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1. NOTE OF PRECAUTION

The material covered in this guide consists of oil insulated transformers, which normally are installed on high voltage systems. Care should be exercised in the installation process to prevent accidental shock and other hazards to personnel, and damage to the equipment.

Ensure that all surrounding conductors and equipment are de-energized and properly grounded prior to starting any installation or maintenance procedures. This guide has been produced to aid in proper installation and care of the transformers, when installed by competent service personnel who are knowledgeable about this type of product. Information contained herein is thorough, however, if additional direction is needed, please contact ABB prior to proceeding.



02 SSVT-IPC



01 SSVT



03 SSMV

2. PRINCIPLE OF OPERATION

Transformers identified in this guide are electromagnetic designs consisting of copper primary windings, copper or aluminum secondary windings, and cores made of cold rolled, grain-oriented, silicon steel. The cores and winding configurations are defined specific to the ratio for the application and accuracy performance requirements.

The major insulation is provided by oil-impregnated cellulose paper assemblies that are fully saturated and submersed in non-PCB mineral oil (less than 1 ppm PCB content). To allow for expansion and contraction of the oil under various ambient and load conditions, a gas cushion is located above the oil in the sealed housing (generally in the dome). In all units, the gas volume is sized to prevent severe over-pressures, or extreme vacuum under normal environmental conditions.

Primary external insulators are carefully specified to provide the required electrical clearance between the high voltage potential at the top dome and the grounded tank. These insulators provide strike and creepage distance in excess of the standard IEEE or IEC ratings specified for each voltage class. All metallic housings (dome and tank) generally consist of mild steel with baked-on, powdered polyester paint to ensure outdoor withstand. This coating system meets the performance requirements for pad-mounted equipment according to IEEE Standard C57.12.28. Stainless steel housings can be supplied as an option to prevent corrosion if specified by the user.

To facilitate safe and secure installation and mounting in the substation, all units come equipped with mounting feet to allow secure mounting.

Station Service Voltage Transformers (SSVTs) are intended to be installed with their primary winding connected line-to-ground with a single bushing on a Wye system across the voltage source to be

transformed. Verify that the nameplate primary voltage selected is appropriate for the source and required secondary output; otherwise, the SSVT may be subjected to over voltages that can cause equipment failure and personnel hazard.

Power Windings - Unless otherwise stated, the total power kVA rating on the SSVT represents the maximum total VA available from all secondary windings combined. The power windings are normally provided as two isolated windings with 120VAC output per winding, which can be series or parallel connected to provide 120/240VAC. A single power-winding configuration, as opposed to the two re-connectable secondary windings, may be supplied to accommodate special output voltages. Refer to the nameplate on the product for specific winding configurations. Also refer to “Connections” section found under “Operating Instructions” for further information on other product connections. A ground terminal is supplied within the power-winding compartment to ensure a solid ground connection is conveniently available for safety.

Meter Windings (when supplied) - The burden (meters and relays) connected to the SSVT metering secondary winding(s) must be in parallel to indicate the proportional voltage from the SSVT. When a metering winding is supplied, 115VAC (or 120VAC) output is provided, and for most applications, a square root of three tap. Standard output ratios for full and tap metering ratings are per IEEE C57.13 latest revision.

When making any power or metering connections, due care should be exercised to prevent a partial or full short-circuit on any of the SSVT secondary windings. This will cause the SSVT to quickly over-heat and it may fail violently resulting in personnel hazard and equipment damage.



Caution - Do not short the secondary windings of any station service voltage transformer.

3. RECEIVING AND INSPECTION

When the transformer is received, a thorough external inspection should be made for any oil leaks or housing damage. The shipping pallet or crate should be inspected for any damage that may have been sustained during shipment. If there is evidence of rough handling, unpack the transformers in the presence of an inspector or a representative of the carrier. If the transformer appears to have been damaged during transit, a claim should be filed with the carrier and ABB HVIT should immediately be notified. Care should be exercised in unpacking the transformer. Never break out parts of the crating. Always use the proper tools and remove fasteners to prevent damage to the high-voltage insulator and/or transformer.

4. HANDLING



Caution - Do not tilt the transformers beyond 25 degrees from the vertical.

These products have a gas cushion above the oil level, which should not be tilted to the point of gas bubbles migrating down into the housing. The transformer should always be handled in the normal upright position. Lifting lugs or lifting eyes are provided for lifting the transformer. These items are designed for VERTICAL LIFT ONLY. When lifting the unit, the cable should be attached so there is a vertical pull on each lug. Use lifting cables of the same length so that the transformer can be lifted easily and evenly.



