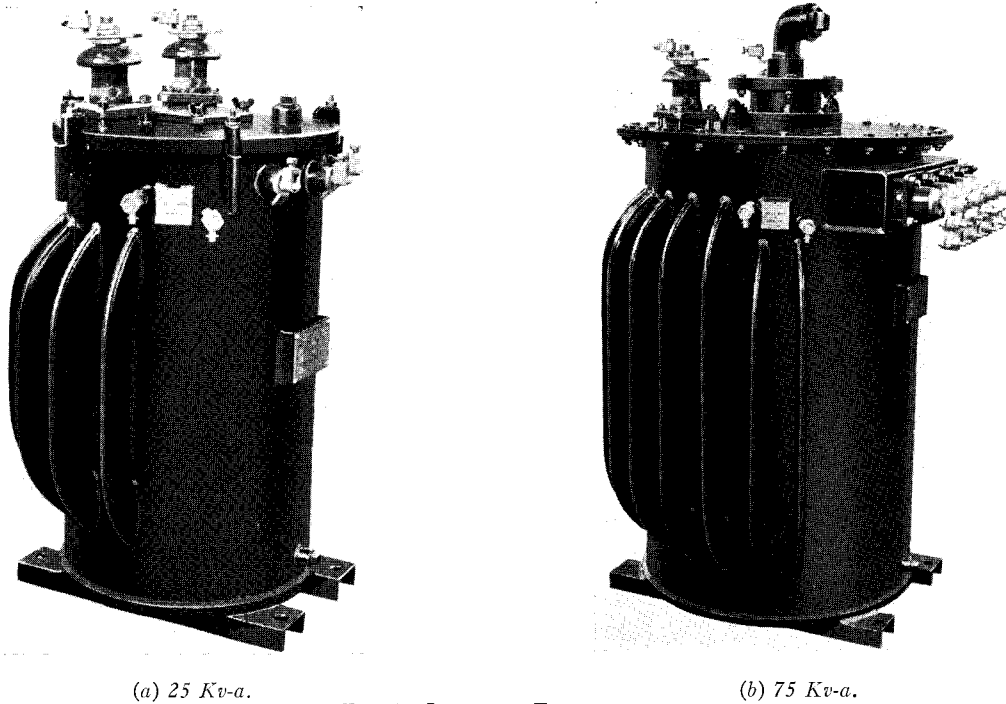


TYPE S INERTEEN TRANSFORMERS

INSTRUCTIONS



(a) 25 Kv-a.

(b) 75 Kv-a.

FIG. 1—INERTEEN TRANSFORMERS

GENERAL

Fig. 1 shows two completely assembled Type "S" Inerteen Distribution Transformers as they would appear when received by the Customer. Fig. 1(a) is representative of the smaller ratings, 25 Kv-a. and below, and Fig 1(b) of the larger ratings.

Type "S" Inerteen transformers are designed in voltage ratings from the 1.0 Kv. class to the 15 Kv. class. Bushings for the 5.0 Kv. class and above are cover-mounted. Low voltage bushings suitable for connecting to 120-240 or 240-480 volt circuits are brought through the tank-wall. All bushings are supplied with solderless clamp type connectors for connecting to the supply and feeder circuits.

All fittings are located on the L.V. side (front) of the transformer. The main drain plug is located on the front centerline at the bottom. The combined level indicator and sampling device is located at the upper left front. This device consists of two $\frac{1}{4}$ inch I.P.S. valves located at the cold (25°C.) and

hot (85°C.) Inerteen levels respectively. When the transformer is hot the sample should be taken from the hot level valve. The diagram nameplate (for standard voltage ratings only) is located on the front centerline of the tank approximately halfway between the cover and the bottom. The internal connections of the transformer are as shown on the nameplate. A filling plug in the cover is provided on all Type "S" Inerteen distribution transformers. Type "S" Inerteen transformers above 25 Kv-a. are supplied with a pressure relief device which is usually located on the handhole. A no-load internally operated tap changer is supplied on ratings that have taps.

SHIPMENT

In general, Type "S" Inerteen Distribution Transformers are shipped with Inerteen in the tanks. Under certain special conditions other methods of shipment may be required.

