DESCRIPTION • INSTALLATION • MAINTENANCE

INSTRUCTIONS

WESTINGHOUSE RADIATORS

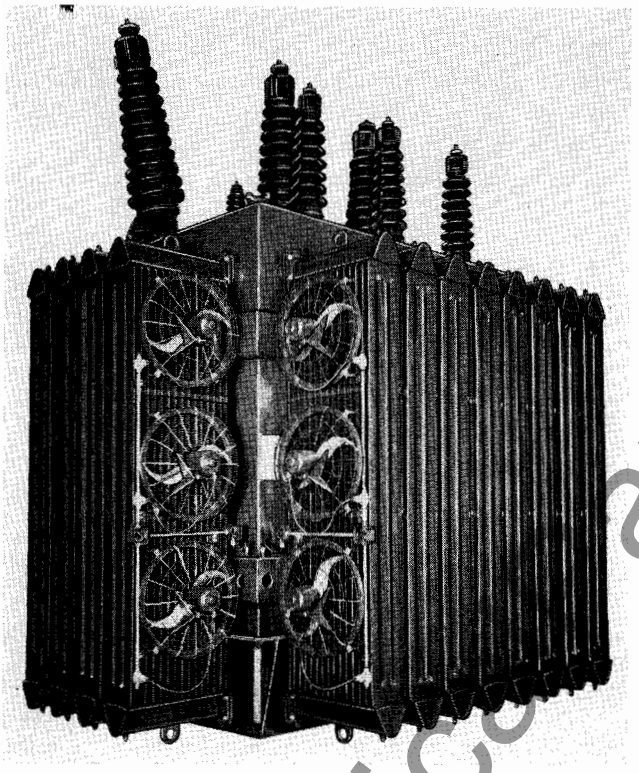

FIG. 1. Westinghouse Single Radiators Mounted Perpendicular to the Wall of a Form-Fit Tank

THE WESTINGHOUSE RADIATOR is a highly efficient cooling unit which is designed for use on large self-cooled transformers where high cooling capacities are required. It is detachable and may be removed for shipment, which reduces shipping clearances and relieves tank wall stresses which might develop due to sudden shocks in transportation.

DESCRIPTION

The radiator is of all-welded sheet metal construction, with vertical cooling sections through which the oil circulates and is cooled. A formed metal header, welded to each end of the assembly of sections, complete the structure and provides connections for the fittings which attach the radiator to the tank.

The individual sections are made from two flat sheets of steel of the same length, each of which is 11⅝ inches wide. To secure different lengths of radiators, these assemblies are made in lengths from four feet to fourteen feet, varied in steps of approximately one foot. The side edges of these sheets are welded together by an automatic resistance seam welding machine. Welded seams are made along the centerline the entire length of the section except for about six inches at each end. Air pressure is applied at one end of an element so that the sheets are forced apart and given a permanent set, where not restrained by the welds, to limits imposed by a restraining mould, thus forming the ducts for oil circulation.

The ends are then sheared off and formed as shown in Fig. 3. This forming of the ends provides a means for proper spacing of sections, external welding surfaces and a "hip roof" shape which eliminates horizontal surfaces between sections and insures complete drainage. The formed header is welded to the formed ends of the section assembly, thus completing the structure and providing means of attaching the radiator to the transformer tank.

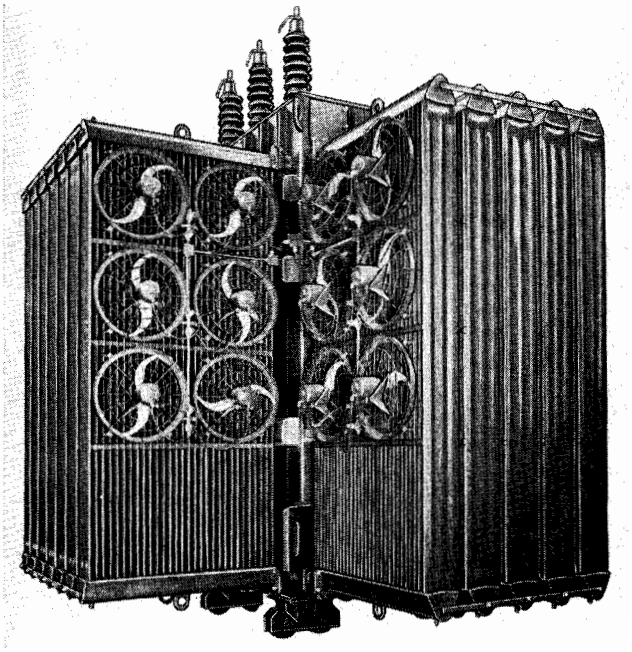

FIG. 2. Westinghouse Double Radiators Mounted Perpendicular to the Wall of a Form-Fit Tank

