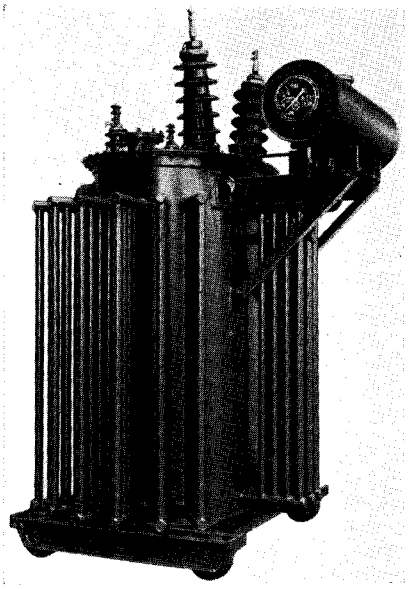
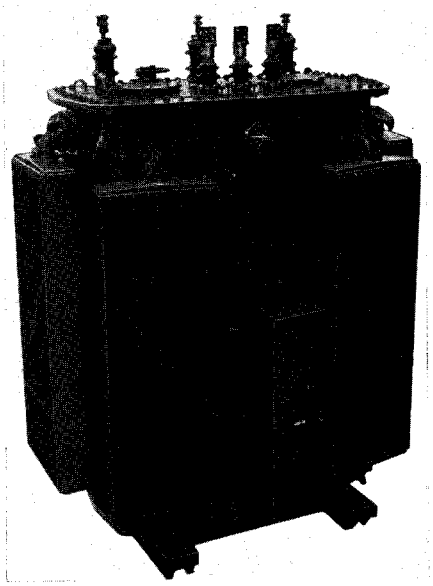
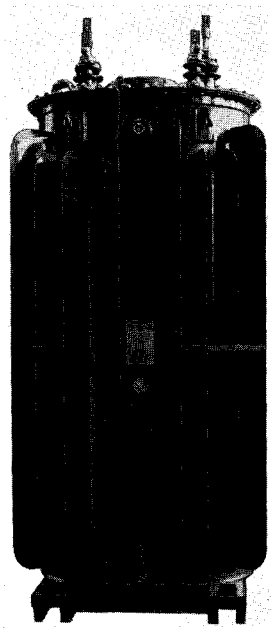
Type SL Power Transformers
INSTRUCTIONS



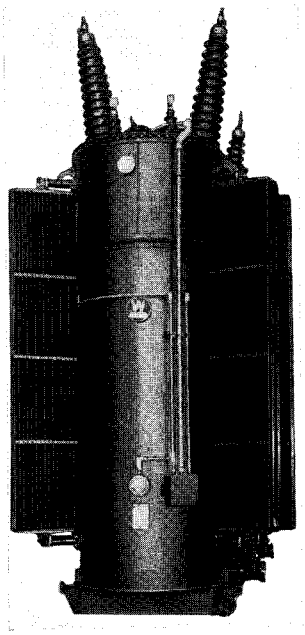
(a) SL Power Transformer Tubular Cooler



(b) SL Power Transformer Radiator Cooler



(c) SL Power Transformer Fin Cooler



(d) SL Power Transformer Radiator Type Cooler

FIGURE 1

GENERAL

Fig. 1 shows typical power transformers as they appear after being set up. When shipping clearances permit, transformers are shipped with bushings and fittings in place.

All bushings on standard power transformers are brought through the cover. Condenser or bulk type bushings are supplied depending on the voltage class. For detailed description of bushings, see Instruction Leaflet for bushings.

The type of cooling supplied with any transformer depends on the Kv-a rating and on special customer requirements. Tubular coolers, tubes, fin coolers and radiators are commonly used.

Standard fittings are supplied and

Type SL Power Transformers—Continued

INSTRUCTIONS—Continued

standard location is followed except as modified by special requirements. The drain valve is located at the bottom of the tank on the centerline of the L.V. side (front). The sampling valve is located to the right of centerline on the low voltage side. The lower filter press connection may be formed by a reducer in the main drain valve or it may be a separate valve. When a separate lower filter press valve is supplied it is located near the bottom of the tank to the left of the drain valve.

