



IEC Capacitive & Coupling Capacitor Voltage Transformers (CVT & CCVT)

72.5kV - 1100kV (325kV - 2100kV BIL)



with **Primary Plus™**

Pre-engineered solution set that digitizes XD|GE primary equipment and provides factory installed and configured protection, monitoring, diagnostics and communications.



GE
Digital Energy



1000kV Capacitive Voltage Transformers



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XD|GE: Collaborating to Deliver High Voltage Solutions

For over a century, utilities around the world have relied on GE to deliver products and services that increase power system reliability, improve grid resiliency and responsiveness. As a global leader in grid infrastructure products and services, GE supports a broad set of utility applications ranging from transmission and substation automation to distribution networks and smart metering, enabling greater safety, connectivity and increased security.

Through an alliance with XD Electric®, GE has extended its portfolio to include high and ultra high-voltage power equipment supporting the highest transmission voltage levels in the world. XD Electric is one of China's largest primary equipment manufacturers dedicated to the research, application and development of critical transmission equipment and solutions. XD Electric has a broad range of products to transform and direct the flow of power for industrial, commercial and residential users.

The XD|GE alliance provides end-to-end transmission solutions to meet the growing global demand for electricity. The combined portfolios of GE and XD provide a comprehensive range of technology solutions to address the unique challenges faced by the utility sector and energy intensive industries.

Instrument Transformers

XD|GE's suite of Instrument Transformers provide high accuracy measurement of voltages and currents for the effective operation and management of transmission & distribution systems.

With a broad range of instrument transformer solutions and in-field experience spanning more than a quarter century, XD|GE is an industry leader providing



Key Features & Benefits

- Applications from 72.5kV - 1100kV
- High accuracy (0.1) with wide margin
- Optional accuracy adjustment terminal for on-site configuration
- Meets applicable IEC® and IEEE®/ANSI® metering and protection standards
- High seismic withstand performance
- Extra creepage distance with strong pollution resistant capability
 - » Pollution: Level D, Creepage: above 44cm/kV
 - » Pollution: Level E, Creepage: above 55cm/kV
- Not prone to ferro-resonance conditions, improving asset and system reliability
- Partial discharge less than 5pC in condition of 1.2Um
- Non-PCB synthetic PXE oil is used in capacitors and mineral oil is used in electromagnetic units
- Mechanical strength
 - » Tension at connection terminal is larger than 2,000N (3-Dimensional)
- Capacitor sections bolt together ensuring easier field installation
- Quality assurance in accordance with ISO 9001

Primary Plus



XD|GE offers Primary Plus on all its primary equipment. Primary Plus is a pre-engineered solution set that provides utilities with a means to reduce the time and labor associated with substation construction and expansion, while at the same time utilizing technologies and methodologies familiar to existing resources.

XD|GE's factory installed and configured solutions include:

- Digitized primary equipment by replacing labor-intensive, individually terminated copper wires with standardized physical interfaces and open digital communications
- Electrical protection systems optimized for the equipment and application to monitor and react to fault conditions
- Highly secure and ruggedized communication network equipment including industrial strength wireless, fiber optic multiplexers and Ethernet switches

high quality, innovative, and reliable products. Its portfolio provides standard to high accuracy solutions suitable for revenue metering and system protection applications and includes Current Transformers (CT's), Voltage Transformers (VT's), Potential Transformers (PT's), Capacitive Voltage (CVT) and Capacitance Coupled Voltage Transformers (CCVT). With this comprehensive range of accurate power sensing devices coupled with GE's vertical integration approach and skilled design engineering staff, we work closely with our global customers to provide the right solution for each unique application.

The XD|GE instrument transformers facilities are ISO® qualified and follow strict quality control measures and processes to ensure reliability and maximum operational life.

Construction



1000kV Capacitive Voltage Transformer in Nan Yang

Capacitive Voltage Transformers / Coupling Capacitor Voltage Transformers

Capacitive Voltage Transformers (CVTs) have been widely used within transmission power systems for applications ranging from high-voltage to ultra high-voltage. CVTs are primarily used for voltage measurement, providing voltage signals to metering units, protection relay devices, and automatic control devices. CVTs can also be used to couple power line carrier technology to the power system for communications purposes.