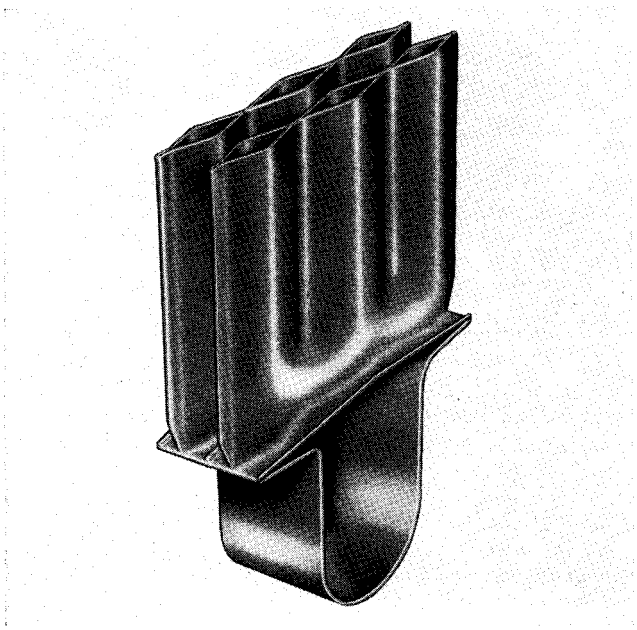

FIG. 3. Radiator Section Showing Joints Formed With Outside Welds

All joints are formed with outside edge welds which are reliable, easy to make, and permit a damaged joint to be repaired easily. Edges are trimmed and rounded for better paint adhesion. In order to produce an all over better paint job, each radiator is given a heavy phosphate coating. Then it is given one coat of primer, followed by two coats of finish paint. Each coat of paint is applied by the flow coat method and baked on in an infra-red lamp oven.

In flow coat painting, the paint is actually flowed over the surface and the surplus allowed to drain back into the main paint reservoir. This method insures complete and even paint coverage with a maximum thickness.

The "hip roof" surfaces between sections and the sloping surfaces on the caps contain no flat surfaces where water can collect and cause rusting. The weld between the sections and the header is scalloped between sections so that any bead formed by the welding operation will be depressed, insuring that no water can collect at this point.

INSTALLATION

Receiving, Handling and Storing. The usual practice is to ship all radiators with all openings on the tank and radiators protected with blind flanges. The blind flanges and shipping gaskets are for shipment only and must be replaced by the gaskets supplied for permanent mounting. Sufficient gasket cement M# 7386 and cadmium plated bolts, nuts and lock washers are also furnished for permanent mounting.

Important: Do not remove the blind flanges until ready to install the radiators. Dirt and moisture must be kept out of the radiators.

Unpacking. When unpacking, lifting or handling the radiators, care must be taken to prevent scratching the paint or damaging the radiator elements. An ample supply of grey touch-up paint is furnished to repaint any minor scratches. This paint should be applied as the radiators are being prepared for mounting. It is recommended that the radiators be lifted from the shipping crate using manila rope with sling spreaders to prevent damaging the radiator elements.

Installing Single Radiators. It will be found most convenient to place the radiator across suitable supports when preparing it for mounting to the tank.

First, remove the blind flanges from a radiator and clean the gasket grooves and flange faces of all paint, varnish, gasket material, etc.

Second, remove the blind flanges from a set of valves on the transformer tank and clean the gasket grooves and flange faces. Apply a liberal coating of gasket cement M# 7386 to the gasket grooves, gaskets and mating surfaces of the radiator flange; again allow the cement to become tacky before mounting the radiator to the tank. Be sure the 3/4 inch studs are screwed tight against the shoulder on the stud before mounting the radiator.

Now lift the prepared radiator by the lifting eye in the top header and swing it into position over the valves.

Lifting of the radiator can be accomplished by using an overhead crane, an A-frame with block and tackle or by block and tackle to the station superstructure.

The weight of a single radiator assembled with elbows is 540 pounds (6 feet length); 760 pounds (9 feet); 980 pounds (12 feet); 1120 pounds (14 feet).

Installing Double Radiators. The procedure for mounting double radiators is essentially the same as for single radiators. The end spacer strips may cause some difficulty if they are not bolted into position before the radiator assembly is drawn down tightly to the tank. Caution must then be exercised to insure a good metal-to-metal contact between the header and the tank valve body.

All other preparation and mounting details remain the same as for single mounted radiators.

Filling of Radiators. To fill a radiator, turn the bottom valve to the open position as indicated on the operating arm and thus allow the liquid from the main tank to flow into the radiator. Secure the valve in this open position by means of the brass thumb screw. Next, open the top valve and allow the entrapped air to escape. Care must be taken that the terminal boards or bridge work of the transformer are not exposed above the liquid in this operation. If there is danger of exposing the terminal boards or bridge, liquid should be added to replace that required to fill each radiator.

After all radiators have been filled the normal liquid level should be restored as soon as possible or within a couple of hours.

Radiator Removal. Should it become necessary to remove a radiator, first close the valves top and bottom. Lock the operating arm in the closed position with the brass thumb screw. Finger tightness will provide sufficient pressure to seat the valve. Next, drain the liquid from the radiator by removing the 3/4 inch drain plug from the bottom header and the 3/4 inch vent plug from the top. After the liquid has been removed from the radiator, proceed to dismantle. If the radiator is to be left off for any length of time the transformer valves should be gasketed and covered with blind flanges. The openings in the radiators should also be gasketed and flanged to keep out dirt and moisture.

MAINTENANCE

The only maintenance required for the radiators consists of repainting or touch up, to keep the surface free from rust. The radiator element wall is of a necessity thin in section for proper cooling, and being of steel construction, is susceptible to rust and possible rupture, unless protected by a good paint finish. The open element construction permits thorough cleaning of all surfaces for repaint or touch up. This ease of accessibility insures a better finish, longer radiator life and the least possible cost of maintenance. Standard finish paint for transformer tanks can be applied as touch-up paint.

A special cleaning tool has been developed for removing rust spots or preparing the radiator surface for painting. For information about this tool, refer to Transformer Renewal Parts Catalog E-1-11.

If the packing gland at the valve operating arm leaks and requires tightening it is necessary to remove the external arm (remove one screw) to get access to the gland nut.

