

# 5. POWER VOLTAGE TRANSFORMERS

Oil-paper insulation  
Gas insulation



› 245 kV Transformer for substation auxiliary services, model UTP. Coyote Switch (USA).

## INTRODUCTION

This type of voltage transformer can supply several kVA low voltage power directly from a high voltage transmission line.

It offers all the benefits of a potential transformer with the applications of a distribution transformer.

Oil-paper insulation:  
 model UT up to 245 kV and 10 kVA;  
 model UTP up to 362 kV and 333 kVA.

Gas insulation:  
 model UG up to 550 kV and 100 kVA.



> Model UTP



> Model UT



> Model UG

## APPLICATIONS

### 1. Substations auxiliary services power supply:

Power supply in conventional substations where low voltage power is needed as a primary or back-up supply; or in remote areas where building distribution lines is unsafe and with unreliable supply that requires frequent maintenance and high costs.

It can also be used as a primary power source in switching substations without power transformers to supply the substation and SCADA control systems.

### 2. Power supply for telecommunication and monitoring systems:

High quality electrical supply for booster antennas in remote locations using a voltage transformer connected to a nearby transmission line.

### 3. Rural electrification of isolated populations:

As a power source for supplying reliable power to rural populations in isolated areas where there are no distribution lines nearby, but there are transmission lines. This particular application supplies low voltage power directly from HV line in an economical and practical way.

### 4. Temporary power supply

when building substations, wind farms, etc., and emergency supply during natural disasters.

### 5. Voltage elevator

for High Voltage electrical test laboratories, wind and solar farms.

> UTP-245 Voltage transformer for rural electrification. Chihuahua State (Mexico).



## DESIGN AND MANUFACTURE

Power voltage transformers have a direct phase to ground connection with galvanic insulation between primary and secondary windings, which are coiled over the same magnetic core with independent insulation.

Voltage transformers for auxiliary services with oil-paper insulation are made with a magnetic core inside a metallic tank with its primary and secondary windings around it. The primary conductor is enclosed by a capacitive bushing consisting of shields and layers of insulating paper impregnated in oil. In order to control oil level changes, they are fitted with metallic bellows.

Voltage transformers for auxiliary services with gas insulation are made with a magnetic core inside a metallic tank with its primary and secondary windings around it. These windings are made of heat-resisting electric wires coated in synthetic resin and a layer of plastic with a high dielectric resistance and excellent thermal and mechanical performance.

The SF<sub>6</sub> and the plastic layer form the electrical insulation. An input valve for SF<sub>6</sub> gas is provided on a side of tank together with a manometer for monitoring leakages and gas pressure.



- > Oil-paper insulated power voltage transformers.
- > 72.5 kV Gas Power voltage transformer. R.E.E. (Spain).

## ADVANTAGES

The conventional solutions used for applications mentioned on page 44 usually are a dedicated medium voltage line, diesel generators or the power transformer tertiary winding. ARTECHE'S power voltage transformer has the following advantages:

- › Highly reliable power source within the substation.
- › Independent power supply, more flexible as the user does not have to depend on third parties.
- › Cost effective.
- › Maintenance-free throughout their lifespan.
- › Quick and flexible solution
- › Release of the power transformer tertiary winding.
- › Social benefits. Electrification of isolated rural areas, emergency power after natural disasters...

In addition to the several advantages of this solution, there are also the common ones to ARTECHE instrument transformers range:

- › Wide range of designs meeting customer needs.
- › Hermetically sealed to guarantee complete water tightness with the minimum volume of oil or gas (Each unit is tested individually).
- › Excellent response under extreme weather conditions, high altitudes, seismic hazard areas, violent winds, etc.
- › Officially homologated in-house testing facilities.
- › Each transformer is routine tested for partial discharges, tangent delta (DDF), insulation and accuracy and designed to withstand all the type tests included in the standards.
- › Environmental-friendly design. The materials used are recyclable and resistant to the elements.
- › May be transported and stored horizontally or vertically.

### OPTIONS:

- › Additional secondaries for measuring and/or protection.
- › Inner temperature monitoring sensor.

