INSTRUCTIONS

STANDARD OUTSIDE FINISH FOR INERTEEN TRANSFORMER TANKS

THE STANDARD outside finish for Westinghouse Inerteen transformers consists of three baked-on coats of a high grade paint which will resist the solvent action of Inerteen. Each coat is usually flowed on. The colors of the first, second and third coats are different so as to obtain a contrast between adjacent coats, thus insuring that each coat is continuous and of sufficient thickness.

The second or intermediate coat is a mixture of the primer and finish paints, one part primer paint to three parts finish paint by volume. These paints can be applied satisfactorily by flowing, dipping, spraying, or brushing.

The transformer tanks and many of the accessories attached, being constructed of steel, are normally susceptible to rusting. Therefore, in order to prevent rusting of exposed steel surfaces on all Westinghouse transformers, careful attention must be given to the following fundamental steps when repainting exposed steel surfaces:

1. All exposed steel surfaces must be thoroughly cleaned and prepared for the application of the protective coats of paint since the proper preparation of the surfaces to be finished is an important factor to securing satisfactory and lasting finish.

Regardless of how good the paint may be, it will fail as a protector if applied over a wet, dirty, rusty, or greasy surface. Rust and scale will absorb and hold moisture. Therefore, in order to obtain a durable finish, it is absolutely essential that no moisture be sealed in by the application of paint. For large areas, a clean dry surface with sufficient roughness for good adhesion of the priming coat can be obtained by shot or sand blasting the exposed surfaces of the transformer tank.

2. The careful application of a high grade durable quality paint that will resist the solvent action of Inerteen is essential to guarantee a lasting finish.

The two factors that determine the quality of any paint are the pigment and vehicle. The pigment gives the color and body of the paint and the vehicle holds the pigment particles in place and forms a continuous adherent film. Although attention is generally centered upon the selection of the pigment, many tests show that the vehicle of a paint is the first of these two components to disintegrate. Therefore, it is important that a paint of high quality be used to obtain a satisfactory finish.

The paint to be used for Inerteen transformers must meet the above requirements and also be able to withstand the strong solvent action of the Inerteen.

Important. Any portion of the paint film damaged during shipment or installation must be repaired as quickly as possible.

To do this, clean the damaged portion by means of scraper or sandpaper, applying a coat of primer paint and allow it to dry for at least 24 hours, then apply a coat of finish paint.

Note. For small marred spots which do not penetrate the paint film to the parent metal, only the finish paint is necessary. Due to the indefinite life of the primer, the finish paint should be applied as soon as possible.

A one-pint container of paint is furnished with each order of transformers for use in touching up any places damaged during shipment or during the process of installation. Larger quantities of Westinghouse paint can be obtained through the nearest Westinghouse Office. Westinghouse Primer Paint is not packaged in small quantities, but if required, can be purchased in the same manner.

WESTINGHOUSE ELECTRIC CORPORATION
SHARON PLANT • TRANSFORMER DIVISION • SHARON, PA.

NEW INFORMATION

APRIL, 1951
Printed in U.S.A.

OPERATION • MAINTENANCE

INSTRUCTIONS

OPERATION AND MAINTENANCE OF INERTEEN TRANSFORMERS

OPERATION

Entrapped air is a potential source of trouble in all transformers. In general, therefore, it is desirable to fill transformers with Inerteen under vacuum. This is done for all transformers shipped in Inerteen from the factory.

The filling of a transformer with Inerteen in the field should be done under as much vacuum as the tank is designed to withstand. This information will usually be found on the main instruction plate, but if it is not known, it should be requested from the Westinghouse Electric Corporation, Sharon, Pennsylvania. For instructions on filling with Inerteen under vacuum, see instruction leaflet "Installation of Inerteen Transformers". If the transformer tanks have not been designed for vacuum and it is imperative to get the maximum impulse strength immediately, the transformer should be filled with Inerteen under vacuum by placing it in an auxiliary tank. Transformers with round wire coils should always be filled with Inerteen under vacuum because of the higher stress across coil groups.

In those cases where the transformers are not filled under vacuum, full voltage should not be applied to the windings until inspection reveals that no more gas, in the form of bubbles, is being released from the core and coil assembly.