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FORCED-AIR COOLING EQUIPMENT UNIT FAN ASSEMBLY

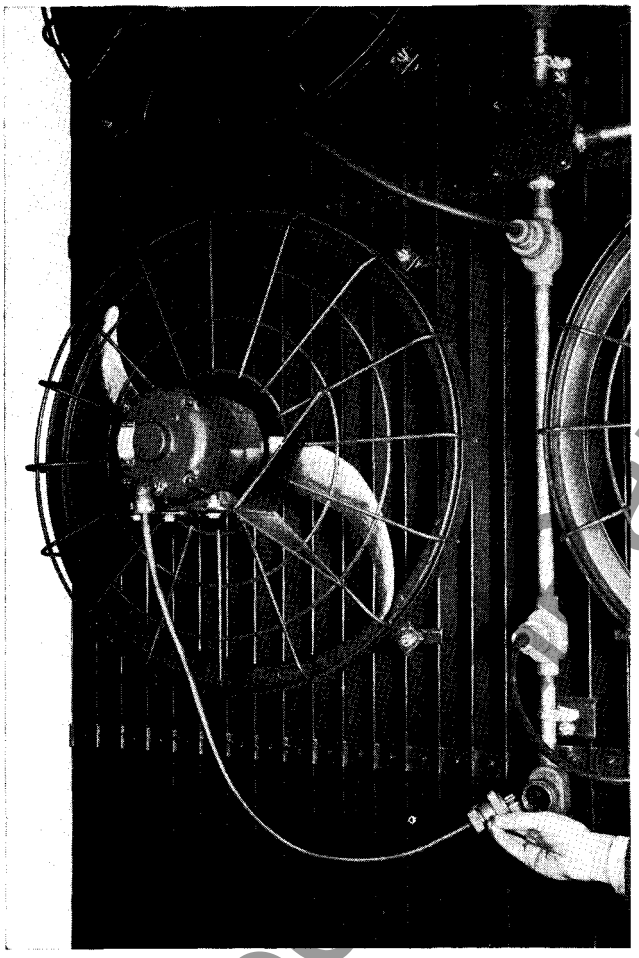

FIG. 1. Bank Type Radiator Forced-Air Equipment.

Westinghouse manufactures three types of forced-air cooling equipment for use on OA/FA (oil-insulated air-cooled, forced air-cooled) transformers: The bank type for radiators, the cooler tube type, and the portable type. The control equipment for all types is the same. An occasional inspection and greasing of motors is required after installation, as described later.

Standard unit fan assemblies are furnished with 1/4 HP motors, single or three-phase. Single-phase motors are capacitor-start, capacitor-run, with the capacitor mounted in a cylindrical case attached to the motor. Both single and three-phase motors are equipped with internally placed thermoguards for protection.

Fan motors are wired in parallel; each motor is equipped with a polarized weatherproof attachment plug that can be disconnected from the supply line by turning counterclockwise and pulling out. Individual motors may be disconnected without disturbing the wiring in the supply line.

Bank Type Radiator Forced-Air Equipment. The bank or multi-fan unit type forced-air equipment consists of a number of fans mounted on the side of the first of a group of radiators. Such an arrangement is shown in Fig. 1.

The Westinghouse type radiator with its expanded cooling elements arranged in parallel rows provides a group of continuous ducts. The blast of air from the fans is directed through this duct system, thereby greatly increasing the normal convection characteristics.

This type of forced-air equipment is applicable only to the Westinghouse radiator. The radiators must be mounted in alignment in banks to provide the proper duct system.

Tube Cooler Type Forced-Air Equipment. The tube cooler type forced-air equipment consists of unit fans which are mounted near the bottom of the tank and under the tubular cooling elements. The air stream is directed upward so that the natural convection of both the tubes and tank wall is increased.

Fig. 2 shows the arrangement of this type of auxiliary equipment.

Portable Type Forced-Air Equipment. The portable type forced-air equipment consists of a complete fan and guard assembly mounted on a

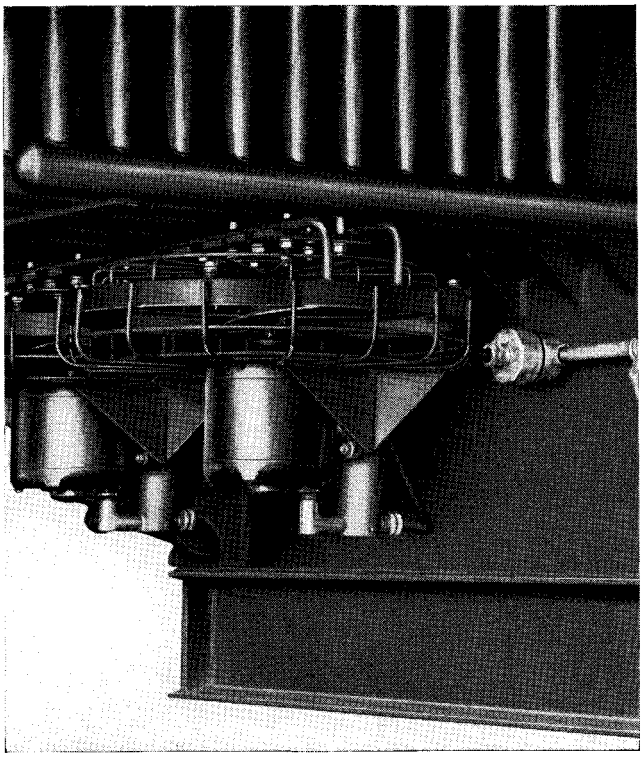

FIG. 2. Tube Cooler Type Forced-Air Equipment.

fabricated steel stand. The unit is designed for use as an auxiliary source of forced-air equipment for miscellaneous types of apparatus. It may be used with effect for any type of radiator or cooling system that normally depends upon natural convection for heat dissipation.

