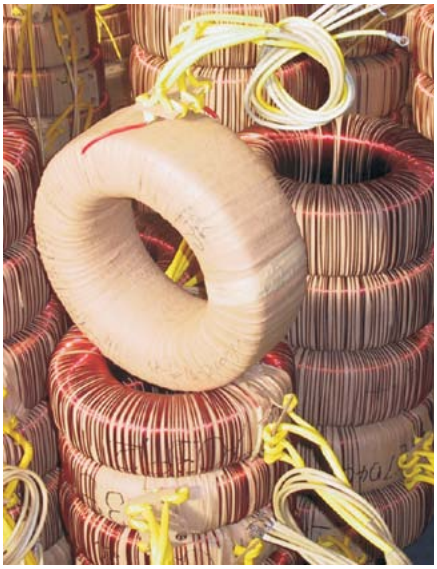
- The primary winding consists of annealed copper bent in a " U " shape.
- The primary is insulated with a special purified crepe paper, having a high mechanical and dielectric strength, and low losses.
- Aluminium stress grading foils are layered between the paper.

  These are strategically placed to reduce and control high voltage stresses.
- This will allow the end user to perform and check paper insulation by means of tan delta tests and continuous condition monitoring of the CT. The primaries are dried out, under vacuum in a heat cycled oven, to remove all the moisture.
- The last screen of the primary winding is also bought out through a terminal, and is earthed via a link to earth inside the terminal box. This link must NEVER be disconnected when the unit is in service, only when tan delta tests and partial discharge tests are done.

STEELWORK

- The lower portion of the transformer consists of a mild steel tank which houses the primary and the secondary windings.
- The top portion of the transformer consists of a conservator, which incorporates the oil level indicator and oil filter plug.
- The steelwork can be either hot dip galvanised or zinc sprayed and painted to customer requirements.

Outline of 132kV CT



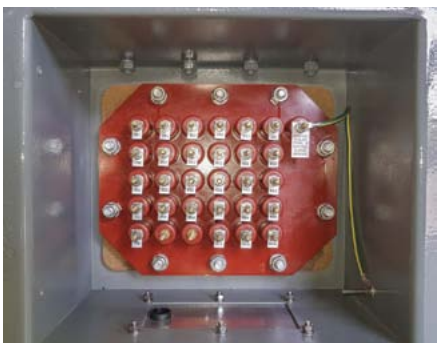
Secondary Cores

HV & SECONDARY TERMINALS

- The high voltage (HV) terminals of a CT are electro-tinned copper, which is fixed through the porcelain insulator and is connected to the primary winding.
- The terminal dimensions are 38mm diameter for currents up to 2500A, and 26mm diameter for currents of 800A and below.
- Flat terminals can be used according to customer requirements.
- Typical static loading on the stems is 2000N and dynamic load is 2800N.
- The secondary terminals are located in the terminal enclosure on the tank.
- Secondary terminals are resin encapsulated and of fully threaded 6mm diameter brass rod.
- The terminal stud is of sufficient length to accept two 2,5mm cables, three locknuts and washers.
- Non-metallic labels identify the secondary terminals.

TERMINAL ENCLOSURE

- The terminal enclosure is of a weather proof type fitted with a sliding cover.
- The enclosure houses secondary winding terminations that are brought out through Low Voltage (LV) terminals.
- A breather is provided in the terminal enclosure that prevents condensation.
- An aluminium gland plate is bolted to the bottom of the terminal enclosure.



CT Terminal

VOLTAGE TRANSFORMER - BENEFITS:

- Reliable track record due to conservative design parameters
- Three year comprehensive guarantee
- All gaskets under oil, enabling early detection of a compromise in the hermetical seal
- ISO 9001: 2010 2015
- High voltage factor of 2.1 continuous
- Conservator expansion filled with dry air.

CONSTRUCTION OF VOLTAGE TRANSFORMER

- The voltage transformers (VT's) are of the inductive single phase oil filled types.
- They are installed and connected between phase and earth .
- The VT's are manufactured to the IEC or AS specifications.
- Main components are the core and winding assembly, steelwork and insulator.
- The VT's are designed with a low flux density accommodating a very high voltage factor of 2.1 continuous.
- This reduces the possibilities of ferro resonance due to large core area.
- The VT normally has two secondary windings, but in some cases a 3rd winding can be added.

ACTOM has also the following variations available:

- A power VT with a winding of up to 16kVA rating (44-132kV) Single phase only
- The 11, 22 and 33kV VT's in three phase / five limb design
- Dual voltage VT's - 44/66kV and 88/132kV
- 11, 22 & 33kV Power VT's, up to 1kVA ratings 3 phase.
- The VT's are hermetically sealed and do not require maintenance.