Inerteen Sampling. There is always a chance that moisture may get into the Inerteen after the transformer is installed so that a sample of Inerteen should be drawn from the top of the tank at least once every three months and tested for dielectric strength. See Instruction Book "Inerteen Insulating Fluid" for methods of testing and information on Westinghouse Inerteen testing service for operators who do not have the facilities for testing.

Temperature Readings. Thermometers should be read as often as good operating practice permits. Temperature limits for any specific condition of loading should be in accordance with ASA Standards and Guides for Operation (C-57) for the loading involved.

MAINTENANCE

Inspection. Transformers require less care and attention than almost any other kind of electrical power apparatus. This, however, is not a reason for neglecting them. The conditions under which they operate will determine to some extent the frequency with which they should be inspected. A regular program of inspection should be established and carried out rigidly.

It is desirable that periodic inspections of the Inerteen be made. Samples of Inerteen should be taken from each transformer and tested after a short period (approximately three months) of service. Following this, when operating conditions permit, routine sampling and testing of the Inerteen at intervals of six months to one year are suggested. Accurate records should be kept of such inspection and test and if the Inerteen shows a dielectric strength of less than 22 KV, it should be conditioned. See instruction leaflet "Inerteen Insulating Fluid" for information on conducting test on Inerteen and Westinghouse Inerteen testing service.

Any increase in operating temperature at normal load should be investigated and if the cause cannot be determined, the transformer should be taken out of service and given a thorough inspection.

Any symptoms, such as unusual noises, high or low Inerteen levels, operation of relief device, etc., should be investigated at once.

Transformers which have been subjected to unusually severe operating conditions, such as overloads, frequent short circuits, or special units should be inspected at least once a year. This can usually be done adequately by lowering the Inerteen level and inspecting with a light through the manhole. Before this inspection is made, the Inerteen should be allowed to cool to reduce the amount of Inerteen fumes given off which are quite objectionable and should not be inhaled.

During periodic inspection, all accessories should be inspected to see if they are operating properly.

Repainting. It is desirable to repaint the transformer at intervals to maintain the finish in good condition. Local climatic conditions cover such a wide range that definite recommendations as to frequency of repainting are not possible. Repainting by flowing on is preferable because it tends to wash off foreign material and produces a uniform coating. Equipment has been developed for flowcoating, cleaning, and handling transformers and parts in the field. The customer should write to the Company for details.

For details on paint in sufficient quantity for repainting complete transformers, write to the Westinghouse Electric Corporation, Sharon, Pennsylvania.

Caution: Activated clay if exposed to the atmosphere will absorb moisture very rapidly. If there is a perforated steel container of activated clay in the transformer and it is exposed to the atmosphere either by removing the core and coils or by lowering the Inerteen level, it should be thoroughly dried before it is again covered with Inerteen. Instructions for drying activated clay can be found in the Instruction Book "Inerteen Insulating Fluid".

Soldering. For soldering, a solution of resin in alcohol is recommended.

Spare Transformers. A spare transformer should be given the same routine checks as are given to transformers continuously in service. The internal parts should be kept free from the condensation and accumulation of moisture. To obtain the maximum advantage from the spare unit, it should be kept ready for instant service.

REPAIRING

With proper care, modern transformers seldom give trouble, but nevertheless, repairs are occasionally necessary.

Where severe arcing or burning has taken place, the bubbling process, for removing hydrochloric acid which may be formed, should be done as quickly as possible after the disturbance. For information on this process, see instruction book "Inerteen Insulating Fluid".

Other than the bubbling process, no general instructions will be given here for repairs of transformers. The operator may write to the Company, describing the nature of the trouble and the extent and character of the damage, and information and instructions for repair will be promptly and freely given.

In writing with reference to any transformer, always give the full name plate reading, as this furnishes accurate information for identification.

WESTINGHOUSE ELECTRIC CORPORATION
SHARON PLANT • TRANSFORMER DIVISION • SHARON, PA.
Printed in U.S.A.

INSTRUCTIONS

DETERMINATION OF DRYNESS AND METHODS OF DRYING OUT INERTEEN TRANSFORMERS

All transformers are dry when they leave the factory, but since they may absorb more or less moisture during shipment and storage, they should not be put into service until it has been determined that the Inerteen and insulation is dry enough for safe operation. The higher the voltage, the more chances there are of trouble from moisture, and the greatest care should be exercised to make sure that any moisture is eliminated.