Type "S" Inerteen distribution transformers are shipped properly filled with Inerteen and ready for installation. Since all Inerteen transformers are sealed

tight there is practically no possibility of moisture entering the transformer during transit. Therefore, it is usually unnecessary to dry Inerteen transformers prior to installation.

Transformers equipped with switch or terminal chamber, which must be opened for installation, are always shipped with the Inerteen for these chambers in separate cans or steel drums.

Inerteen must always be kept in sealed containers to prevent the loss of its more volatile constituents by evaporation or possible contamination from dirt or moisture.

Special precautions must be observed in handling Inerteen. See section on "Handling of Inerteen".

UNPACKING

Since Type "S" Inerteen Distribution Transformers are usually shipped completely assembled, unpacking is a simple matter. The crating or bracing should be removed and the transformer is then ready for setting in place.

All boxes containing accessories must

Type S Inerteen Transformers—Continued

INSTRUCTIONS—Continued

be stored carefully and thoroughly protected against moisture.

When the transformer is unpacked it should be examined carefully to ascertain whether it has been damaged in shipment and whether all parts are in place and in good condition.

The inspection of Type "S" Inerteen transformers immediately after unpacking should include a check of the Inerteen level and at least removal of the manhole cover to determine whether any parts have become loose or out of place. The inside of the transformer should be inspected carefully for the presence of moisture. Insulation tests of the Inerteen should be made and if the dielectric strength is less than 22 Kv. or if there is any evidence of moisture, the transformer should be dried.

INSTALLATION

Location—Accessibility, ventilation and ease of inspection should be given careful consideration in locating transformers. Indoor transformers must be so located that water cannot fall on the case or rain blow in upon them.

Self-cooled transformers depend entirely upon the surrounding air for carrying away their heat. For this reason care must be taken to provide adequate ventilating facilities.

For indoor installation the room in which the transformers are placed must be well ventilated so that heated air can escape readily and be replaced by cool air from the outside. If the room is poorly ventilated the exchange of air takes place too slowly and the temperature of the air in the room may become excessively high. At any given load the temperature rise of a self-cooled transformer will be a fixed number of degrees above the temperature of the surrounding air. The temperature of the transformer is the sum of the rise and the air temperature; therefore, care should be taken to provide a room sufficiently well ventilated to permit operation of transformers at a reasonable temperature. The ambient temperature should not exceed 40°C.

Self-cooled transformers should always be well separated from one another and from adjacent walls, partitions, etc., in order to permit free air circulation about the cases. The separation should not be less than 24 to 36 inches depending on the size of the unit.

INSTALLATION OF TRANSFORMERS AND ACCESSORIES

CAUTION—Care must be taken in handling and installing transformers, particularly those wound for high voltage. As moisture is an enemy of insulation, a transformer should not be allowed to stand so that it can absorb moisture from the air or from any other source. A blow upon any part of the winding, stray pieces of solder or wire, tools, nuts, or foreign matter of any kind dropped into the transformer may cause a breakdown or burnout.

Setting Up—Where a transformer cannot be handled by a crane, it may be skidded or moved on rollers into place but in doing so care must be taken that it is not tipped over. A transformer with a round base is easily tipped over and should preferably be bolted to a temporary wooden frame or base before moving.

For convenience of handling, all cases are provided with lifting hooks or eyes, by means of which the case, transformer and Inerteen may be lifted and handled as a unit.

Precaution—When working about a transformer particular care must be taken in handling all tools and other loose articles, since material dropped into the windings and allowed to remain may cause a breakdown.

Before being set up, a transformer should be inspected for breakage, injury, or displacement of parts during shipment. It should then be tested for dryness and the condition of the Inerteen should be determined.

An outline drawing is furnished showing the relative location of all fittings and this should be followed in setting up. The outline drawing will also list special features requiring attention during installation.