### OIL-PAPER:

- › Oil compensating system that effectively regulates changes in oil volume mainly caused by temperature.
- › Oil sampling valve for periodic analysis.

### OPTIONS:

- › Porcelain or silicone rubber insulator.
- › Over-pressure relief valve with connection capability to SCADA system.
- › Terminal for main insulation monitoring (tangent  $\delta$  measurement).
- › Taps for voltage regulation.
- › Winding for secondary current measuring and protection.
- › Single-phase/three-phase voltages in the secondary from a single HV phase.

### GAS:

- › The silicone rubber insulator guarantees safety during transportation and service.
- › Online monitoring of the insulation status with a manometer alarm.
- › Pressure relief device (rupture disc) in the top part of the transformer.

ARTECHE has developed a pioneering pilot project in the State of Chihuahua (Mexico) in collaboration with the local government and C.F.E. to extend electrical service to the region's rural population, using power voltage transformers, helping to reduce their isolation. This project has been awarded with the "Tomorrow's Energy Prize" in the 2013 World Energy Congress (WEC).

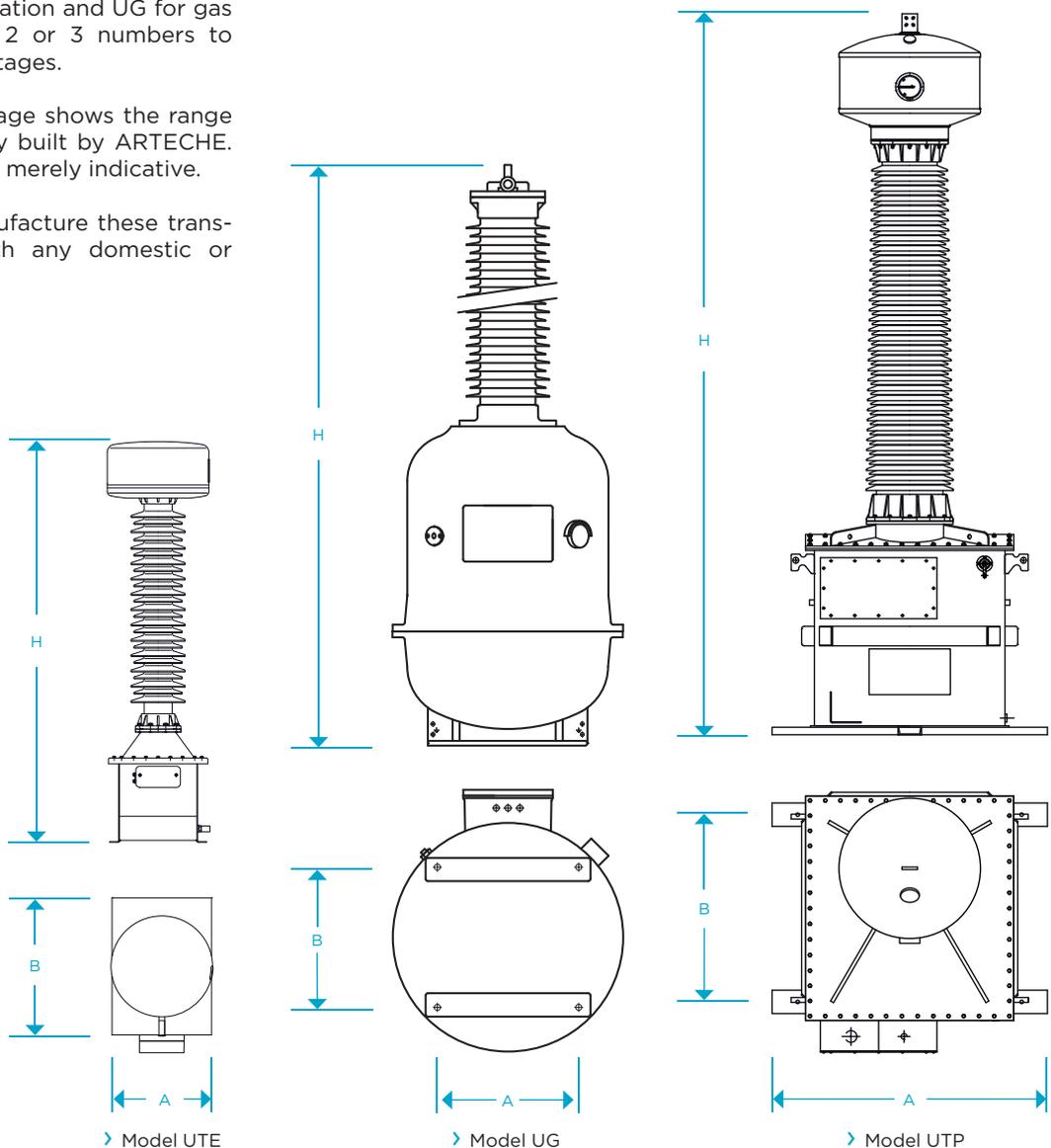


## RANGE

Auxiliary service inductive voltage transformers are named using different letters (UT followed by a third letter to indicate the model for oil-paper insulation and UG for gas insulation) followed by 2 or 3 numbers to indicate their service voltages.

The table on the next page shows the range of transformers currently built by ARTECHE. These characteristics are merely indicative.

ARTECHE can also manufacture these transformers to comply with any domestic or international standards.



- > 145 kV UTE Power voltage transformers. Transener (Argentina).
- > 420 kV UG Power voltage transformer. Routine tested in ARTECHE's laboratory.