The air stream may be directed at any angle from downward to upward by adjusting the fan mounting. Fig. 3 shows this type of equipment.

The unit may be placed in service as a temporary or permanent installation for either indoor or outdoor use. Standard automatic or manual control is available for Westinghouse transformer application.

INSTALLATION

It is usually necessary to remove radiators for shipment due to railroad clearance limitations. Before the radiators are assembled on the transformer, a careful study of the outline drawing and the actual job should be made. The outline shows the proper height for the location of banked fans. Banked fans are usually shipped properly located and attached to one or more radiators, depending upon the number of banks.

Some shipments of assembled fans and motors are made with the fan and shaft braced to prevent vibration during shipment. Be sure all shipping straps or braces are removed, and that the fan turns freely when it is put into operation.

Mount the radiators and cooling fans, the control cabinet, conduit and connections as shown on the outline drawing.

The hot oil thermometer (which also contains the thermal switch for activation of air blast fans) is sometimes removed for shipment. In this case it is necessary to install the thermometer in the well on the side wall of the transformer and connect the flexible alarm cable to the conduit or tank brace.

An oil-tight well is provided to permit installation and removal of the thermometer without lowering the level of the oil inside the transformer tank. This is a close, smooth fitting well and requires no liquid between the bulb and the wall. See Fig. 4.

The power connections to the panel are to be made as shown on the forced-air wiring diagram, a copy of which is included in the complete Transformer Instruction Book.

Control Panel. The forced-air control panel is located in a weatherproof cabinet which is attached to the tank wall. There are two types of panels:

Type A, (For Standardized Transformers). The 220 volt, 60 cycle, single-phase panel for auto-

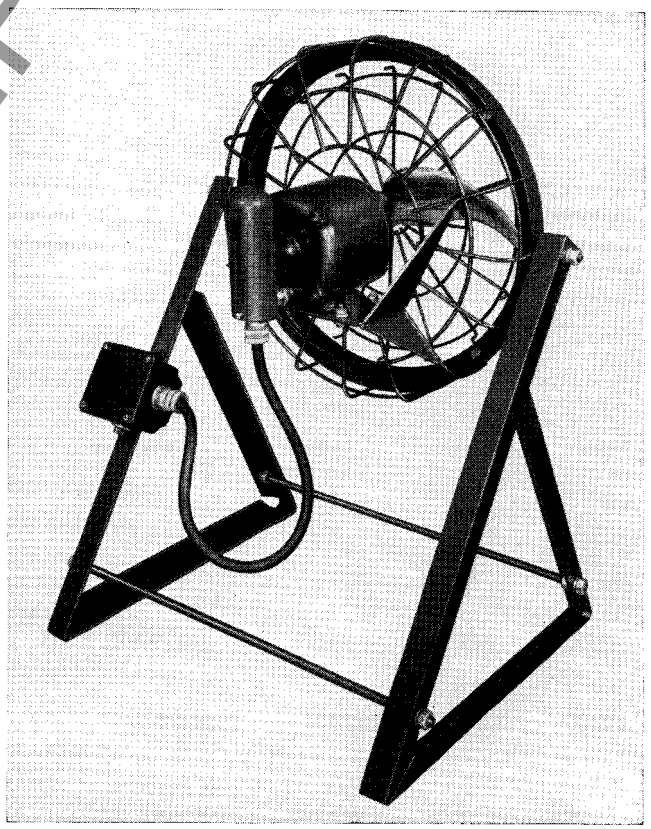

FIG. 3. Portable Type Forced-Air Equipment.

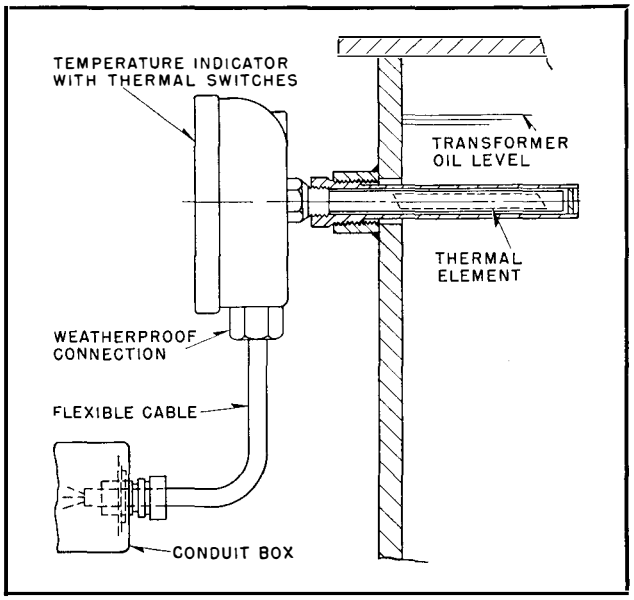

FIG. 4. Thermometer and Well Construction.

matic control of standardized transformers consists of a "De-ion" type AB line breaker, a Type N contactor and a flip-on switch.

For manual control only the AB breaker is supplied, with provision for the future addition of the contactor and flip-on switch.

Type B (For Non-Standard Application). The 220 volt, 60 cycle, three-phase panel for automatic control consists of a "De-ion" type AB line breaker, a type N contactor, a flip-on switch and additional terminals. There are auxiliary contacts for lamp or alarm indication available at terminals on the panel. For manual control, the same panel is provided, the only difference being that the thermal switch is not supplied on the thermometer.

