

# 4. CAPACITIVE VOLTAGE TRANSFORMERS AND COUPLING CAPACITORS

## Oil-paper insulation



› 420 kV Capacitive voltage transformers. Fingrid, Visulahti (Finland).

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### INTRODUCTION

Capacitive voltage transformers isolate the measuring instruments, meter, relays, protections, etc., from the high voltage power circuit and provide a scaled replica of the voltage in the HV line.

They enable transmission of high frequency signals through the high voltage HV lines.

Coupling Capacitors are only used for coupling high frequency communication signals and they are equivalent to the capacitive part of a CVT.



› Model DFK

› Model DDN

› Model DDB

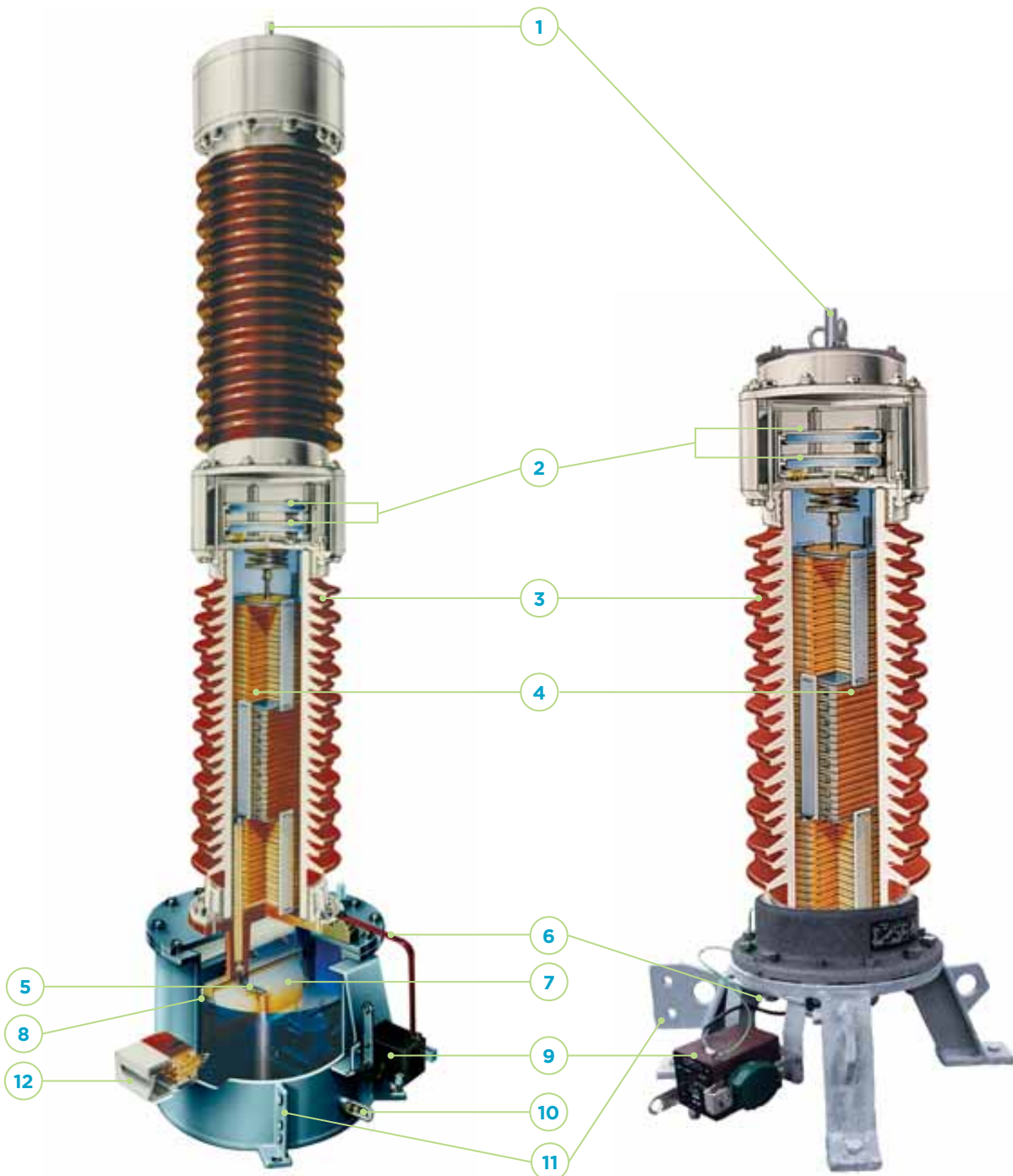
Capacitive voltage transformer  
model DFK up to 800 kV,  
model DDB up to 170 kV.