TESTING FOR DRYNESS

When a transformer has been shipped assembled in its case with the Inerteen, four or five samples of the Inerteen should be drawn from the sampling device and tested. If the average of these tests shows a breakdown value of not less than 22,000 volts in a standard 1/10" gap test cup, the transformer is in a satisfactory condition for service. If the average breakdown value is less than 22,000 volts, the transformer must be dried. After the transformer has been in service for four or five days it is advisable to test the Inerteen again for moisture.

METHOD OF DRYING

Inerteen transformers should be dried by the short circuit method with the transformer immersed in the Inerteen and with the tank sealed tightly. During the drying out operation, the Inerteen should be circulated through a filter press or preferably through an Inerteen conditioner. A filter press will remove dirt and most of the moisture, but the conditioner will remove these and other contaminating materials as well.

The desired load current should be obtained by short circuiting one winding and impressing the proper impedance voltage on the other winding. The full load impedance may usually be found on the instruction plate for the transformers; if the impedance of the transformer is not known, it should be requested from the Westinghouse Electric Corporation, Sharon, Pennsylvania, by identifying the transformer with its serial number.

If the transformer is at or lower than room temperature at the start of the drying process, circulation of 125 to 150% of full load current will hasten the heating, and a higher top Inerteen temperature can be obtained more quickly by blanketing the coolers when tubular coolers are used or by shutting off the radiator valves when radiators are used. The cover should be lagged to prevent condensation.

The loading should be carefully watched and when the top Inerteen reaches a temperature of 60° C., the load should be reduced to obtain an approximately constant top Inerteen temperature based on the following table:

Short Circuit Amperes In Percent of Load	Maximum Temperature of the Top Inerteen
50%	85 C.
75%	80 C.
85%	75 C.

While the windings of the transformer heat up, do not permit the temperature of the top Inerteen to exceed the value specified for a given percentage of load. This precaution is necessary because the windings will heat up more quickly and operate at a higher temperature than the Inerteen. If the windings are allowed to reach too high a temperature, the insulation will be damaged. The drying of a transformer should be continued until the dielectric strength of samples of Inerteen taken from the transformer test at 30 KV or higher.

PRECAUTIONS IN DRYING OUT

The cover should be kept tightly sealed during the temperature run, and until the transformer has cooled down to room temperature to prevent condensation. This also prevents the release of hot Inerteen vapors which are quite objectionable, particularly if the ventilation is poor.

CAUTION: It is not safe to attempt the drying out of transformers unless constant attention is given to the job.

WESTINGHOUSE ELECTRIC CORPORATION
SHARON PLANT • TRANSFORMER DIVISION • SHARON, PA.

NEW INFORMATION

EFFECTIVE MAY, 1951
(Rep. 6-63) Printed in U.S.A

INSTRUCTIONS

INSTALLATION OF INERTEEN TRANSFORMERS

LOCATION

Accessibility, ventilation, and ease of inspection should be considered carefully in locating transformers. Another consideration often overlooked is noise; transformers should not be located on structural members that may transmit or near surfaces that may reflect and amplify the characteristic transformer hum. When it is impossible to locate otherwise and the noise may be a source of annoyance, transformers can be mounted on vibration dampeners. Wall, partitions, and ceilings can be covered with sound absorbing materials.

Inerteen transformers larger than 25 kva are equipped with a pressure relief device. If the device is mounted on the side of a tank or chamber, the transformer should be located so that the exhaust does not face an aisle or passageway. Where practicable for indoor installations or required by code, the relief device should be piped to the outside atmosphere.

Self-Cooled Transformers. 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.

An indoor installation requires that the room in which the transformers are placed must be well ventilated so that the heated air can readily escape and be replaced by cooler air from the outside. If the room is poorly ventilated, this 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 this rise and the air temperature; therefore, care must be taken to provide a room sufficiently ventilated to permit operation of transformers at a reasonable temperature. Area of the air inlets should be such that the ambient temperature never exceeds 40°C. (104°F.) with an average over twenty-four hours not exceeding 30°C. (86°F.); 50 to 60 square feet per 1000 kva of transformer capacity has been satisfactory. Outlet openings with the same total area should be provided.

