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INSTALLATION, OPERATIONS AND MAINTENANCE MANUAL

CVC COMBINATION CURRENT AND VOLTAGE TRANSFORMERS

15–34.5 kV

ENGINEERED
TO OUTRUN



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INSTRUCTIONS FOR APPLICATION, INSTALLATION AND USE OF CVC COMBINATION CURRENT AND VOLTAGE TRANSFORMERS

This application, installation and use guide is valid for dry-type medium voltage outdoor combination current (CT) and voltage transformers (VT). The CVCs in this guide include all 15–34.5 kV class combination instrument transformers (ITs).

Safety information

WARNING

- Keep these instructions available to personnel responsible for the product's proper installation, maintenance and operation.
- Follow your company's safety procedures.
- Read these instructions carefully before attempting to install, operate or maintain this device. Failure to follow these instructions could cause severe personal injury, death or property damage.
- Apparatus covered by this instruction literature should be operated and serviced only by competent personnel familiar with the installation of this type of product and good safety practices. These instructions are written for such personnel and are not intended as a substitute for proper training and experience in safety procedures for this type of equipment.

Safety symbols



This is the safety alert symbol. It is used to alert you to potential physical injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

Danger indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Notice is used to address practices not related to physical injury.

General information

Combination transformers in this guide are designed to transform primary currents and voltages from distribution levels to a level that is usable for measurement and protection devices, typically 1 or 5 A and 115 or 120 V. Combination instrument transformers (ITs) are designed for 60 Hz unless specified otherwise.

This guide includes instructions for the following types of combination transformers:

- 15 kV: CVC-110BER, CVC-110BRER
- 25 kV: CVC-150
- 34.5 kV: CVC-200

Any of these type designations can be followed by another letter that indicates additional product features. The suffix “ER” indicates a high accuracy and extended range CT in ABB’s AccuRange® current transformer family that exceeds the IEEE 0.15 accuracy class and has $\pm 0.15\%$ accuracy from 1% of the rated current through the rating factor. The suffix “R” indicates that the IT is designed with ABB’s ResiVolt™ very fast transient (VFT) overvoltage technology, which mitigates the harmful effects of VFTs on the transformer.

For additional naming conventions, please reference ABB’s instrument transformer and sensor type designations guide online.

Operating conditions

ABB’s medium voltage outdoor ITs are designed to be installed and operated up to 34.5 kV on overhead lines or inside enclosures that may experience condensation, such as pad-mounted metering cabinets in outdoor conditions.

Unless otherwise noted in the individual product literature, ITs are rated per IEEE C57.13 for ambient temperatures between -30°C and $+70^{\circ}\text{C}$ (storage and transportation temperatures in the same range). The average ambient temperature, measured over a period of 24 hours, should not exceed 30°C , and the temperature of the cooling air should not exceed 40°C .

These transformers are designed, rated and tested for applications up to 1000 meters above sea level. Contact the factory or your ABB sales representative for applications above 1000 meters.

For insulation and protection, transformer bodies are cast in either polyurethane or hydrophobic cycloaliphatic epoxy (HCEP). Units cast in polyurethane will be black in appearance and HCEP ITs will be gray. Both materials can be used in outdoor environments; however, the HCEP material offers superior arc track-, ozone- and ultraviolet-resistive properties while providing excellent physical strength. The hydrophobic surface properties of HCEP are recommended for wet, humid, coastal or contaminated environments.

Before installation, ensure that the characteristic data on the nameplate matches the requirements of the system.

For additional environmental service conditions, see IEEE C57.13-2016, section 4.

Technical details

For transformer dimensions, see dimensional drawings in the product literature. Rated values for each individual transformer are stated in the product literature and on the product’s nameplate.

Extended range high accuracy CTs in ABB’s AccuRange family deliver high accuracy and stable performance over a wide load swing, making them ideal fits for variable load applications. Accuracy is guaranteed to be $\pm 0.15\%$ from 1% of nominal current through the rating factor. With the wide current accuracy range, these CTs can be used to replace many different ratios of standard accuracy CTs and deliver savings through improved accuracy metering and reduced inventory. AccuRange CTs are rated for metering applications only and should not be used for protection applications.