Coupling capacitor:  
model DFN up to 800 kV,  
model DDN up to 170 kV.

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SECTIONS

- |   |                                  |
|---|----------------------------------|
| 1. Primary terminal                         | 7. Inductive voltage transformer |
| 2. Oil volume compensating system           | 8. Oil level indicator           |
| 3. Insulator (porcelain or silicone rubber) | 9. Carrier accessories           |
| 4. Capacitors                               | 10. Oil sampling valve           |
| 5. Intermediate voltage tap                 | 11. Earthing terminal            |
| 6. High frequency terminal                  | 12. Secondary terminal box       |



> Capacitive voltage transformer

> Coupling capacitor

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### APPLICATIONS

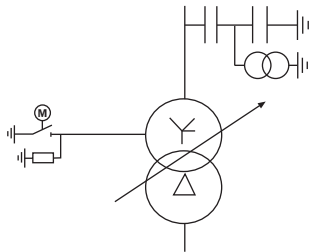
Ideal for installation at metering points due to its very high accuracy class and extremely steady capacitance.

Transmission of high-frequency signals through the high voltage lines (PLC).

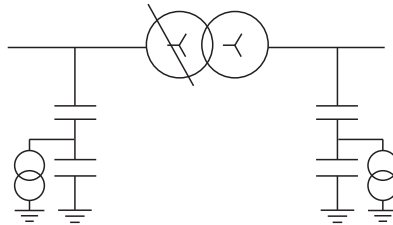
Helps to reduce voltage peaks in the line.

#### Examples of applications:

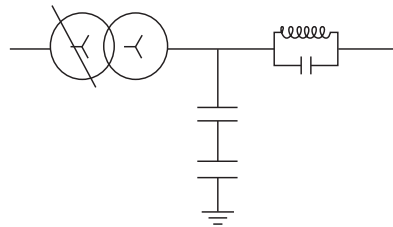
1. Revenue metering.



2. Protection for high voltage lines and substations.



3. Transmission of high frequency signals.



> 400 kV Capacitive voltage transformers. R.E.E. (Spain).



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# DESIGN AND MANUFACTURE

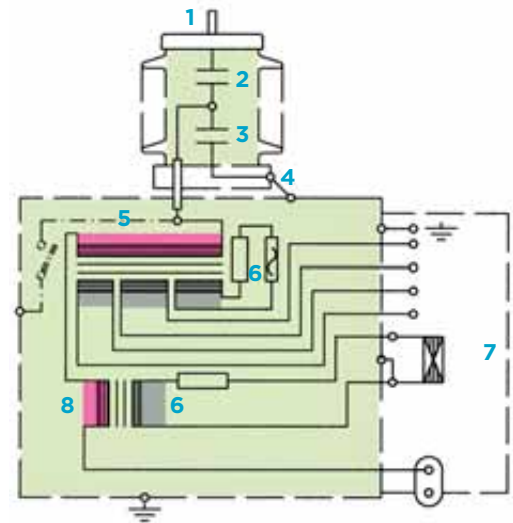
Capacitive voltage transformers consist of a series of capacitors connected in series on top of a tank in which the electromagnetic unit (inductive transformer (5), series reactor (8) and auxiliary elements) is housed. These capacitors form a voltage divider (2, 3) between the high voltage terminal (1) and the high frequency terminal (4).

The capacitors, impregnated with high grade dielectric oil, are housed in one or more insulators. Each of them forms an hermetically sealed independent unit, with a very stable capacitance over time.

The high frequency terminal (4) for the PLC signal comes out of one side through a piece of resin that separates the capacitive unit from the inductive voltage transformer.

The medium voltage inductive voltage transformer is immersed in mineral oil and housed inside an hermetically sealed metallic tank.

The secondary terminals are located inside a box (7) enabling connections and has space with protection elements such as fuses or circuit breakers.