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. This separation should not be less than 24 to 36 inches depending on the size of the units.

Water-Cooled Transformers. Water-cooled transformers depend almost entirely upon the flow of water through the cooling coils for carrying away heat so that the temperature of the surrounding air has little effect upon that of the transformer. For this reason ventilation is only of minor importance and other considerations should be used in locating water-cooled units.

FOUNDATIONS

Indoor transformers require no special foundation other than a level floor of sufficient strength to support the weight of the transformers.

Outdoor units should never be placed with their bases resting directly upon the ground due to the corrosive action of soil acids. For permanent installation a raised concrete or wooden platform is preferred, but for temporary installations a thick bed of cinders or crushed stone should be first laid down instead of setting the transformers directly on the soil.

Transformers should be located with the thermometers and liquid gauges to the front so that abnormal conditions can be noted readily by an attendant. The water flow gauges on water-cooled units should be easily observed in order that a failure of the water supply may be quickly detected.

SETTING UP

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

Caution: Care must be taken in handling and installing transformers, particularly those wound for high voltage. A blow upon any part of the winding; stray pieces of wire or solder, tools, nuts, or foreign matter of any kind dropped into the transformer may cause

sures at a temperature of approximately 25°C. before placing the transformer in service.

Grounding Transformer Tank. Regardless of the type of foundation or floor on which a transformer is to rest, the tank should be definitely and permanently grounded to eliminate the possibility of obtaining static shocks or being injured by accidental grounding of a winding to the case. A ground pad or lug is always provided near the bottom of the tank for the purpose of connecting the grounded lead.

Caution: A good low-resistance ground is necessary for adequate protection—a poor ground may be worse than none at all.

Grounding Low Voltage Winding. Every effort is made in insulating transformers to guard against any chance of breakdown between high voltage and low voltage windings; however, in order to be absolutely safe, it is advisable that low voltage circuits with which persons may come in contact be grounded. The maximum voltage that can be obtained to ground is then limited to the normal voltage that exists between the grounded point and the line; this is true even though the high voltage and low voltage windings become connected electrically.

In grounding the winding, the neutral point should be used if it is available. When transformers operate on single phase circuits with the middle point of the low voltage, the maximum voltage that can exist between any part of the low voltage circuit and ground is one-half of the low voltages.

MAKING CONNECTIONS

A diagram, usually on the metal instruction plate attached to the side of the case, shows the proper power terminal connections to be made for various voltages. Care should be taken to see that all connections and only those shown are properly made, for a wrong connection may cause severe damage. **Important: Terminal board, no-load tap changer, or other connections must never be made or changed when the transformer is energized.** Any lead or connector not in use should be insulated from all other leads and connectors and from ground.

Some installations require an auxiliary source of power or control leads to be wired to terminals at the transformer; a wiring diagram, either a separate drawing or included as part of the outline drawing, show the connections to be made.

Voltage Application. 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 operated without load for a few hours. It should be kept under close observation during this time and also during the first few hours while loaded.

WESTINGHOUSE ELECTRIC CORPORATION
SHARON PLANT • TRANSFORMER DIVISIONS • SHARON, PA.

(Rep. 3-64) Printed in U.S.A.

INSTRUCTIONS

SHIPMENT OF TRANSFORMERS IN INERTEEN

TRANSFORMERS shipped in Inerteen are usually in their own tanks and are filled to the proper operating level. Sometimes other requirements make it desirable to ship them in special tanks filled with Inerteen to cover the transformer assembly; when this must be done the purchaser will be consulted prior to shipment to be sure that facilities are available for the transfer from shipping to operating tank.

The general practice is to ship as many detail parts and bushings in place as is safe and as shipping clearances will permit. Bushings or other detail parts when removed are boxed separately and are to be mounted when the transformers are installed.

The transformer core is always braced or tied securely to the tank wall to take care of shocks received in shipment. If the transformer is removed from the tank for inspection during installation, it is unnecessary to replace the tie plates if there is no possibility of reshipment.