## 5. POWER VOLTAGE TRANSFORMERS > Oil-paper and gas insulation

### Oil-paper insulation > Model UT

Model	Highest Voltage (kV)	Rated insulation level			Burden (kVA)	Standard creepage distance (mm)	Dimensions		Weight (kg)
		Power frequency (kV)	Lightning impulse (BIL) (kVp)	Switching impulse (kVp)			AxB (mm)	H (mm)	
UTE-72	72.5	140	325	-	up to 10	1825	400x430	1645	285
UTE-145	145	275	650	-	up to 10	3625	400x400	2105	400
UTG-245	245	460	1050	-	up to 10	6125	500x640	3260	800

Approximate dimensions and weights. For special requirements, please consult.

### Oil-paper insulation > Model UTP

Model	Highest Voltage (kV)	Rated insulation level			Burden (kVA)	Standard creepage distance (mm)	Dimensions		Weight (kg)
		Power frequency (kV)	Lightning impulse (BIL) (kVp)	Switching impulse (kVp)			AxB (mm)	H (mm)	
UTP-123	123	230	550	-	50/100	4525	1100x776	3100	2950
UTP-145	145	275	650	-	50/100	4525	1101x776	3100	2950
UTP-170	170	325	750	-	50/100	5285	1102x776	3400	3200
UTP-245	245	395	900	-	50/100/167/333	6125	1450x1220	4590	4500
		460	1050				1451x1220		
UTP-362	362	510	1175	950	50/100/167/333	9050	1452x1220	5270	5135
		575	1300				1453x1220		

Approximate dimensions and weights For special requirements, please consult

### Gas insulation > Model UG

Model	Highest voltage (kV)	Rated insulation level			Burden (kVA)	Standard creepage distance (mm)	Dimensions		Weight (kg)
		Power frequency (kV)	Lightning impulse (BIL) (kVp)	Switching Impulse (kVp)			Base (mm)	Height (mm)	
UG-72	72.5	140	325	-	50	2248	600x600/1200x1200	2250	< 3500
UG-145	123	230	550	-	100	3813	600x600/1200x1200	3100	< 3500
	145	275	650	-	100	4495	600x600/1200x1200	3100	< 3500
UG-245	170	325	750	-	100	5270	600x600/1200x1200	3300	< 3500
	245	460	1050	-	100	7595	600x600/1200x1200	3800	< 3500
	300	460	1050	850	100	9300	600x600/1200x1200	4200	< 3500
UG-420	362	510	1175	950	100	11222	900x900/1200x1200	4600	< 3500
	420	630	1425	1050	100	13020	900x900/1200x1200	5300	< 3500
UG-550	550	680	1550	1175	100	17050	900x900/1200x1200	5800	< 3500

Approximate dimensions and weights For special requirements, please consult