Pressure Testing—All Inerteen transformers are pressure tested at the factory and shipped free of leaks. After installation and before voltage is applied, it is desirable to pressure test each transformer, especially if any fittings or covers have been removed and replaced during the installation. Dry compressed nitrogen or air should be used at a test pressure of 7 lbs. per square inch for a period of six hours. It is suggested that the air space above the Inerteen be blown out with nitrogen, all vents closed and the pressure test applied. The test

pressure can best be limited by the use of a regulating valve on the nitrogen cylinder. A check for leaks above the Inerteen level may be made with a solution of soap and water applied to all gasketed-joints, screwed-fittings and wiping-sleeve connections.

PLACING IN SERVICE

Relief devices found on transformers above 25 Kv-a. should be inspected for possible breakage before placing the transformers in service. This relief device consists essentially of a glass diaphragm clamped with gasketed pressure rings.

Type "S" Inerteen transformers have provision for making a pipe connection between the relief device and the outside atmosphere. A pipe plug will be found in the connection which is put in for protection during shipment only. Remove this plug and make pipe connection to the outside atmosphere. On outdoor Inerteen transformers it is merely necessary to open the vent pipe by removing the pipe plug. On indoor Inerteen transformers pipe connections from the transformer to outside are to be provided by the Customer when required. When this is done it is recommended that a tee connection be used in place of the elbow. Connect the vent pipe at the side and insert a pipe plug at the top. It is then only necessary to remove the plug to inspect the diaphragm.

When voltage is first applied to the transformer it should, if possible, be brought up slowly to its full value so that any wrong connection or other trouble may be disclosed before damage can result. After full voltage has been applied successfully the transformer should be preferably operated for a few hours without load. It should be kept under observation during the first few hours that it delivers load.

Although Inerteen has been tested for moisture prior to placing the transformer in service, it is advisable to again test the Inerteen for moisture after four or five days of service.

Grounding and Making Connections—No matter what the type of floor or foundation on which the transformer is to rest, the tank should be definitely and permanently grounded by connecting a lead to the tank base.

Terminal board, tap changer and other connections should never be

Type S Inerteen Transformers—Continued

INSTRUCTIONS—Continued

changed with voltage on the transformer. Make no connections except those indicated on the diagram or the diagram nameplate shipped with the transformer.

Any lead or connector not in use should be insulated from all other leads and connectors and from ground.

Paint—Inerteen Transformers are finished with a special Westinghouse paint M-7664-1, which is resistant to the solvent action of Inerteen. A sufficient quantity of this paint is furnished with each transformer to "touch up" any places damaged during the process of installation.

MAINTENANCE

Inerteen Equipment—Care must be exercised in handling Inerteen to prevent contamination since impurities alter its non-inflammable and electrical characteristics. It must be handled in thoroughly clean containers free from oil. If there is any question concerning the cleanliness of the containers, they should be thoroughly washed with Westinghouse Trichlorbenzene M-6872 and dried before any Inerteen is placed in them. The transformer tank or any of its compartments in which Inerteen is used, must be free from oil and other contaminating materials.

Inerteen should not be mixed with vegetable oils since these materials affect the deterioration, D.C. resistance and otherwise contaminate it. Compounds of asphaltic nature, paraffin and ordinary soldering flux are particularly harmful to Inerteen.

For soldering, a solution of rosin in alcohol is recommended.

An all-metal hose must be used in handling Inerteen since the lining used in most hose is soluble in Inerteen.

Filling Transformers—When it is necessary to fill a transformer with Inerteen one should make sure that all joints are tight; Westinghouse Cement M-7386 should be used for this purpose. Steel pipe or metal hose should be used, and preferably the transformer should be filled through the drain valve. This will keep aeration of the Inerteen to a minimum. See that air vents are open as the transformer is filled.

It is desirable to fill a transformer by passing the Inerteen through an Inerteen Conditioner. If this cannot be done and the Inerteen tests satisfactorily, fill the transformer by passing the

Inerteen through three thicknesses of tightly woven white cloth, which has first been washed in Trichlorbenzene M-6872 and dried to remove any sizing. New cloths should be used for at least every two transformers.

When it is necessary to fill Inerteen transformers out-of-doors and particularly on damp days due precaution must be taken to prevent the entrance of moisture into the transformer.