Sometimes special blocking or bracing may be used that interferes with normal operation; it is essential that this bracing be removed before the transformers are placed in service. Where special bracing must be removed, the outline drawing will contain notes of instructions regarding it. The outline drawing should always be checked for such instructions.

Radiator type coolers are always removed and crated before shipment; the radiator flanges on the tank wall are sealed with blind flanges to prevent the accidental loss of liquid from the tank. Valves are built into the radiator flanges making it unnecessary to drain the Inerteen when radiators are installed; sufficient additional Inerteen to fill the removed radiators is shipped in sealed drums.

When switch or terminal chambers are furnished that must be opened for installation purposes, the Inerteen for them is usually shipped in separate sealed containers to avoid frequent handling and possible contamination by moisture or dirt.

Core Form Transformers. In most cases core form transformers can be shipped in their own tanks in an upright position.

Occasionally, it is necessary for large transformers to have a horizontal joint in the tank so that the top section can be removed for shipment. Either the regular cover or a special shipping cover is bolted on top of the lower tank section. If the cover is special, it may be an inverted box-like structure which makes room for terminal boards, etc., that extend up beyond the top of the lower tank section and is usually filled with liquid to a point above the joint in the tank. Care must be taken to lower the level of the Inerteen below the joint before removing this cover.

Shell Form Transformers. Shell form transformers are usually made with form-fit tanks; transformers may be shipped in the upright position or lying down in a horizontal position. The bracing for units in form-fit tanks is usually arranged so that it need not be removed. In exceptional cases, particularly when the transformer is shipped horizontally, it may be necessary to use additional internal bracing. In these cases the outline drawing will contain notes calling attention to the necessity for removing any special bracing.

Occasionally, shell form transformers are placed in rectangular tanks. Large size units may require sectionalized tanks with special covers to meet height limitations for shipment. If a hat-shaped cover is used, care must be taken to lower the level of the Inerteen below the joint before removing the cover. The outline drawing will indicate when special covers are used in shipment.

UNPACKING

When a transformer is shipped complete and in its own tank with Inerteen, unpacking is a simple matter. It is ready to be set in place when the crating or bracing is removed.

Before unpacking, the transformers should be carefully examined to ascertain whether it has been

damaged in shipment and whether all parts are in place and in good condition. In cases where damage is self-evident or parts are obviously missing, a claim should be filed at once with the carrier, and the Westinghouse Electric Corporation should be promptly notified.

Should the transformer be shipped with Inerteen in a special tank, the shipping tank should not be opened until the transformer tank is in place ready to receive the transformer. In order to avoid condensation, the shipping tank should not be opened until the temperature of the transformer is the same or higher than the surrounding air temperature. The greatest care should be taken to avoid getting moisture in the transformer while transferring it from the shipping tank to its own tank.

All bushings and accessories when shipped separately should be protected against moisture until they are installed. During the installation of these parts, care should be exercised to protect the transformer against the possibility of the entry of moisture. As an extra precaution against moisture having entered during shipment or installation, the dielectric strength of the Inerteen should be tested before the transformer is put in service. The dielectric strength of the Inerteen when tested in a standard test cup should not be less than 22 KV. Tests lower than this are indicative of contamination or moisture and the proper corrective steps must be taken as described in the instruction leaflet "Inerteen Insulating Fluid".

HANDLING

For convenience in handling, all transformers are equipped with lugs or eyes for lifting and moving the complete assembly filled with Inerteen by use of a crane. Additional means are provided for the heavier parts such as covers, core and coils, radiators, and terminal chambers. Jacking lugs are also supplied on either the base or corners of the tank. A transformer should only be lifted or moved by jacks placed against these lugs and not against the cooling tubes, radiator valves, or other fittings.

Where a transformer cannot be handled by a crane, it may be skidded or moved on rollers, but in doing so, care must be taken that it is not tipped over. Bases are constructed to permit movement on rollers in any direction. Transformers with a round base are easily tipped and should preferably be bolted to a temporary wooden frame or base before moving.

When lifting a core and coil assembly, it may be necessary to use a spreader to prevent the sling ropes or chains from pressing against the terminal board or insulation and damaging them.

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SHARON PLANT • TRANSFORMER DIVISION • SHARON, PA.
(Rep. 6-63) Printed in U.S.A.