With more than 45 years of in-service field experience, XD|GE has been offering high-accuracy (0.1% rated), innovative, and reliable CVT/CCVT solutions that may be applied to transmission systems ranging from 72.5kV to 1100kV.

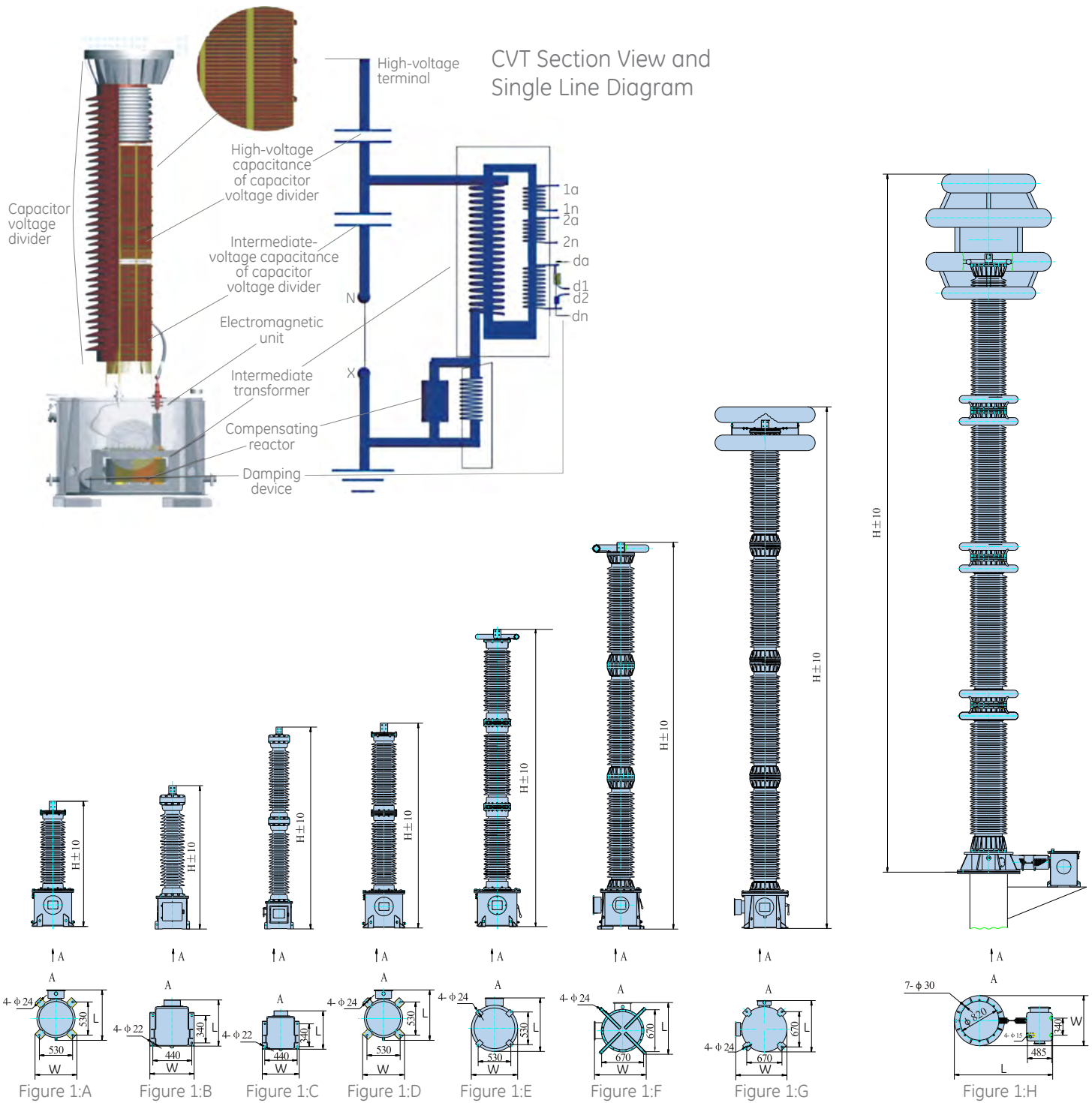
The capacitors utilized in the GE|XD CVTs are manufactured in GE|XD's state of the art, 120,000 square yard facility which also manufactures Shunt Capacitors, Filter Capacitors, and HVDC Shunt Capacitors.