OPERATION

The thermal trip AB breaker provides short circuit protection and a means of de-energizing the panel for inspection and for maintenance.

A thermally actuated switch included in the hot oil (or hot spot) thermometer controls the solenoid of a magnetic contactor which in turn starts and stops the fan motors in response to a change in oil (or hot spot) temperature.

The circuit is energized from the load side of the panel power circuit. The manually operated flip-on switch provides a means of starting the fans independently of the position of the thermal switch. With the thermal switch in the closed position, the fans may be stopped by simply opening the AB breaker.

Control by Bimetal Thermometer (Hot Oil Type). The bimetal type thermometer projects into the hot oil through a well and a fitting on the wall of the transformer case. A special set of contacts on the thermometer is supplied to control the fans, and is set to close at 60°C oil temperature. This setting is adjustable over a small range to accommodate the requirements of actual loading or for seasonal changes. See Instruction Leaflet pertaining to the thermometer for method of adjustment. A constant differential of 5°C is provided between the temperature of closing and opening of the thermal switch contacts to prevent too frequent stopping and starting of fans.

Control by Bimetal Thermometer (Hot Spot Type). This is the same type of thermometer as the hot oil type, except that the well is surrounded by an auxiliary heating coil. Current proportional to the load on the power transformer is supplied to a heating coil from a current transformer. The heating coil and current transformer are designed to include compensation for duplicating the hot spot winding temperature of the transformer. Factory setting of the thermal switch on the thermometer is 75°C, with a 5°C differential between closing and opening temperatures. Adjustment of the 75° setting is possible, see Instruction Leaflet pertaining to the thermometer.

Control by Special Thermostat. In special cases control is obtained from an individual thermostat with the bulb mounted through the cover of the transformer case and extending into the oil. This control may be from hot oil or hot spot temperatures. Contacts are set at the factory, are adjustable and are wired to a relay in the control cabinet for starting and stopping fans.

Control by TRO Thermal Relay. This type of control operates from winding temperature by means of a TRO thermal relay. The relay is wall-mounted in a well near the oil level. For details of this type of control, see TRO relay instruction leaflet.

MAINTENANCE

Greasing. The motors have ball bearings designed to operate for long periods of time without greasing. Over-greasing a ball bearing assembly

is an invitation to trouble. It is recommended that the threaded plug at each bearing hub be removed at one to two-year intervals. Fill the plug hole with grease, press in firmly with the thumb and replace the plug. Do not use pressure guns that will force the grease past the bearings into the windings. A high grade of grease, such as Westinghouse grease ※ 5612-2 should be used as a lubricant. This grease may be obtained from the Lima Motor Division, through the nearest Westinghouse Office.

Painting. Good practice dictates that apparatus should be kept protected with paint. The entire air blast equipment, except the propeller, should be painted at regular intervals.

Inspection. A regular thorough inspection should be made of the equipment to insure the best service.

Renewal Parts. When ordering renewal parts, send a complete description of the particular part and the transformer serial number to the nearest Westinghouse Office.

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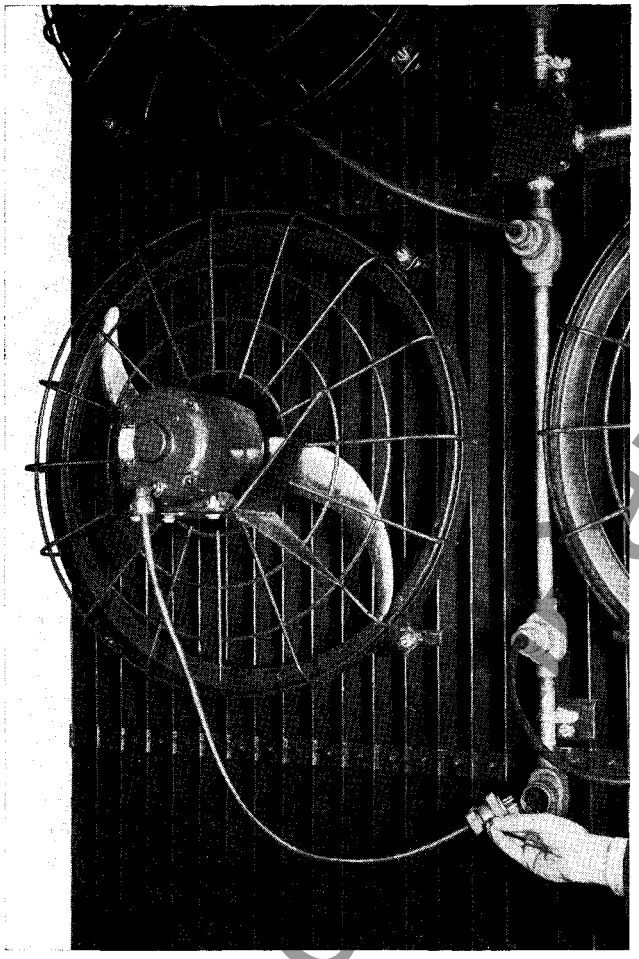
FORCED-AIR COOLING EQUIPMENT
UNIT FAN ASSEMBLY



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Standard unit fan assemblies are furnished with single or three-phase motors. Single-phase motors are capacitor-start, capacitor-run, with the capacitor mounted in a cylindrical case attached to the motor. Both single and three-phase motors are equipped with internally placed thermoguards for protection.

Fan motors are wired in parallel; each motor is equipped with a polarized weatherproof attachment plug that can be disconnected from the supply line by unscrewing counter-clockwise and pulling out. Individual motors may be disconnected without disturbing the wiring in the supply line.