Filling Switch and Terminal Chambers—Care should be exercised when filling switch and terminal chambers with Inerteen, and during servicing to avoid contamination by moisture or dirt, which may lower the dielectric strength of the Inerteen. The moisture may be present during the filling operation due to condensation and absorption on the inside of the chamber walls, or may appear as vapor in the gas space above the Inerteen or from any minute leaks.

The use of bonded tubes of activated clay in Inerteen-filled chambers of transformers in service is recommended where routine tests show the Inerteen to have unsatisfactory dielectric strength.

The tubes should not be removed from their containers until the terminal chamber is ready for their installation. The tubes should not be exposed to air more than approximately thirty minutes before closing up the chamber preparatory to filling it with Inerteen unless they are first dried for two hours at a temperature of approximately 250°C. or for twelve hours at 135 to 150°C.

If it becomes necessary to drain the Inerteen or to open the chamber after a period of service, it is recommended that new tubes be installed. To do this, it is only necessary to remove the bolts holding the spring clips, remove the old and insert the new tubes, and replace the clips and bolts.

When an Inerteen Conditioner is not available for use in filling chambers with Inerteen, it is recommended that the Inerteen be strained through two or three layers of tightly woven white cloth and poured through a container in which three or four clay tubes have been broken into small pieces. This will materially reduce the possibility of contamination of the Inerteen from dirt and moisture.

Bonded clay tubes should be ordered as Style #1150140 from the Westinghouse Electric & Manufacturing Company, Sharon, Penna. It is also desirable

when ordering new tubes to identify the transformer for which they are required by including the serial number of the transformer.

Periodic Inspections

Inerteen—It is desirable that top and bottom samples of Inerteen be taken from each transformer and tested after a short period of operation. When operating conditions permit, routine sampling of the Inerteen at intervals of six months is recommended. Accurate records should be kept of such inspections and tests, and if the Inerteen shows a dielectric strength of less than 16 Kv. the Inerteen Conditioner may be used. This depends somewhat on the transformer load cycle and climatic conditions. If no facilities are available for making dielectric tests on Inerteen, samples should be sent to the Westinghouse Electric & Manufacturing Company, Sharon, Penna. Each sample of Inerteen should be properly identified by the transformer serial number and it should be recorded whether taken from the top or bottom of the tank or from a tank-compartment. Samples should be carefully packed to avoid breakage in transit. When any appreciable amount of Inerteen is removed from a transformer, it should be replaced with an equal amount of new Inerteen of proper dielectric strength so that the liquid level in the transformer is maintained.

Operation of Transformers—It is recommended that a periodic check be made of the operating temperatures of Inerteen transformers and that the temperature of the Inerteen be kept below 90°C. for a maximum-rated self-cooled transformer.

Paint—The external tank surfaces of Inerteen Transformers should be examined regularly for signs of corrosion. If appreciable corrosion is found, its cause should be determined and, if possible, remedied. Inerteen Transformer tanks are made from corrosion-resisting, copper-bearing steel, and they are finished with a high grade Inerteen-resisting paint which is baked on at high temperature. Any surface which is found corroded, should be thoroughly cleaned to the bare metal and refinished with one coat of Westinghouse paint M-6930, and two coats of Westinghouse paint M-7664-1. Allow twelve hours drying time between each coat of paint.

Type S Inerteen Transformers—Continued

INSTRUCTIONS—Continued

Gaskets

Gaskets used on Inerteen Transformers are made from a high grade of cork and, it is recommended, in replacing any gaskets that they be made of cork. Before replacing a gasket, all gasket surfaces should be thoroughly cleaned free of rust, oil, grease, paint or other foreign materials. The cleaning may be done by scraping or wire-brushing and then wiping the gasket surface with denatured alcohol.

Westinghouse Gasket Cement M-7386 especially developed for use with Inerteen, should always be used in applying gaskets. Thoroughly brush the cement on the tank surface and on the bottom side of the gasket. Place the gasket in position and apply weights or other means to obtain good adhesion of the gasket to the metal surface. The gasket should be allowed to set approximately one-half hour before the weights are removed. Cement M-7386 should then be applied to the top surface of the gasket. The gasket surfaces must immediately be bolted together under a uniform pressure.