The upper filter press valve supplied on all power transformers is located to the left of the front centerline and slightly below the oil level except for transformers with expansion tanks. If the transformer is equipped with an expansion tank, the upper filter press valve is located on the expansion tank. See Instruction Leaflet 3194. Large power transformers are supplied with an intermediate filter press valve. The intermediate filter press valve is located on the side opposite the drain valve at approximately one-fourth the tank height. The oil gage is located on the centerline near top of the tank. The diagram nameplate is located at eye level and to the left of the centerline. The dial type thermometer is located to the left of the front centerline. For small power transformers the dial type thermometer is of necessity located near the oil level since a connection through the tank wall is provided at the thermometer. On the larger power transformers thermometers are supplied with a connection through the cover. With this arrangement the thermometer is located on the front of the tank at eye level. For special instructions covering dial type thermometer, see Instruction Leaflet for Thermometers.

Fittings found on the cover of Type SL Power Transformers are a pressure relief device, no-load tap changer operating mechanism and in general a thermometer connection. For description of relief device, see Instruction Leaflet for Relief Devices.

Certain special fittings are supplied with power transformers depending on the Kv-a rating. Transformers 2000 Kv-a and below are Sealdaire construction. Transformers above 2000 Kv-a are supplied with Inertaire equipment. Another special fitting is the hot spot thermometer. Its location is on front of tank to the left of the centerline. See Instruction Leaflet 3225 describing hot spot thermometer furnished with all transformers having this special fitting. Hot spot thermometers are furnished when ordered special by customer. Hot spot indicators may be supplied with switchboard connection. In this case, consult Instruction Leaflet 3226 describing switchboard type hot spot indicator.

SHIPMENT

Methods of Shipment

Transformers may be shipped by any one of a number of methods. The method used in a particular case depends upon the size of the transformer, type of case, transportation facilities from factory to destination and convenience in installing. The methods commonly used are:

1. Shipment in oil.
   - (a) Assembled in own case.
   - (b) Assembled in special shipping tank.
2. Shipment in dry nitrogen.
   - (a) Assembled in own case.
   - (b) Assembled in special shipping tank.
3. Shipment with oil in air.
   - (a) Assembled in own case.
   - (b) Assembled in special shipping tank.
4. Boxed and shipped separately from own case.
5. Shipped completely dismantled.

Transformers are generally shipped by the first method unless shipping clearances prevent.

Transformers equipped with radiators are usually shipped by method No. 1(a) or 2(a), but with some or all of the radiators removed. The radiator flanges on the tank are covered by blind flanges or by radiator valves and blind flanges. The detached radiators are always crated and shipped separately.

Where radiator valves are used it is unnecessary to drain the oil from the tank to install the radiators. See Leaflet on radiator valves.

When method No. 2, 3, 4 or 5 is used the oil is shipped in tightly sealed metal drums or tank cars.

Transformers which are too high to ship standing up may sometimes be shipped by methods No. 2 or 3 by laying them down on the car. In such cases special bracing must be placed inside the tank. This bracing must be removed when the transformer is installed, unless specified otherwise on the outline drawing of the transformer.

On the larger transformers the bushings are always shipped separately. The openings in the cover or tank walls are covered with blind flanges for shipment. The bushings and all details such as thermometer, oil gages, hot spot temperature equipment, Inertaire or expansion tanks are always boxed separately and are to be mounted when the transformers are installed.

When methods No. 1 and 2 are not practicable, transformers may be shipped without oil as in method No. 3, sealed with atmospheric air in its own case or in a shipping tank.

With methods No. 1 and 2, it is frequently necessary with large transformers to have a joint in the tank so that the top section may be removed for shipment. Either the regular cover or a special shipping cover is bolted on the top of the lower section of the tank for shipment. If a special cover is used it is sometimes made with a box-like structure which makes room for terminal boards, etc., which extend up beyond the top of the lower section of the tank. If shipped in oil, this tank is usually filled until the oil extends up into this box. Care must be taken to lower the oil below the joint before removing this cover.

Some of the bracing in a transformer is put on for shipment only. The transformer core is always tied securely to the tank wall in large transformers 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 these ties.

It is sometimes necessary to ship transformers by some method other than

Type SL Power Transformers—Continued

INSTRUCTIONS—Continued

shipping in oil in its own tank. If a special method of shipment is required a leaflet will be included describing the shipping and unpacking procedure.

UNPACKING

Transformers Shipped with Oil or in Air

When a transformer is shipped assembled either with or without oil, unpacking is a simple matter. The crating or bracing should be removed and the transformer is then ready for setting in place.

When shipped separate from the case, the transformer should not be unboxed until preparations have been made for drying out or until the case is in place ready to receive it. It should not be opened until the temperature of the transformer is the same as or higher than the air temperature.

During the time that the boxed transformer is stored, it must be kept in a dry place and not allowed to stand where it is exposed to dampness or weather.