Some CVCs are specially designed to withstand very fast transient (VFT) overvoltages. These CVCs are designed with ResiVolt technology, which offers unparalleled performance in applications where frequent line switching is present, including but not limited to areas with significant recloser or capacitor bank switching or where renewable generation is present.

Installation instructions

Safety instructions

⚠ WARNING

Always consider the transformer as a part of the circuit to which it is connected. Do not touch the leads, terminals or other parts of the transformer unless they are known to be de-energized and grounded.

Always ground instrument transformers using appropriate grounding methods based on the application. This can be done through the metallic baseplate, grounding L-bracket connected to the baseplate and to the ground terminal inside the secondary junction box. See section 1.5.6 for additional grounding instructions.



01 External grounding bracket

NOTICE

Never short circuit the secondary terminals of a voltage transformer, even when it is not in use. A secondary short circuit will cause the unit to overheat and fail in a very short period.

⚠ WARNING

Never energize the combination transformer with open secondaries. Open CT secondaries are extremely dangerous to personnel and can cause catastrophic failure of the CT. For more information, see section 1.5.2 below.

CT shorting

When no secondary burden is connected, the secondary terminals of the CT should always be shorted using the shorting mechanism included in the junction box. See figures 2 and 3.

⚠ WARNING

If the secondary terminals are left open circuited while the CT is energized, the voltage across the secondaries will continue to rise until the CT arcs to the nearest grounded object. This high voltage can break down insulation and is very dangerous to personnel.

The CT secondary safety shorting mechanism is a bronze pivoting clip that can be rotated to short the CT secondaries (figure 2) or be left open (figure 3). CTs are always shipped with the shorting mechanism in the shorted position for safety. When the CT is ready to be energized, the shorting mechanism should be rotated out of the shorting position and into the open position to allow current to flow through the metering path.



02 CT secondary shorted

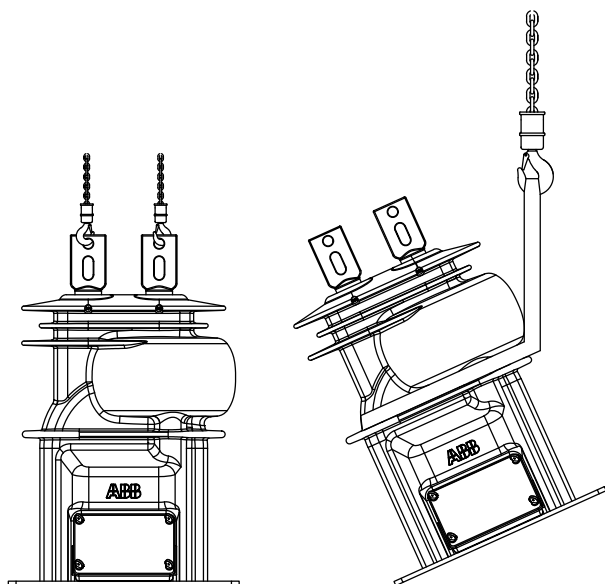


03 CT secondary open

Lifting

The recommended lifting method for medium voltage HCEP and polyurethane CVCs is to wrap a strap around the middle bushing shed or below the rounded CT core on the CVC-110B. If a strap is not used, CVCs can also be lifted carefully from both primary terminals. Lifting from one terminal can damage or bend the terminal if the transformer weight is unbalanced. By lifting from both terminals, the risk of terminal damage is reduced. While lifting, it is important to use slow and fluent movements to avoid the dynamic forces caused by abrupt motions. See figure 4 for a lifting diagram.

Review figure 5 and the individual product literature for transformer weight to ensure that the lifting hoist, strap and other equipment are properly rated for the transformer's weight.



04 Lifting techniques by the primary terminals or sling

TABLE 1: APPROXIMATE COMBINATION TRANSFORMER WEIGHTS

Transformer type	Approximate weight (lbs.)
CVC-110B HCEP	98
CVC-150 polyurethane	225
CVC-200 polyurethane	274

Clearance

Always ensure adequate clearances between the live components of transformers, medium voltage lines and ground. These clearances can be found and referenced in IEEE and NEMA standards.