Rotation of the fan blade is counter-clockwise when looking at the motor from the lead end. Pipe plugs are omitted from the underside of each end cap to eliminate condensation inside the motor.

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Fig. 2 shows the arrangement of this type of auxiliary equipment.

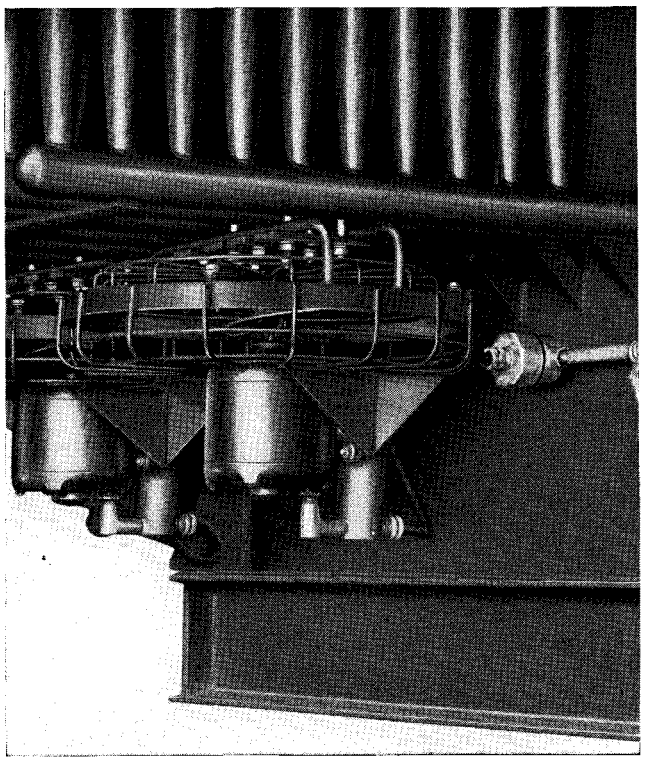

FIG. 2. Tube Cooler Type Forced-Air Equipment.

Portable Type Forced-Air Equipment. The portable type forced-air equipment consists of a complete fan and guard assembly mounted on a fabricated steel stand. The unit is designed for use as an auxiliary source of forced-air equipment for miscellaneous types of apparatus. It may be used with effect for any type of radiator or cooling system that normally depends upon natural convection for heat dissipation.

The air stream may be directed at any angle from downward to upward by adjusting the fan mounting. Fig. 3 shows this type of equipment.

The unit may be placed in service as a temporary or permanent installation for either indoor or outdoor use. Standard automatic or manual control is available for Westinghouse transformer application.

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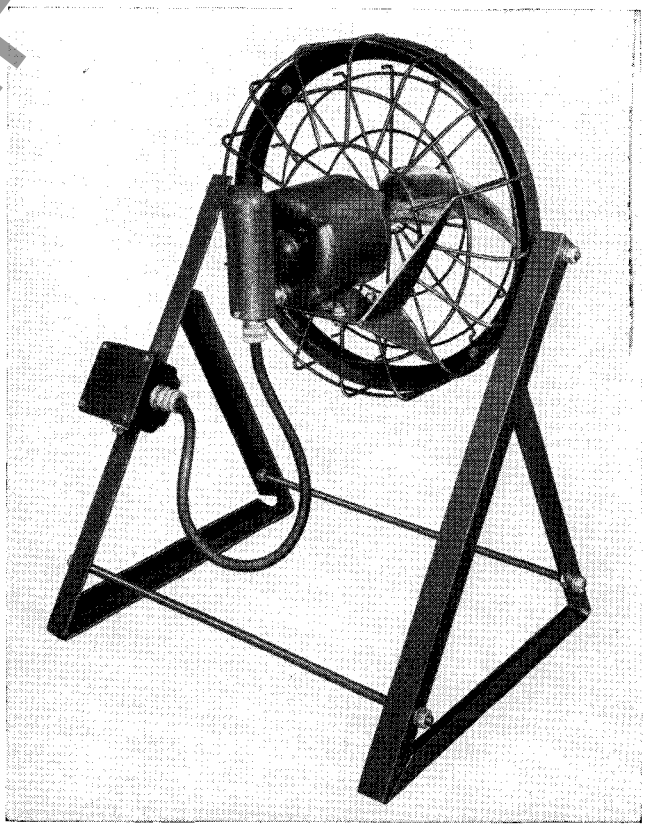

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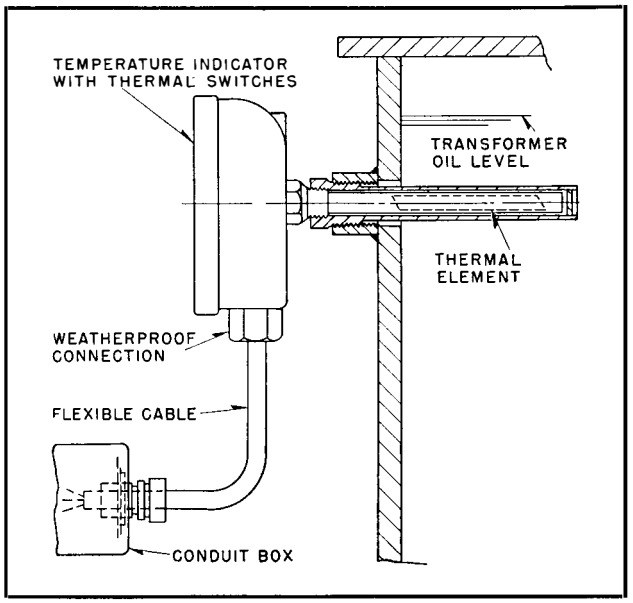

FIG. 4. Thermometer and Well Construction.