The standard CVT design uses a combination of polypropylene, paper and PXE oil to create a stable, long lasting capacitor stack. The capacitor stack or divider is housed in a porcelain housing, and the other components such as the compensating reactor, damping device, ferroresonance suppression circuit and step down transformer are located in the base of the unit.

Construction

The CVT consists of two main components, the high-voltage capacitor divider stack and the Electromagnetic Unit (EMU) housing. The capacitor stack may consist of one or more sections. The capacitor stack consists of serially connected capacitor elements housed in hermetically sealed porcelain housing. The capacitor's polypropylene/kraft paper insulation system is impregnated with specially processed capacitor oil. Each hermetically sealed section utilizes a stainless steel expansion chamber to allow for oil expansion and contraction as the ambient temperature changes. The capacitor divider will provide between 5kV and 20kV to the intermediate step down transformer which has a low voltage output as required.

Dimensions



CVT Configuration and Dimensional Drawings

All measurements are in millimeters (mm)

Innovative Facilities and Rigorous Quality Processes

XD|GE's technology portfolio is built in state-of-the-art manufacturing and testing facilities with robust quality processes which provide customers with products that meet the critical and demanding reliability and environmental challenges of transmission applications.

Manufacturing Excellence

XD|GE designs a broad range of instrument transformers in two specialized production facilities including machining, surface treatment, insulating, windings, and housings. One facility is dedicated to the production of oil CTs and CVTs and the SF₆ CT's are manufactured within the GIS facility.

The components and final assembly are manufactured by XD|GE through a completely integrated manufacturing model to ensure quality and supply chain integrity.

The instrument transformers facilities are ISO® 9001 certified, ISO 14001 certified for environmental management systems, as well as OSHA® 18001 certified for health and safety management systems.

Exceptional Quality

A focus on quality is an ongoing strategic initiative for XD|GE and that is evident throughout the manufacturing environment. The quality process begins with an incoming inspection of all materials to ensure the best possible inputs before manufacturing begins.

Throughout the production and assembly process, there are multiple checkpoints, including both visual inspections as well as stopped flow inspections, all performed to documented test plans. The production facilities follow strict non-conforming procedures to identify, control and avoid the use and delivery of non-conforming products. Each production facility has developed strict environmental standards, including controls of cleanliness, temperature and humidity, and has controls in place to monitor and manage to the established standards.

In addition, XD|GE has a dedicated measurement and inspection department with a certified full time inspector in each of its manufacturing sites. The measurement and inspection department provides a secondary cross-inspection for all work in process, as well as finished products, ensuring a high level of quality is achieved throughout the manufacturing process. First Pass Yield and Cost of Quality data is maintained and analyzed, per product family, in order to drive continual product and process improvements and higher product reliability.

From raw materials acquisition and inspection to finished product, XD|GE's instrument transformers are designed to meet rigid quality processes so the installed product provides the highest level of reliability.

Advanced Test Facilities

XIHARI®, the Xi'an High Voltage Apparatus Research Institute, is an integral part of the XD|GE alliance. XIHARI has extensive testing capabilities at its facility sites, which include a: High Power Laboratory, High Voltage Laboratory, Artificial Climate Laboratory, EMC Laboratory, and an Operational Test Circuit for HVDC Thyristor Valves.