All boxes containing accessories must 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.

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 into or 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 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 the rise and the air temperature; therefore, care must 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. This separation should not be less than 24 to 36 inches, depending on the size of the units.

Fire Risk—While the oil supplied with Westinghouse transformers will not take fire readily, it should be remembered that the possibility of catching fire is ever present and some precaution against fire should be taken. Transformers may be placed on a concrete floor surrounded by a ledge. Suitable means should be provided for drawing off the oil and extinguishing the fire.

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 oil may be lifted and handled as a unit. Jack lugs are also provided on the base or tank wall for lifting the complete unit. Do not use jacks on any part of the transformer except on lugs provided for this purpose.

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 oil 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.

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.

When a transformer has been shipped in its case with the oil, it should be inspected for breakage, injury or displacement of parts during shipment. This can generally be done without removing any of the oil. A sample of oil should be drawn from the bottom of case and tested. If the inspection and oil tests are satisfactory, the transformer is ready to be put into service. If the oil tests too low, it will have to be filtered and it may also be necessary to dry out the transformer. Whether drying will be necessary can be determined by the Megger test.

Connections—The diagram, usually on a metal plate attached to the side of the case, shows the terminal connections for various voltages. Care should be taken to see that all connections are properly made, as a wrong connection may cause serious damage or a burnout. Then with the outlet bushings in place, the high voltage and low voltage leads should be connected to their proper terminals.

In condenser type transformer bushings, the lead is sometimes drawn up through the central tube by means of a piece of string or twine and fastened at the top. Be sure that all bushings and terminals are screwed up tightly so they cannot work loose.

Type SL Power Transformers—Continued

INSTRUCTIONS—Continued

PLACING IN SERVICE

Operation

General—After a transformer has been set up, full voltage should not be applied to the windings for several hours after the oil has been put in the case. This time is necessary to allow the air bubbles to escape. This is particularly important for line voltages of 88,000 volts and above.

Filling under a vacuum is recommended for large high voltage transformers. For procedure in such cases refer to the manufacturer.

When the 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 preferably in that way for a few hours without load. It should be kept under observation during this time and also during the first few hours that it delivers load. After four or five days' service it is advisable to test the oil again for moisture.

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 rigidly carried out.

The oil should be tested for dielectric strength and the presence of sludge. If there is an indication of moisture or sludge formation, the oil should be tested further and treated as described in Instruction Book 5336. If tests show the oil to be in bad condition an inspection should be made on the inside of the tank for possible cause of the trouble. However, if the oil tests satisfactorily the case should not be opened but a careful inspection of all accessories should be made to see that they are functioning properly. Transformers equipped with the Inertaire device cannot have sludge formation since oxygen is excluded. The record of deoxidizing compound, or nitrogen gas consumption should be studied and if excessive the case should be tested for leaks as described in Instruction Book 5592.

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 oil levels, rupturing of relief diaphragm, 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 such as furnace transformers should be inspected internally at least once a year. This can usually be done adequately by lowering the oil level and inspecting with a light through the manhole.

OIL

The oil used with Westinghouse transformers should be that which is supplied with them or an oil specifically approved by the Company. Westinghouse transformer oil is shipped either in the case with the transformer, in tank cars or in steel drums provided with screw bungs, which are sealed before shipment. All oil should be carefully inspected and tested before using. For methods of handling and testing oil, see Instruction Book 5336 on this subject.

TEMPERATURE READINGS

Thermometers should be read daily or more often. If, at rated load or less, the oil temperature reaches 80°C. for an oil-immersed, forced air-cooled transformer, it is advisable to check operating conditions.

Oil-immersed, self-cooled transformers or oil-immersed forced air-cooled transformers should not be operated for long periods of time at oil temperatures in excess of 80°C. on account of increased rate of deterioration of the insulations. The oil temperature in these transformers should not be allowed to exceed 90°C. even for short periods of time.

RENEWAL PARTS

The spare parts for SL power transformers are described in detail under the section covering the component parts of SL power transformers. It is recommended that a spare set of bushing and handhole gaskets be carried in stock. Other spare parts described in individual leaflets may be carried, if desired.

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

SERVICE DEPARTMENT

This company maintains a Service Department for the purpose of giving service to customers. It is recommended that questions of installation, operation or maintenance which are not covered in this instruction book, be taken up with the nearest Service Department or Sales Office.

Westinghouse Electric & Manufacturing Company

Sharon, Pa.

Westinghouse Press
Printed in U.S.A. (Rep. 9-42)