1. Primary terminal
2. Capacitors
3. Capacitors
4. High frequency terminal
5. Inductive voltage transformer
6. Ferroresonance suppression circuit
7. Secondary terminal box
8. Compensating reactor



- > Earthing switch for safety handling during operation.
- > Protection devices for the secondaries may be installed inside the terminal block.

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### ADVANTAGES

- › High stability of capacity, and therefore of accuracy.
- › Reliable ferroresonance suppression system that does not affect transient response or accuracy.
- › Excellent mechanical resistance to seismic forces.
- › Pressure relief device to guarantee maximum safety.
- › Robust mechanical strength and reduced size due to a compact design that is easy to transport, store and install, and which reduces visual impact.
- › Hermetically sealed to guarantee complete water tightness with the minimum volume of oil or gas (Each unit is tested individually).
- › Oil level compensating system that effectively regulates changes in oil volume.
- › Maintenance-free throughout their lifespan.
- › Environmental-friendly design through the use of materials recyclable and resistant to the elements. Its advanced design adheres to environmental regulations through the use of high quality insulating oils, free of PCB.
- › Excellent response under extreme weather conditions (from -55°C; up to +55°C), altitudes over 1.000 m.a.s.l., seismic hazard areas, violent winds, etc.
- › Each transformer is routine tested for partial discharges, tangent delta (DDF), insulation and accuracy. Designed to withstand all the type test included in the standards.
- › Compliance to any international standards: IEC, IEEE, UNE, BS, VDE, SS, CAN, AS, NBR, JIS, GOST, NF...
- › Officially homologated in-house testing facilities.

### OPTIONS:

- › Silicone rubber insulation.
- › Carrier accessories.
- › Earthing switch for the inductive part.
- › Wide range of primary and secondary terminals.
- › Sealable secondary terminals.
- › Line traps can be installed on the top.
- › Different cable glands and accessories available.
- › Wide range of capacitances.
- › Secondary terminal protection devices inside the terminal box.

Maximum safety and reliability within a custom-made design.

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### RANGE

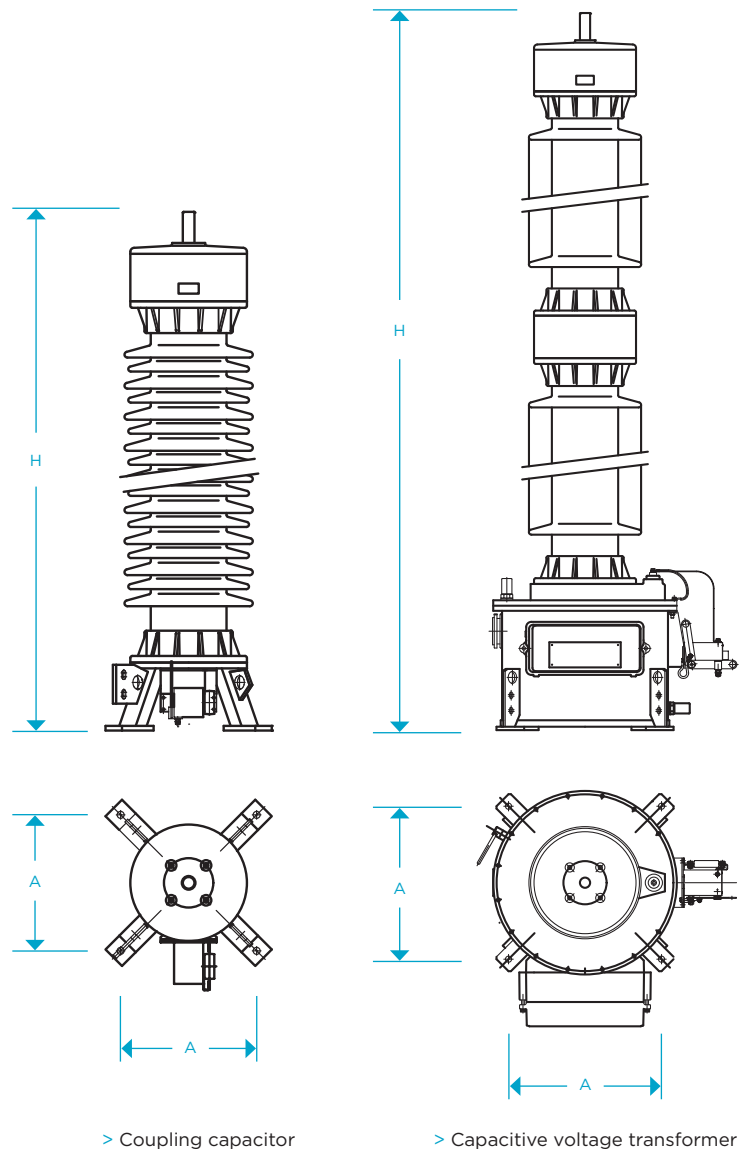
ARTECHE capacitive voltage transformers and coupling capacitors are named with different letters (DDB or DFK for transformers; DDN or DFN for capacitors) followed by 2 or 3 numbers indicating the maximum voltage of the network for which they are designed.