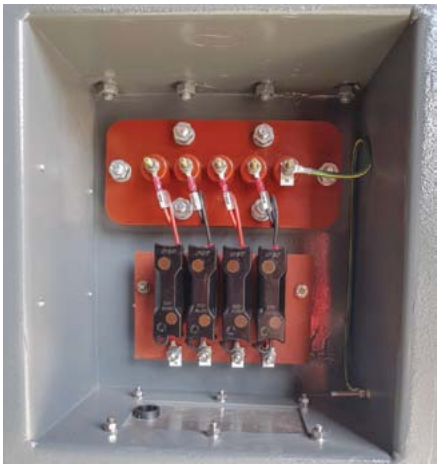
CORE AND WINDING

- The primary and secondary windings are wound around a former that in turn fits around one leg of the core.
- The core is made up of stacked core steel.
- The secondary windings are closest to the core with the primary windings being wound on top of the secondary windings.
- The primary is a multi-layered coil of enamelled copper wire with insulation paper between the layers.
- ACTOM Voltage Transformers do not require any resistors across the LV terminals to suppress the Ferroresonance, due to a low flux density core design.

Outline of 132kV VT

HV & SECONDARY TERMINALS

- The HV terminal of the VT is made of a 26mm diameter stainless steel rod that is welded to the top of the conservator.
- The neutral end of the HV winding is brought out through a terminal inside the terminal enclosure.
- The high voltage side of the primary winding is channelled through the porcelain and condenser bushing to the top of the VT conservator on the high voltage terminal.
- The secondary terminals are located in the terminal enclosure on the tank.
- Secondary terminals are resin encapsulated and of fully threaded 6mm diameter brass rod.
- The terminal stud is of sufficient length to accept two 2,5mm² cables, three locknuts and washers
- Non-metallic labels identify the secondary terminals



VT Terminal

STEELWORK

- The lower portion of the transformer consists of a mild steel tank which houses the primary and secondary windings.
- The top portion of the transformer consists of a conservator and the HV connection
- The steelwork can be either hot dip galvanised or zinc sprayed.

TERMINAL ENCLOSURE

- The terminal enclosure is of a weatherproof type fitted with a sliding cover.
- The enclosure houses the secondary winding terminals.
- The secondary windings are fused with 32A fuses where the neutral side of the secondaries is brought out via links.
- The HV winding neutral terminal is earthed via a link inside the terminal box.
- A breather is provided in the terminal enclosure that prevents condensation.
- An aluminium gland-plate is bolted to the bottom of the terminal box.

GENERAL CHARACTERISTICS

- The central portion of the transformer consists of a high grade brown or munsel grey glazed hollow porcelain.
- Total creepage is a standard of 31mm/kV
- Composite Insulated hollow core insulators can be fitted 22-132kV.

CONSERVATOR DESIGN

- The head of ACTOM's instrument transformers consists of a gas cushioned conservator, which is of sufficient volume to allow for expansion / contraction of the oil due to the temperature and atmosphere variances.
- Also located in the conservator is an oil gauge and filler plug, which will always be under oil.

Conservator detail

ASSEMBLING AND OIL FILLING

- Before assembly commences, all components are quality checked and tested to verify compliance with the specification.
- The units are then filled under vacuum with hot de-gassed oil.
- Only virgin oil is used with no PCB's present.
- The units are then checked for oil leaks by means of pressure test at 75kPa.
- The CT's and VT's will then undergo routine testing according to the applicable standards.
- Units will be quality inspected before release

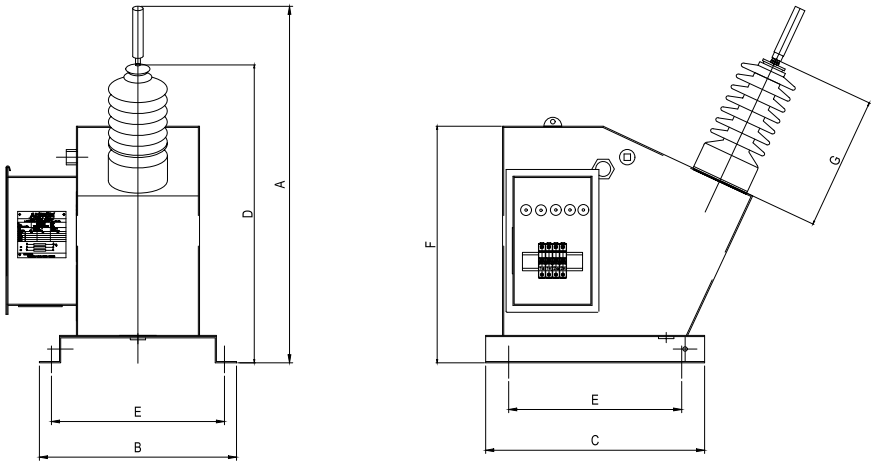
Oil filling

TESTING

- The manufacturing of Instrument Transformers requires accurate and carefulll testing at any step of construction.
- ACTOM has a thorough quality system that is managed by a QA manager.
- Prototypes are built and type tests carried out before mass production commences
- During the manufacturing process stage inspection is carried out at various steps to ensure unvarying characteristics of each type of transformer.
- High Voltage testing, normally tan delta, partial discharge and power frequency testing are carried out in a special Faraday cage.
- All HV tests are in compliance with standards and customer requirements.
- Testing All our units are fully tested according to the following standards IEC 61896 and NRS 029 and 030 (Eskom standards).