Transformers are frequently equipped with terminal or switch compartments into which cables enter by means of potheads. In some cases, it will be necessary to remove the switch-cover to make the cable connections.

When transformers are designed for bayonet connections, it is only necessary to remove the bayonet pothead, make the cable connections and replace the pothead.

Extra gaskets and Cement M-7386 are furnished with all Inerteen Transformers where their installation requires the removal of any gaskets. Additional gaskets and cement should be ordered from the manufacturer.

Pipe Fittings

Care should be taken to see that threads of pipe fittings are not damaged. All threads should be thoroughly cleaned to remove dirt, grease, etc. After cleaning, apply Cement M-7386 to the threads of each fitting. Immediately screw the proper fittings together tightly.

Storage

Inerteen Transformers must always be stored filled to the proper level with

Inerteen, otherwise a certain amount of moisture may accumulate on account of variations of air temperature. Inerteen Transformers should be stored in a dry place, and where minimum temperature changes will occur.

Where it is necessary to temporarily store coils, insulation or other parts for the complete core and coil assembly of an Inerteen Transformer, they should be immersed in Inerteen to prevent moisture absorption. If such storage is necessary for a long period of time, the tank or storage container must be sealed to prevent the entrance of moisture and the evaporation of Inerteen.

Inerteen Transformers which have been idle or stored for an appreciable length of time, should be put into service only after making certain that the transformer is dry and that the dielectric strength of the Inerteen tests 22,000 volts or higher. The inspection instructions should also be followed.

Dielectric Testing of Inerteen

The same rules and precautions as normally followed in testing oil should be used in testing Inerteen, except as herein stated.

The test cup should be wiped with a clean, dry chamois and thoroughly rinsed with clean gasoline and allowed to dry before being used. The electrode spacing should be checked.

To determine whether the test cup is suitable for testing Inerteen, fill it with dry gasoline and test this under a standard voltage rise of 3 kv. per second. If the dielectric strength of the gasoline is not less than 22 Kv., the test cup is suitable for testing Inerteen, after the cup has been dried in an oven where the temperature does not exceed 50°C. to remove all traces of gasoline. Care should be exercised in handling gasoline as it is highly inflammable. In testing Inerteen, make only one "shot" per filling of the test cup. Five different fillings should be made and the average result used.

Drying and Filtering Inerteen

Inerteen may be dehydrated and filtered by means of an oil filter press but in order that it may not be contaminated, it is necessary that the filter press be used for Inerteen only.

A different procedure than that fol-

lowed for oil is required to purify Inerteen. Contamination in Inerteen cannot be removed entirely by filter paper alone. To clean Inerteen thoroughly it must be filtered through "activated clay" which absorbs impurities. In practice, it is only necessary to pass the Inerteen through the clay and to separate the clay mechanically from the Inerteen to obtain clean Inerteen of proper dielectric strength.

If Transformers Fail in Service

Should an Inerteen Transformer fail in service, the nearest Westinghouse Electric & Manufacturing Company District Office should be notified as soon as possible. Give the rating of the transformer and its serial number and, if possible, the conditions under which the failure took place. Samples of the Inerteen should be taken so that an analysis of it can be made. The transformer should be kept immersed in Inerteen and it is recommended that no work be done on the transformer except under advice from the District Office.

RENEWAL PARTS

When information is required concerning a transformer, always give its serial number, particularly whenever renewal or stock parts are ordered. The serial number will be found engraved on the nameplate attached to the transformer tank and on the small nameplate attached to the top or end of the core and coils assembly. Whenever possible, a sketch showing the part or parts and their exact locations, will materially help to assure that the proper parts are supplied by the Factory. This sketch should always indicate the direction or side of the transformer from which the view is made.

NOTE: Some transformers are ordered designed for Inerteen but are to be operated first as oil-insulated transformers. Consequently, they are shipped from the factory filled with oil. Whenever it is desired to operate these transformers with Inerteen, complete instructions for the removal of the oil, the cleaning of the transformer and filling it with Inerteen should be obtained from the Westinghouse Electric & Manufacturing Company, Sharon, Pennsylvania.

Westinghouse Electric & Manufacturing Company