The tables show the ranges of both types of devices currently built by ARTECHE. These characteristics are merely indicative; they can be manufactured to comply with any domestic or international standard.

#### Standard accuracy classes and powers:

- > According to IEC standards
  - 100 VA Class 0,2 / 3P
  - 250 VA Class 0,5 / 3P
- > According to IEEE standards
  - 0.3 WXYZ
  - 1.2 WXYZ, ZZ

Higher accuracy classes and burdens available.



- > 245 kV Capacitive voltage transformers. NEPCO (Jordan).
- > 525 kV Capacitive voltage transformers. UTE (Uruguay).

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Capacitive voltage transformers										
Model	Highest Voltage (kV)	Rated insulation level			Standard capacitance (pF)	High capacitance (pF)	Standard creepage distance (mm)	Dimensions		Weight (kg)
		Power frequency (kV)	Lightning impulse (BIL) (kVp)	Switching impulse (kVp)				A (mm)	H (mm)	
DDB-72	72,5	140	325	-	10.300	25.500	1.825	450	1.510	245
DDB-100	100	185	450	-	5.700	14.300	2.500	450	1.600	255
DDB-123	123	230	550	-	5.600	14.000	3.075	450	1.830	300
DDB-145	145	275	650	-	3.900	19.500	3.625	450	1.920	310
DDB-170	170	325	750	-	7.500	16.500	4.250	450	2.065	330
DFK-245	245	460	1.050	-	5.800	11.000	6.125	450	2.885	450
		395	950							
DFK-300	300	460	1.050	850	6.000	12.500	7.500	450	3.205	480
DFK-362	362	510	1.175	950	4.500	10.100	9.050	450	3.675	520
DFK-420	420	630	1.425	1.050	3.500	7.700	10.500	450	4.595	670
		575	1.300	950						
DFK-525	(525) 550	680	1.550	1.175	3.000	6.200	13.125	450	5.560	1.065
		800	1.800	1.175						
DFK-765	(765) 800	880	1.950	1.425	3.000	4.500	15.300	450	7.010	1.270
		975	2.100	1.550						

Approximate dimensions and weights. For special requirements, please consult. Higher capacities available upon request.

Coupling capacitors										
Model	Highest Voltage (kV)	Rated insulation level			Standard capacitance (pF)	High capacitance (pF)	Standard creepage distance (mm)	Dimensions		Weight (kg)
		Power frequency (kV)	Lightning impulse (BIL) (kVp)	Switching impulse (kVp)				A (mm)	H (mm)	
DDN-72	72,5	140	325	-	10.300	25.500	1.825	450	1.235	115
DDN-100	100	185	450	-	5.700	14.300	2.500	450	1.325	120
DDN-123	123	230	550	-	5.600	14.000	3.075	450	1.585	145
DDN-145	145	275	650	-	3.900	19.500	3.625	450	1.675	150
DDN-170	170	325	750	-	7.500	16.500	4.250	450	1.805	170
DFN-245	245	460	1.050	-	5.800	11.000	6.125	450	2.625	255
DFN-300	300	460	1.050	850	6.000	12.500	7.500	450	2.945	305
DFN-362	362	510	1.175	950	4.500	10.100	9.050	450	3.415	345
DFN-420	420	630	1.425	1.050	3.500	7.700	10.500	450	4.335	495
		575	1.300	950						
DFN-525	(525) 550	680	1.550	1.175	3.000	6.200	13.125	450	5.300	890
		800	1.800	1.173						
DFN-765	(765) 800	880	1.950	1.425	3.000	4.500	15.300	450	6.760	1.095
		975	2.100	1.550						

Approximate dimensions and weights. For special requirements, please consult. Higher capacities available upon request.