Caution - On units with lifting eyes at the bottom of the base, precautions should be taken to stabilize these units by using a restraining rope around the sling to prevent the transformer from toppling out of the lifting sling. Avoid cable or sling contact with the HV insulator as this may cause breakage.

5. STORAGE

If the transformer will not be installed in its permanent location as soon as received, it should be stored in a suitable location in the original shipping pallet or crate, if possible. The porcelain should be protected against breakage. Store the SSVT away from energized locations to prevent the upper housings (domes) from voltage rises due to capacitive coupling.

If the transformer is shipped with the dome off, the dome should be installed before prolonged storage. Section 12 describes how to install the expansion dome. Failure to do so can cause oil to vent through the PRV on top of the insulator and possible damage to the inner bushing insulation integrity.

6. PREPARING FOR SERVICE

A careful inspection of all external parts is required to disclose any evidence of mistreatment or damage. The following precautions must be taken before placing the transformer in service:

- Check for external damage.
- Check liquid level. If equipped with a gauge, the indicator should rest between “MIN” and “MAX”. If equipped with a sight glass, oil must be visible in the glass.
- Closely check for liquid leaks, which can be very deceptive and difficult to spot. NOTE: residual or trace oil may be present due to the manufacturing process. This is normal as oil collects outside the gasket surfaces in crevices or bolt holes in flanges and does not necessarily indicate the presence of a leak. Clean the area of trace oil with a degreaser such as denatured alcohol and, if still concerned, perform a chalk test by mixing denatured alcohol and carpenters chalk into a slurry and paint the area with this mixture. Active oil leaks will show up as a spreading dark stain in the chalk.
- Touch up all scratches on painted surfaces.

- Thoroughly clean all current carrying or voltage contact surfaces prior to use. Also clean the NEMA 2-hole ground pad surface. It is recommended to vigorously clean the contact surfaces with a clean, dry, lint-free cloth (do not use a metallic brush). After cleaning, it is recommended to place a thin layer of contact grease over the contact surfaces and install all connectors with the screws lightly and evenly tightened, and then torque to the recommended values shown in Section 7.
- Check nameplate on each unit and verify acceptability for use in the intended application.
- Station Service Voltage Transformers must not be short circuited, nor continuously applied to circuits that exceed 120% of their nominal rating.



Caution - Verify that the “H₀” (or neutral bushing) located on the tank, is solidly grounded to the tank with the provided grounding cable, prior to use. A separate system ground lead must be connected to the NEMA 2-Hole pad located on the lower tank wall, prior to use, to ensure adequate ground reference. Do not depend upon grounding through equipment mounting structures. Failure to make proper connections will result in equipment damage and personnel hazard.



04 H0 Bushing Grounding Label

7. TORQUE VALUES

It is not necessary to tighten any hardware, but if elected, the following torque values are to be used for all bolts or studs.

Fastener Size / Type	Torque Range
1/4" copper terminals	1 – 2 ft-lbs. (1.4 – 2.7 N-m)
1/4" stainless steel studs	3 – 4 ft-lbs. (4.0 – 5.4 N-m)
5/16" stainless steel studs	6 – 8 ft-lbs. (8.1 – 10.8 N-m)
3/8" stainless steel bolts/studs	12 – 14 ft-lbs. (16.3 – 19.0 N-m)
1/2" stainless steel bolts/studs	30 – 35 ft-lbs. (40.6 – 47.5 N-m)

05 Torque Values Table

8. INSTALLATION

All SSVTs are designed for platform or pad mounting and should be mounted using the holes provided in the base. Refer to outline drawings for individual mounting dimensions. Primary connections should be constructed so they will impose the minimum possible load on the primary terminal. Where aluminum connectors are used, connectors should be tin plated to prevent galvanic corrosion. Make positive ground connection using the tank ground pad and a proper connector.

Primary terminals can support terminal loading of 200lbs in any direction. Do not connect directly to the terminal with rigid bus, as this will place undue stress on the transformer. Note- these designs have a pressurized gas cushion above the oil in the dome. Care should be exercised when

working with pressurized designs. Gas pressure may be tested by using the gas valve fitting – do not use the pressure relief device as moisture may enter the transformer.

All windings available from the SSVT are normally isolated from the equipment base housing and from other coils. Depending upon connections made (refer to Operating Instructions section), the user can configure for a specific voltage output. A fuse block is located in the metering terminal compartment (if supplied) in order to provide protection for the SSVT metering winding from secondary short-circuits. Use this block when making connections to the meter load.