Mounting

Transformers can be mounted in either upright (vertical) or cantilever (horizontal) positions per figure 6. They can also be mounted upside down in an underhung position, but this is not recommended due to the location of the weep holes on the bottom of the junction box. Weep holes allow moisture to exit

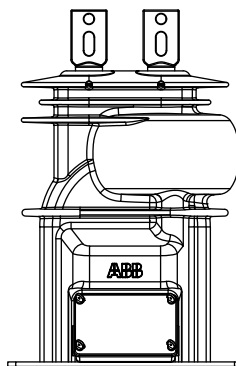
the junction box; however, mounting in an underhung position creates potential for rainwater to enter the box. Contact the factory or your ABB sales representative for applications requiring underhung mounting.

The maximum cantilever load that can be applied to each primary terminal should be limited to 170 lbf.

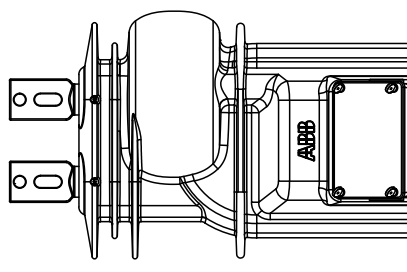
Specific mounting orientation options can be found below and in the individual product literature.

TABLE 2: ACCEPTABLE COMBINATION TRANSFORMER MOUNTING ORIENTATIONS

Transformer type	Upright	Cantilever
CVC-110B HCEP	•	•
CVC-150 polyurethane	•	
CVC-200 polyurethane	•	



05 Example of upright mounting orientation



06 Example of cantilever mounting orientation

Transformers are provided with aluminum baseplates for mounting to crossarms, racks, etc. See the individual product literature for specific baseplate mounting dimensions. Mounting bolts are not included.

Grounding

Combination transformers must be connected to ground by the aluminum baseplate, internal junction box ground and/or baseplate ground lug (L-shaped bracket).

See IEEE C57.13.3, IEEE Guide for Grounding of Instrument Transformer Secondary Circuits and Cases for more information regarding IT grounding.

Secondary connections

Secondary connections are made inside the secondary junction box and include brass hex-head slotted screws. Connections can be made with ring terminals or by using the 1/4"-20 screws as clamp-type connections for #14 AWG through #1 AWG wire.

TABLE 3: RECOMMENDED TORQUE FOR SCREW CONNECTIONS

Screw	Min torque (ft.-lbs.)	Max torque (ft.-lbs.)
1/4"-20	2.5	4
3/8"-16	15	26
7/16"-14	25	37
3/4"-16	60	100

Refer to product nameplates for wiring diagrams for each style. Examples of different types of secondary connections are shown below. Unlabeled dashed circles represent polarity markers.

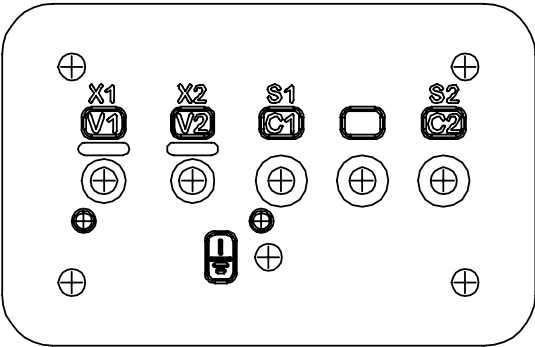
CT secondary

For current measurement, all CVC combination transformers have a single secondary CT. Single secondary styles only have one secondary winding and only require secondary connections on the C1 and C2 terminals.

VT secondary

For voltage measurement, CVC combination transformers can have a single or tapped secondary VT.

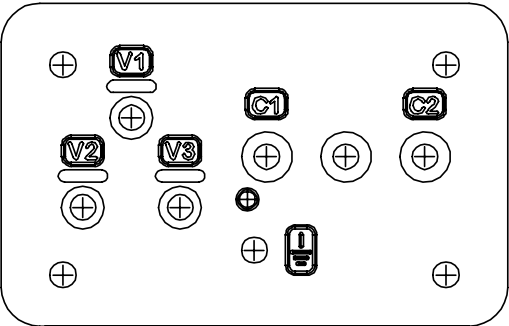
Single secondary VT



07 Secondary terminals for single secondary CT and VT

Single secondary styles only have one secondary winding and only require secondary connections on the V1-V2 terminals.

Tapped secondary VT



08 Secondary terminals for single secondary CT with tapped secondary VT

For tapped secondary styles, two of the three connections must always be used. V1-V3 is the full winding and V2-V3 is the tapped ratio.