The testing hall meets all of the requirements of ISO/IEC 17025 and houses some of the largest test equipment in the world, providing the capacity to test primary equipment as large as 1,100kV AC. The High Voltage Apparatus Laboratory in XIHARI is a government authorized national high-voltage apparatus quality supervision and inspection test center. It is an independent third-party laboratory for type tests, routine tests, performance tests and certificate tests for high-voltage apparatus. The testing facilities at XIHARI also include an extension environmental laboratory. Testing capabilities here include high altitude testing, high humidity testing, and temperature testing from -70° C up to +150° C.



Support and Service

Global Project Engineering Services

XD|GE is dedicated to helping its customers reach their system objectives and provides a suite of professional services to assist in the successful deployment and maintenance of XD|GE products and solutions. From design and implementation to post-sales support, a team of technical and business experts are available to help customers effectively use the capabilities and product domain knowledge that are available from XD|GE.

This support infrastructure covers the entire life cycle of the product. From the coordination of transportation logistics to the completion of site acceptance testing and warranty service, the highly qualified XD|GE team is available throughout the implementation.

To ensure a high quality of service to meet the needs of each unique application, XD|GE has a global field service team of highly experienced and dedicated individuals. Coupled with a vast network of high-voltage power equipment domain experts, XD|GE is able to support a broad range of applications in various environments.

Finally, XD|GE offers a 24x7 global support service to address and direct any customer application and field questions.

Specialized Installation and Commissioning

- Logistics management including coordination of ocean and inland transportation
- Installation services include receiving, rigging, unloading and labor (mechanical and electrical)
- Test commissioning
- Site acceptance testing

Post-Sales and Installation Support

- 24x7 global customer service
- Emergency response hotline
- Several customer support access points available to ensure timely support (telephone, e-mail, fax, or web)
- Global spare parts reserve
- A global network of maintenance and repair facilities



4800kV/720 kJ Impulse Voltage Generator &
±2000kV 30mA DC Voltage Generator

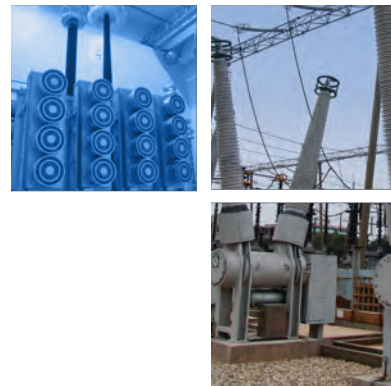
Primary Plus



Pre-Engineering Secondary Equipment

Primary Plus, XD|GE's supplemental offering to its primary equipment, is a pre-engineered, factory installed solution set that allows utilities to reduce the time and labor associated with substation construction and expansion. Primary Plus uses technologies and methodologies familiar to existing resources and skill sets.

- Digitized primary equipment for replacing labor-intensive, individually terminated copper wires
- Electrical transformer protection to monitor and react to fault conditions
- Transformer monitoring and diagnostics to predict problems and proactively manage performance
- Secure and ruggedized wireless devices, fiber optic multiplexers and Ethernet switches



Digitized Substation

Multilin™ HardFiber System

- Using the Multilin HardFiber system, XD|GE primary equipment can deliver primary equipment with digital communications. The Multilin HardFiber system provides a reduction in total life costs of protection and control through labor and resource optimization.
- This factory-installed solution reduces the amount of labor-intensive, individual terminated copper wire connections with pre-terminated copper and fiber optic cables with standard physical interfaces and open digital communications.

Key Benefits

- Reduces up to 50% of labor for protection and control
- Replaces extensive copper wiring with pre-terminated copper and fiber cables
- Reduces specialized on-site labor by shifting spending to readily available materials
- Improves employee safety by leaving potentially dangerous high-energy signals in the switchyard
- Reduces the chances for operational mistakes made during isolation and restoration for routine maintenance
- Built on the Multilin Universal Relay (UR) family, allowing for fast transition into most protection and control applications
- Provides wide-area network protection



Electrical Protection & Control

Advanced Relay's for Substation Equipment

Primary Plus uses the Multilin C70 and D60 protection, control, and monitoring solutions to provide sensitive and effective protection of substation, primary equipment, and transmission network. CVT and CCVT devices provide critical, accurate voltage measurement.