Caution - Separate protective provisions, such as fusing, for the power output(s) must be made by the user to prevent overloading the SSVT power winding(s).

9. CAUTIONS PRIOR TO ENERGIZING



Caution - NEVER short-circuit secondary terminals of the SSVT.

This will cause excessive current and the unit may fail violently. Each unit has the warning sticker shown below, attached to the tank to warn of danger if misapplied.



06 Secondary Short Circuit Warning Label



Caution - H₀ BUSHING DANGER!

– NEVER leave the H₀ (neutral) bushing ungrounded during operation. Ensure that the H₀-to-ground connection is re-established after field testing and prior to energizing the transformer. Failure to ground the neutral bushing eliminates a ground reference for the primary winding and allows it to float, which, in turn, may result in excessive voltage at the neutral point. Each unit has the warning sticker shown below attached to the tank to warn of danger if misapplied.



07 H0 Bushing Grounding Label



Caution - After the transformer is mounted, it should be allowed to set a minimum of twenty-four (24) hours before energizing. This will allow any gas bubbles, developed during shipment to the site and handling, to migrate from the oil in the stressed areas.

10. OPERATING INSTRUCTIONS

The following rules should be observed to provide years of trouble free service from your ABB SSVTs. They are designed to deliver their thermal rating continuously. Do not exceed this value without first contacting the factory. Where metering windings are supplied, the accuracy level assigned to the metering output(s) cannot be guaranteed beyond 10% load on the power winding.

CONNECTIONS --- Connections for specific ratios are shown on the nameplate of each transformer. For optional configurations, please refer to the specific nameplate data and the general wiring examples shown below:



Caution - The SSVT will over-heat if any part of the secondary winding is shorted. The SSVT should be left open circuited if not connected to an appropriate load.

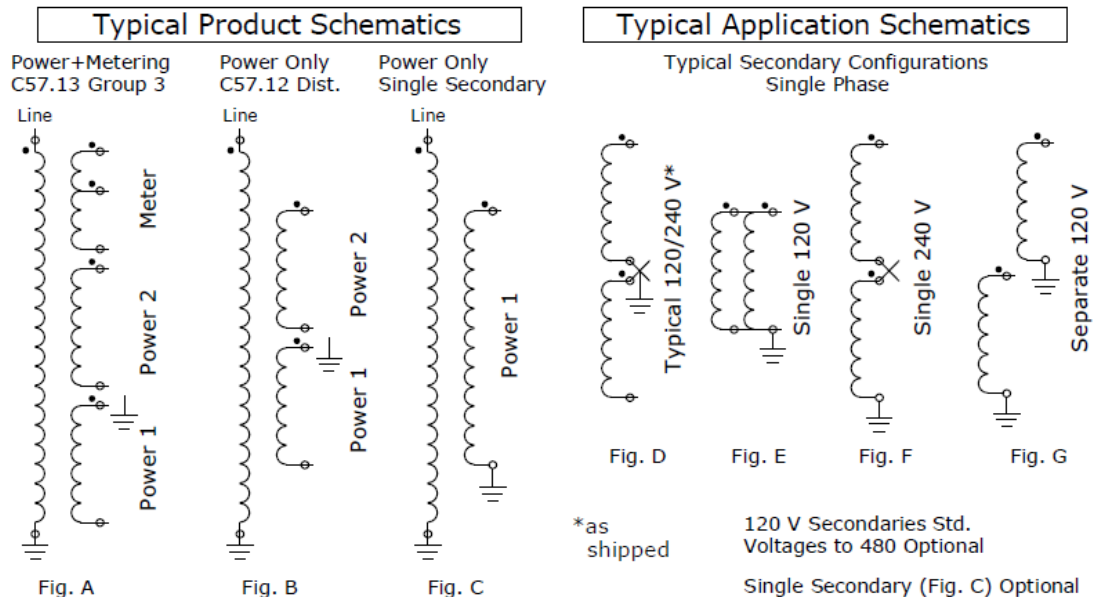


Caution - Maintain proper safety regulations for operating in the vicinity of high tension wires.

11. MAINTENANCE

General recommendations- Other than routine conventional maintenance, ABB SSVT transformers only require periodic inspections and checking of the oil level. Should a visual inspection reveal chipped or damaged paint, these areas should be touched up to prevent corrosion.