Example: 60/70:1

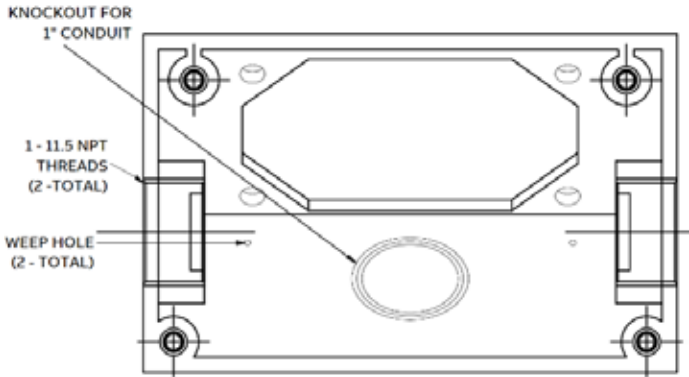
V1-V3, 60:1

V2-V3, 70:1

Secondary junction box

The secondary terminals are housed inside a thermoplastic junction box having 1"-11.5 NPT hubs on each side, and a 1" knockout on the bottom. See figure 12. All conduit hubs are closed to prevent water ingress during shipping but are designed to be easily knocked out for installation and use. Use proper liquid-tight fittings to maintain IP rating. Do not leave any unused hubs open. They are provided with a cover and thumb screws to close the junction box after connections are made.

Standard junction boxes have an IP44 rating when mounted in an upright or cantilever position. If the CT is mounted in an underhung position, the IP rating is not guaranteed. See the weep hole information in section 1.5.5.



09 Secondary junction box with bottom and side knockouts

Primary connections

The primary terminals are electro-tin-plated copper with a 0.56" (14 mm) hole and 0.56" x 1.31" (14 x 33 mm) slot to facilitate primary connection (attaching hardware not provided).



10 Primary terminals

Stress-relief devices should be used where applicable to support primary cable connections and reduce stress on the IT primary terminals. Contact the factory or your ABB sales representative for applications that may exceed 170 lbf of load on each primary terminal.

Instructions for use

Combination transformers are used to isolate the primary and secondary circuits from each other to protect the secondary equipment (meters, relays and other IEDs) from the harmful effects of higher currents and voltages appearing during normal operation. Primary currents are typically reduced to 5 A, while voltages are commonly reduced to 115–120 V for use by secondary devices.

The use of transformers for purposes other than described in this guide or at higher-than-advertised voltage classes or current levels is not recommended and will void the manufacturer's warranty if not agreed upon in advance with ABB.

Before installation, discuss with ABB any application conditions that may exceed product ratings.

Voltage designations

Voltage class designations may vary slightly by application. For example, units listed as 36 kV may have a nominal system voltage rating of 34.5 kV and maximum system voltage rating of 36.5 kV, as per IEEE C57.13

7200/12470GY — CVC units with this primary voltage are rated for 7200 operating volts and can be connected at 7200 volts L-G on a 12470 V system (L-L volts are 12470 V). They CANNOT be connected L-L. The "GY" indicates only one fully insulated bushing, making them suitable for L-G connection only.

Instructions for maintenance

Excessive dust or other kinds of pollution must be cleaned off the transformer. HCEP transformers can be cleaned with spirits, petrol or toluene. Polyurethane transformers should be cleaned with water or a mixture of water and a mild soap. Review material safety data sheets (SDS) and use appropriate safety procedures and personal protective equipment when using any chemicals.

Repairing any surface damage, arc traces, etc., is not recommended. If repairs are required, contact your ABB representative.

Transportation and storage

The permissible transportation and storage temperatures are from -30°C to +70°C. Some ITs are rated to -50°C. See the appropriate individual product literature for temperature range.

In ideal conditions, the transformers should be kept in their original packaging or in dry and clean accommodations, protected from direct sunlight, precipitation and frost. This additional protection will increase the longevity of the transformer.

Transformers are packed in wooden crates on a skid. It is important to adhere to package labeling such as "do not stack," proper storage direction, etc.

Disposal of the transformer

Materials used in ABB instrument transformers are non-toxic and will not harm the environment. All appropriate regulations should be followed in product disposal.



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