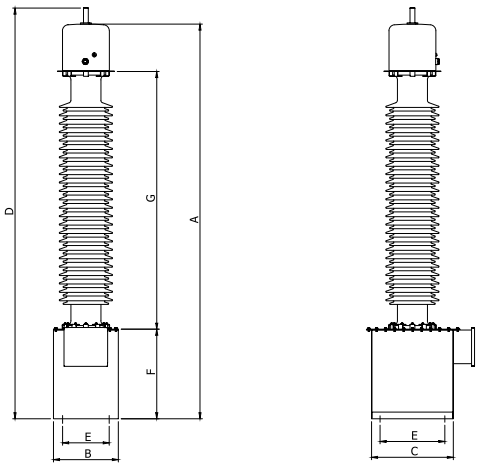
132kV CT's during electrical testing

VOLTAGE TRANSFORMERS



22-33KV LG RANGE VOLTAGE TRANSFORMER STANDARD DIMENSIONS

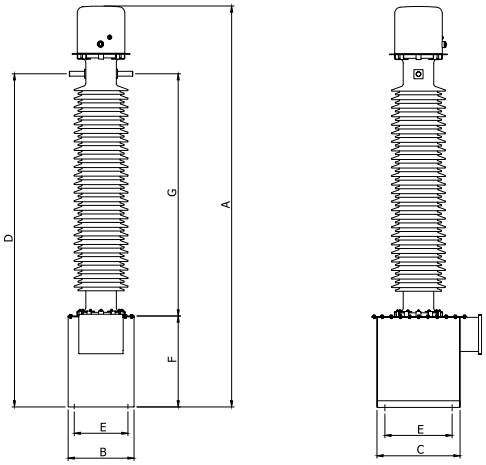
		A	B	C	D	E	F	G			
Nominal working Voltage	Impulse withstand voltage	Height	Width	Length	Height Stem to base	Fixing Centres	Tank Height	Live to earth	Porcelain Creepage	Total Mass (kg)	Crated Volume $(m)^3$
11kV	95kV	897	573	780	787	430 x 430	520	479	375	165	0.4
22kV	150kV	897	573	780	787	430 x 430	520	479	745	175	0.4
33kV	200kV	996	573	822	787	430 x 430	520	479	1120	185	0.47



44-132 LG RANGE VOLTAGE TRANSFORMER STANDARD DIMENSIONS

		A	B	C	D	E	F	G			
Nominal working Voltage	Impulse withstand voltage	Height	Width	Length	Height Stem to base	Fixing Centres	Tank Height	Live to earth	Porcelain Creepage	Total Mass (kg)	Crated Volume $(m)^3$
44kV	250kV	1725	390	695	1225	350 x 350	500	570	1430	245	0.77
66kV	350kV	1945	540	750	1385	450 x 450	560	750	1825	365	1.1
88kV	450kV	2425	540	850	1760	500 x 500	665	750	2500	450	1.6
132kV	650kV	2875	710	830	1995	500 x 500	880	1500	4100	785	2.10

CURRENT TRANSFORMERS



22-132KV CO RANGE CURRENT TRANSFORMER STANDARD DIMENSIONS

		A	B	C	D	E	F	G			
Nominal working Voltage	Impulse withstand voltage	Height	Width	Length	Height Stem to base	Fixing Centres	Tank Height	Live to earth	Porcelain Creepage	Total Mass (kg)	Crated Volume $(m)^3$
22kV	150kV	1320	550	490	900	300 x300	560	230	600	180	0.52
33kV	200kV	1470	550	490	1070	300 x300	560	400	900	220	0.56
44kV	250kV	1610	550	490	1210	300 x300	560	550	1360	250	0.70
66kV	350kV	1960	420	780	1520	300 x300	710	720	1820	380	1.00
88kV	450kV	2735	540	820	2190	500 x 500	755	1030	2500	650	1.74
132kV	650kV	2850	540	820	2300	500 x 500	755	1500	4495	750	1.80

RANGE OF UNITS

We can offer composite Insulators.
Current Transformers - 22, 33, 66, 88 & 132kV
Voltage Transformers - 6.6, 11, 22, 33, 44, 66, 88, & 132kV

132kV Composite Current Transformer

132kV Composite Voltage Transformer

Line to Ground

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2 Magnet Road, Knights, 1413.
Tel : +27 (0) 11 820 5349
Fax : +27 (0) 11 820 5100

Directions:
GPS Co—ordinates S:S: 26° 11.875′
E:E: 28° 11.925′

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