Spare parts – Due to the integral nature of the components in these designs, no spare parts are recommended for the oil-filled station service voltage transformers.



12. MOUNTING THE EXPANSION CHAMBER

(FOR SSVTs EQUIPPED WITH REMOVABLE EXPANSION CHAMBER)

Some Station Service Voltage Transformers are equipped with a removable expansion chamber (detachable dome). This is often the case when the unit is too tall for economical shipment, or the load of the fully assembled and oil-filled dome endangers the integrity of the porcelain insulator. The steps described here must be followed for proper installation or removal of the dome.

Transformers shipped with the dome off will have a small gas cushion within the top portion of the HV insulator to accommodate oil volume changes while in transport.

The expansion chamber is to be mounted only after the transformer is securely mounted onto its stand/pedestal/riser. The expansion chamber must also be mounted if the SSVT will be kept in storage before installed and energized.



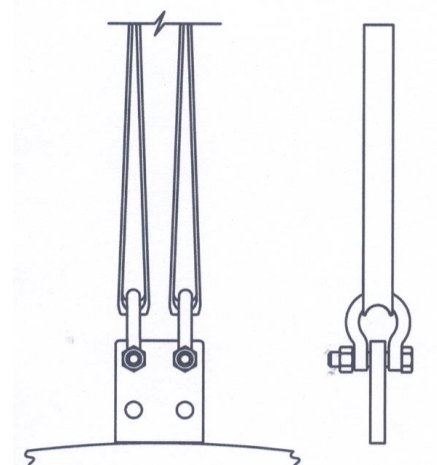
Caution - DO NOT TRANSPORT the unit with the expansion chamber installed. The warranty will be voided by such transport.

The expansion chamber must be removed if the transformer is to be re-located. See the following procedure.

It is necessary that the expansion chamber be installed a minimum of 24 hours prior to energization. Pre-commissioning tests without the expansion chamber installed may include momentary voltage application up to normal operating voltage. For higher voltage testing, it is necessary to fill the gas cushion in the porcelain with oil. The added oil must be removed prior to mounting the dome. Alternatively, the dome may be mounted 24 hours or longer before test, then removed per instructions below.

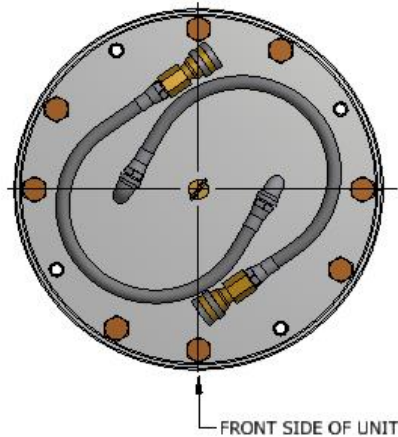
EXPANSION CHAMBER (DETACHABLE DOME) MOUNTING PROCEDURE:

- a. Open the packing crate. (Conserve the packing crate if the unit is to be re-located)
- b. Hoist the expansion chamber from the crating using two ½" shackles in the two upper holes of the H₁ terminal and a single sling through each of these. Assure that the shackles and sling are rated for the load, and that they are securely attached.

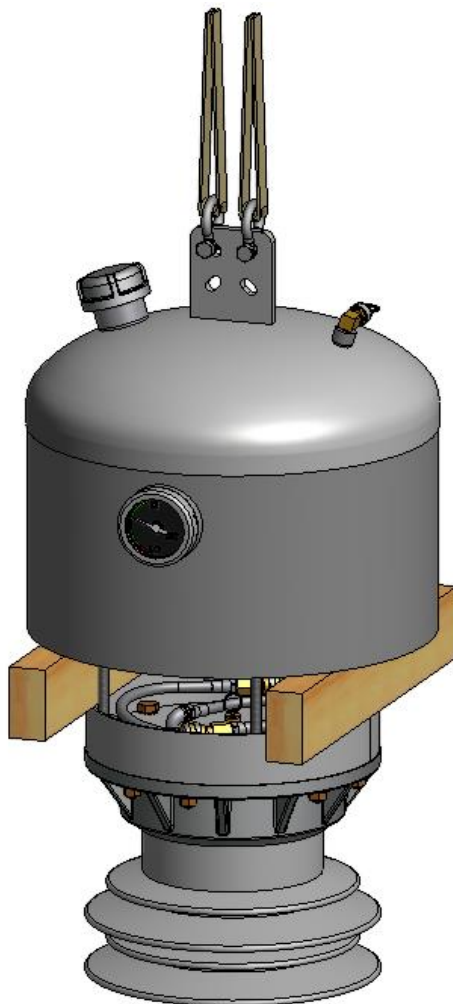


09 Hoist the expansion chamber

- c. Remove the protective caps on the quick disconnect fittings. **Do not excessively bend the hoses.**
- d. Place the 19" diameter spacer ring onto the top of the high voltage insulator.
- e. Position the hoses as shown in Fig 10
- f. Hoist the expansion chamber into position above the insulator.
- g. Place safety blocking on the spacer ring.
- h. Rotate the dome until the oil level gauge is positioned over the secondary terminal box.