Key Benefits

- Robust network security enables critical infrastructure protection
- Advanced automation capabilities for customized protection
- Advanced fault and disturbance recording, including internal relay operating signals
- Superior phase selection algorithm
- Flexible programmable logic for building customized schemes
- Phasor measurements units



Technical Specifications

Technical Data for 72.5kV CVT

Max Voltage	72.5	72.5
BIL (kV)	350	350
Rated capacitances (pF)	10000	20000
Ratio (2 windings)	660:1	660:1
Secondary Voltage	100 / $\sqrt{3}$	100 / $\sqrt{3}$
Accuracy Class / max. burden (2 windings) Class 0,2 Class 0,5	100	200
Auxiliary Rating (other ratings available)	3P100	3P100
Thermal VA	1000	1000
Creepage distance (mm/kV)	2270	2270
L x W x H (mm)	808 x 660 x 1750	808 x 660 x 1750
Weight (kg)	570	570
# of coupling capacitors	1	1
Figure 1	A	A

Technical Data for 126kV CVT

Max Voltage	126	126	126	126
BIL (kV)	550/611	550/611	550/611	550/611
Rated capacitances (pF)	10000	10000	15000	20000
Ratio (2 windings)	1100:1 (1150:1)	1100:1 (1150:1)	1100:1	1100:1 (1150:1)
Secondary Voltage	100 / $\sqrt{3}$	100 / $\sqrt{3}$	100 / $\sqrt{3}$	100 / $\sqrt{3}$
Accuracy Class/ max. burden (2 windings) Class 0,2 Class 0,5	150	150	150	300(150)
Auxiliary Rating (other ratings available)	3P100	3P100	3P100	3P100
Thermal VA	1000	1000	1000	1500
Creepage distance (mm/kV)	3530/4500	3530/4500	3530/4500	3530/4500
L x W x H (mm)	715 x 590 x 1900/2330	808 x 660 x 2000/2330	808 x 660 x 2000/2330	808 x 660 x 2000/2330
Weight (kg)	500/530	650/685	650/685	615/650
# of coupling capacitors	1	1	1	1
Figure 1	A	A	A	B

Technical Data for 145kV CVT

Max Voltage	145	145	145
BIL (kV)	650	650	650
Rated capacitances (pF)	10000	15000	20000
Ratio (2 windings)	1320:1	1320:1	1320:1
Secondary Voltage	100 / $\sqrt{3}$	100 / $\sqrt{3}$	100 / $\sqrt{3}$
Accuracy Class / max. burden (2 windings) Class 0,2 Class 0,5	150	200	300
Auxiliary Rating (other ratings available)	3P100	3P100	3P100
Thermal VA	1000	1500	1500
Creepage distance (mm/kV)	4500	4500	4500
L x W x H (mm)	855 x 740 x 2330	855 x 740 x 2330	855 x 740 x 2330
Weight (kg)	840	670	870
# of coupling capacitors	1	1	1
Figure 1	A	A	B

Technical Data for 170kV CVT

Max Voltage	170
BIL (kV)	950
Rated capacitances (pF)	10000
Ratio (2 windings)	1610:1
Secondary Voltage	100 / $\sqrt{3}$
Accuracy Class / max. burden (2 windings) Class 0,2 Class 0,5	200
Auxiliary Rating (other ratings available)	3P100
Thermal VA	1000
Creepage distance (mm/kV)	7060
L x W x H (mm)	805 x 660 x 3270
Weight (kg)	840
# of coupling capacitors	2
Figure 1	C

Technical Specifications (continued)



1000kV Capacitive Voltage Transformer in Nan Yang, China at Night

Technical Data for 245kV CVT

Max Voltage	245	245	245
BIL (kV)	1050/1167	1050/1167	1050/1167
Rated capacitances (pF)	5000	5000	10000
Ratio (2 windings)	2300:1	2300:1	2300:1
Secondary Voltage	100 / $\sqrt{3}$	100 / $\sqrt{3}$	100 / $\sqrt{3}$
Accuracy Class/ max. burden (2 windings)			
Class 0,2	150	150	300
Class 0,5			
Auxiliary Rating (other ratings available)	3P100	3P100	3P100
Thermal VA	1000	1000	1500
Creepage distance (mm/kV)	7060/9000	7060/9000	7060/9000
L x W x H (mm)	715 x 590 x 3170/3830	808 x 660 x 3270/3930	808 x 660 x 3270/3930
Weight (kg)	725/795	865/935	840/900
# of coupling capacitors	2	2	2
Figure 1*	D	D	D