Control Panel. The forced air control panel is located in a weatherproof cabinet which is attached to the tank wall. Automatic control consists of a "De-ion" type AB line breaker, a type N contactor, a manual flip-on switch and additional terminals for alarm or lamp indication. For manual control only the AB breaker is supplied.

OPERATION

The thermal trip AB breaker provides short circuit protection and a means of de-energizing the panel for inspection and for maintenance.

A thermally actuated switch included in the hot oil (or hot spot) thermometer controls the solenoid of a magnetic contactor which in turn starts and stops the fan motors in response to a change in oil (or hot spot) temperature.

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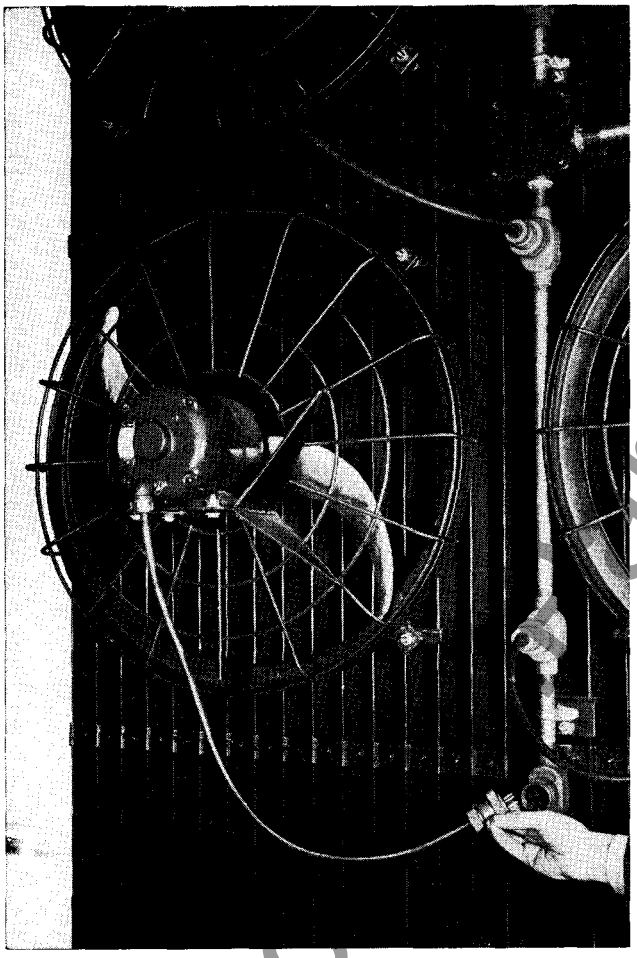

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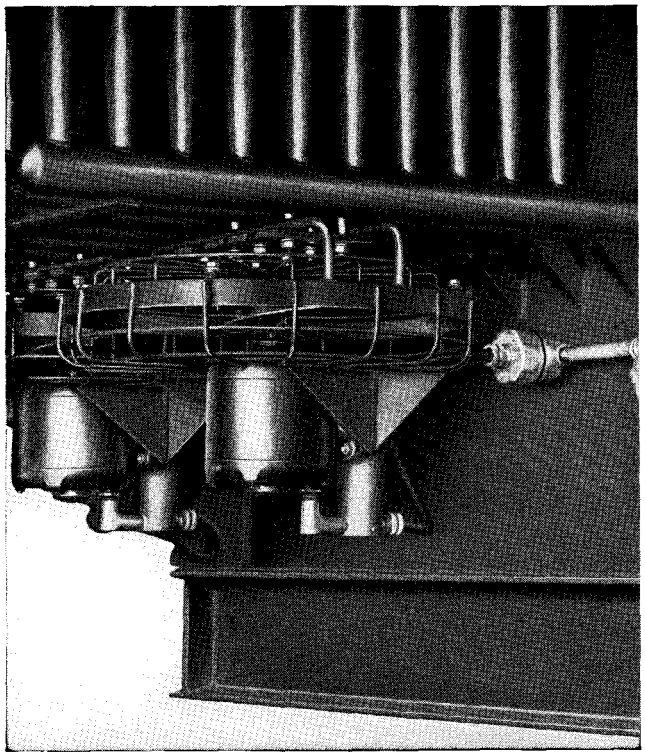

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Portable Type Forced-Air Equipment. The portable type forced-air equipment consists of a complete fan and guard assembly mounted on a fabricated steel stand. The unit is designed for use as an auxiliary source of forced-air equipment for miscellaneous types of apparatus. It may be used with effect for any type of radiator or cooling system that normally depends upon natural convection for heat dissipation.

The air stream may be directed at any angle from downward to upward by adjusting the fan mounting. Fig. 3 shows this type of equipment.

The unit may be placed in service as a temporary or permanent installation for either indoor or outdoor use. Standard automatic or manual control is available for Westinghouse transformer application.

INSTALLATION

It is usually necessary to remove radiators for shipment due to railroad clearance limitations. Before the radiators are assembled on the transformer, a careful study of the outline drawing and the actual job should be made. The outline shows the proper height for the location of banked fans. Banked fans are usually shipped properly located and attached to one or more radiators, depending upon the number of banks.

Some shipments of assembled fans and motors are made with the fan and shaft braced to prevent vibration during shipment. Be sure all shipping straps or braces are removed, and that the fan turns freely when it is put into operation.

Mount the radiators and cooling fans, the control cabinet, conduit and connections as shown on the outline drawing.