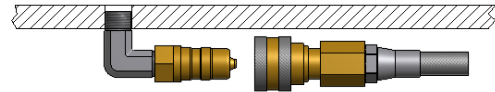


10 Top view of the high voltage insulator



11 Expansion chamber on top of insulator

- i. Lower to approximately 6" above the oil hoses.
- j. Remove protective caps from the expansion chamber fittings and attach the quick disconnect oil hoses.



12 Oil Hose Connections

- k. Remove the safety blocks. Lower the expansion chamber onto the spacer ring, aligning the studs with the four open holes. Seat carefully to avoid paint damage. Place a flat washer, lock washer and nut on each stud. Tighten the nuts to 30-35 ft. lb. torque.



13 Dome Mounting Hardware

- l. Remove the hoisting equipment.
- m. Allow a minimum of 24 hours standing time for the oil and gas to normalize. At temperatures below 32°F/0°C allow a minimum of 48 hours standing time. After the required standing time, the oil level on the gauge should be normal (N) to slightly high (at 70°F/20°C).
- n. **The unit may now be energized.**

13. REMOVAL OF THE EXPANSION CHAMBER AND PREPARATION FOR SHIPMENT

The expansion chamber is to be removed prior to any lifting or transport of this transformer.

- a. Remove the nuts, flat washers, and lock washers on four mounting studs. These are located on the diagonals. Look for slightly longer threads. Retain the hardware.
- b. Refer to Section 12b and Figure 09. Lift the expansion chamber 6" and place safety blocking between the expansion chamber and the spacer ring.
- c. Disconnect the two oil hoses at the quick-connect fittings and replace the protective fitting caps to prevent dirt and moisture contamination.
- d. Place the expansion chamber in the original crate or other suitable transport package.
- e. If the expansion chamber is to be dismantled for more than 72 hours, or if the average oil temperature is expected to change more than 20°F during the short storage interval, complete the following process:
 - i. Un-seal the fill plug on the porcelain cap to relieve internal vacuum or pressure and to allow oil flow.
 - ii. Drain 1-1/2 gallons (6 liters) of oil at the oil drain valve. **Avoid air entry into the drain valve.**
 - iii. Retain this oil in a clean dry container or in the expansion chamber.

- iv. Replace the fill plug on the porcelain cap.

- f. Pour the retained oil into the expansion chamber. For all temperatures, the oil level gauge should read at about 10:00 o'clock angle after transfer.
- g. Make certain all quick-connect fittings are wrapped or capped to prevent contamination by moisture, dust, insects, etc.
- h. Wrap a weather resistant cover over the porcelain cap.
- i. **The unit is now ready for local transport and storage.**



Caution - For long-distance transport or for rough roads:

- a. Wrap the porcelain in protective foam.
- b. Place a wind resistant cover over the weather resistant cover on the porcelain cap.

14. SSVT for internal arc protection (SSVT-IPC)

The SSVT-IPC is designed with an increased level of protection to safeguard against collateral damage from eventful failures for the safety-conscious users of SSVTs up to 170 kV. It meets the stringent requirements for Internal Arc Protection Class II, Stage 2 as outlined by both IEC 61869-1 and IEEE C57.13.5.

The housing is tested to stay intact during a 40 kA (rms) fault for a 300 ms duration, due to two Pressure Relief Devices (PRD), a polymer insulator, enhanced tank wall thickness, and an increased size and number of tank cover bolts. The dual PRDs also facilitate a rapid resealing of the tank to minimize environmental impact from oil contamination and reduce the risk of fires.

Instructions for the PRDs are provided separately.

ABB HVIT CONTACT INFORMATION

For any contingency not covered in this guide, please contact ABB HVIT at the location below for assistance. If the material requires return to the factory for any reason, please obtain a Field Discrepancy report (CCRP) number by contacting ABB HVIT prior to shipping the material back to the factory.

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