Technical Data for 362kV CVT

Max Voltage	362	362	362
BIL (kV)	1175/1390	1175	1175
Rated capacitances (pF)	5000	7500	10000
Ratio (2 windings)	3300:1	3300:1	3300:1
Secondary Voltage	100 / $\sqrt{3}$	100 / $\sqrt{3}$	100 / $\sqrt{3}$
Accuracy Class/ max. burden (2 windings)			
Class 0,2	200	175	250
Class 0,5			
Auxiliary Rating (other ratings available)	3P100	3P100	3P100
Thermal VA	1000	1500	1500
Creepage distance (mm/kV)	10165/12380	11253	11253
L x W x H (mm)	855 x 740 x 4760/5240	855 x 740 x 5060	855 x 740 x 5060
Weight (kg)	1300/1400	1580	1580
# of coupling capacitors	3	3	3
Figure 1	E	E	E

Technical Data for 420kV CVT

Max Voltage	420	420
BIL (kV)	1425	1425
Rated capacitances (pF)	5000	10000
Ratio (2 windings)	4000:1	4000:1
Secondary Voltage	100 / $\sqrt{3}$	100 / $\sqrt{3}$
Accuracy Class/ max. burden (2 windings)		
Class 0,2	150	300
Class 0,5		
Auxiliary Rating (other ratings available)	3P100	3P100
Thermal VA	1500	1500
Creepage distance (mm/kV)	11760	12600
L x W x H (mm)	905 x 740 x 5070	905 x 740 x 5190
Weight (kg)	1645	1840
# of coupling capacitors	3	3
Figure 1	F	F

Technical Data for 550kV CVT

Max Voltage	550	550
BIL (kV)	1550/1860	1550
Rated capacitances (pF)	5000	10000
Ratio (2 windings)	5000:1	5000:1
Secondary Voltage	100 / $\sqrt{3}$	100 / $\sqrt{3}$
Accuracy Class/ max. burden (2 windings)		
Class 0,2	300	250
Class 0,5		
Auxiliary Rating (other ratings available)	3P100	3P100
Thermal VA	1500	1500
Creepage distance (mm/kV)	17100/18700	18700
L x W x H (mm)	855 x 740 x 6310/6910	855 x 740 x 6910
Weight (kg)	2040/2160	2220
# of coupling capacitors	3	3
Figure 1	F	F

Technical Data for 800kV CVT

Max Voltage	800
BIL (kV)	2400/2688
Rated capacitances (pF)	5000
Ratio (2 windings)	7650:1
Secondary Voltage	100 / $\sqrt{3}$
Accuracy Class/ max. burden (2 windings)	
Class 0,2	250
Class 0,5	
Auxiliary Rating (other ratings available)	3P100
Thermal VA	1500
Creepage distance (mm/kV)	22400/24800
L x W x H (mm)	860 x 860 x 8350/9150
Weight (kg)	2825/2985
# of coupling capacitors	4
Figure 1	G

Technical Data for 1000kV CVT

Max Voltage	1000
BIL (kV)	2600
Rated capacitances (pF)	5000
Ratio (2 windings)	10000:1
Secondary Voltage	100 / $\sqrt{3}$
Accuracy Class/ max. burden (2 windings)	
Class 0,2	45
Class 0,5	
Auxiliary Rating (other ratings available)	3P15
Thermal VA	1500
Creepage distance (mm/kV)	33000
L x W x H (mm)	3930 x 1000 x 11150
Weight (kg)	4400
# of coupling capacitors	4
Figure 1	H

*Figure 1 refers to diagram on page 5



Digital Energy

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