The hot oil thermometer (which also contains the thermal switch for activation of air blast fans) is sometimes removed for shipment. In this case it is necessary to install the thermometer in the well on the side wall of the transformer and connect the flexible alarm cable to the conduit or tank brace.

An oil-tight well is provided to permit installation and removal of the thermometer without lowering the level of the oil inside the transformer tank. This is a close, smooth fitting well and requires no liquid between the bulb and the wall. See Fig. 4.

The power connections to the panel are to be made as shown on the forced-air wiring diagram, a copy of which is included in the complete Transformer Instruction Book.

FIG. 3. Portable Type Forced-Air Equipment

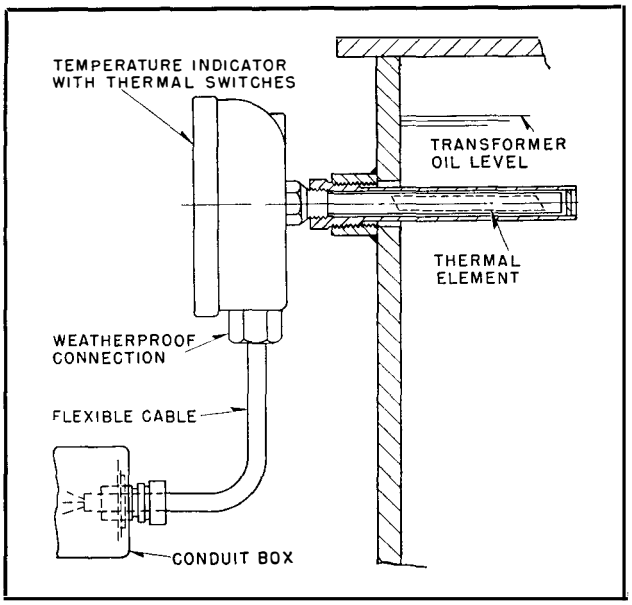

FIG. 4. Thermometer and Well Construction

Control Panel. The forced air control panel is located in a weatherproof cabinet which is attached to the tank wall. Automatic control consists of a "De-ion" type AB line breaker, a type N contactor, a manual flip-on switch and additional terminals for alarm or lamp indication. For manual control only the AB breaker is supplied.

OPERATION

The thermal trip AB breaker provides short circuit protection and a means of de-energizing the panel for inspection and for maintenance.

A thermally actuated switch included in the hot oil (or hot spot) thermometer controls the solenoid of a magnetic contactor which in turn starts and stops the fan motors in response to a change in oil (or hot spot) temperature.

The circuit is energized from the load side of the panel power circuit. The manually operated flip-on switch provides a means of starting the fans independently of the position of the thermal switch. With the thermal switch in the closed position, the fans may be stopped by simply opening the AB breaker.

Control by Bimetal Thermometer (Hot Oil Type). The bimetal type thermometer projects into the hot oil through a well and a fitting on the wall of the transformer case. A special set of contacts on the thermometer is supplied to control the fans, and is set to close at 60°C oil temperature. This setting is adjustable over a small range to accommodate the requirements of actual loading or for seasonal changes. See Instruction Leaflet pertaining to the thermometer for method of adjustment. A constant differential of 5°C is provided between the temperature of closing and opening of the thermal switch contacts to prevent too frequent stopping and starting of fans.

Control by Bimetal Thermometer (Hot Spot Type). This is the same type of thermometer as the hot oil type, except that the well is surrounded by an auxiliary heating coil. Current proportional to the load on the power transformer is supplied to a heating coil from a current transformer. The heating coil and current transformer are designed to include compensation for duplicating the hot spot winding temperature of the transformer. Factory setting of the thermal switch on the thermometer is 75°C, with a 5°C differential between closing and opening temperatures. Adjustment of the 75° setting is possible, see Instruction Leaflet pertaining to the thermometer.

Control by Special Thermostat. In special cases control is obtained from an individual thermostat with the bulb mounted through the cover of the transformer case and extending into the oil. This control may be from hot oil or hot spot temperatures. Contacts are set at the factory, are adjustable and are wired to a relay in the control cabinet for starting and stopping fans.

Control by TRO Thermal Relay. This type of control operates from winding temperature by means of a TRO thermal relay. The relay is wall-mounted in a well near the oil level. For details of this type of control, see TRO relay instruction leaflet.

MAINTENANCE

Greasing. The motors have ball bearings designed to operate for long periods of time without greasing. Overgreasing a ball bearing assembly is an invitation to trouble.

Motors Without Pressure Grease Fittings. It is recommended that the threaded plug at each bearing hub be removed at one to two-year intervals. Fill the plug hole with grease, press in firmly with the thumb and replace the plug. Do not use pressure guns that will force the grease past the bearings into the windings.

Motors With Pressure Grease Fittings. The motor is designed with a pressure and relief fitting at both bearings. They have ball bearings with a seal on the winding side of the motor and a shield on the opposite side. These bearings should be greased at one to two-year intervals using only the necessary pressure to show grease coming from the relief fitting.

A high grade of grease, such as Westinghouse Grease #5612-2 should be used as a lubricant for either motor. This grease can be obtained from Lima Motor Division through the nearest Westinghouse Office.

Painting. Good practice dictates that apparatus should be kept protected with paint. The entire air blast equipment, except the propeller, should be painted at regular intervals.

Inspection. A regular thorough inspection should be made of the equipment to insure the best service.

Renewal Parts. When ordering renewal parts, send a complete description of the particular part and the transformer serial number to the nearest Westinghouse Office.

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