DESCRIPTION • OPERATION • MAINTENANCE

INSTRUCTIONS

TRA RELAY FORCED AIR COOLING CONTROL

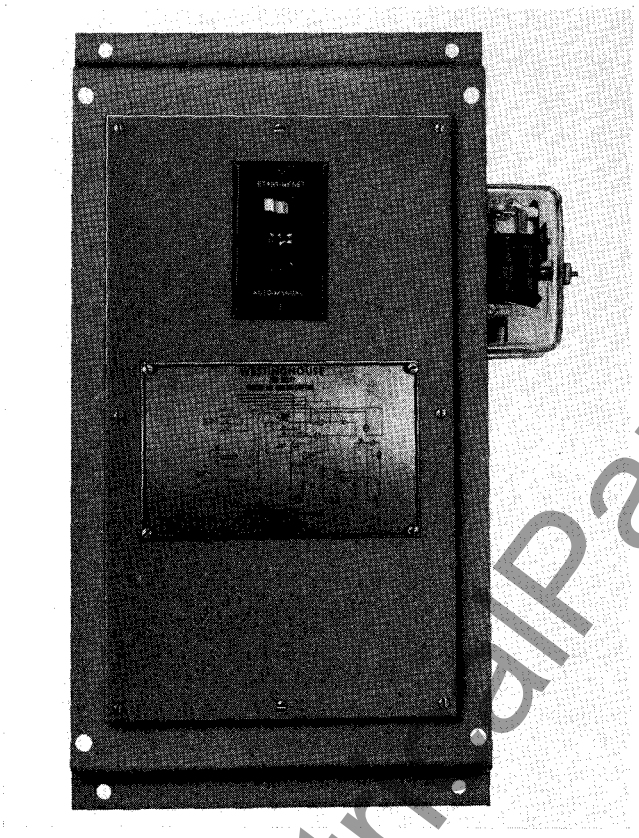

FIG. 1. Front View, TRA Relay Forced Air Cooling Control

THE TRA RELAY CONTROL provides either manual or fully automatic control of fan installations for cooling of type ASL transformers. A selector switch is provided on the control panel so that the operator may choose at will either the manual or automatic control.

With automatic control, the fans are called upon for additional cooling air only when the transformer is approaching its limiting operating temperature under the condition of normal self-cooled operation. Once started, the fans continue to run until the transformer load is reduced to the normal self-cooled rating of the transformer. At this point the fans will be switched off. This cycle may be repeated indefinitely, and the frequency and duration of the forced air cooling periods will depend on the transformer load cycle characteristics.

If the fans do not start when called upon by the control system, the transformer temperature will continue to rise. Before the limit of the transformer operating temperature is reached, the alarm circuit is energized at the control panel, to actuate suitable devices calling for investigation and corrective action.

THE TRA RELAY

The protective features of this control are initiated by the TRA relay. The TRA relay is a temperature-operated device which, when applied on forced air cooling controls, will turn on the fans whenever the transformer approaches a limiting operating temperature. The operating temperature of the relay is coordinated with the hot spot temperature of the transformer windings. A bimetal thermal tripping device is heated by the hot air from the coil cooling ducts, and also by current from the secondary of a current transformer in the load circuit. First, one bimetal arm trips and energizes the circuit for starting the fans; then, if the fans do not act to cool the transformer, the other bimetal trips at a slightly higher temperature, energizing an alarm circuit.

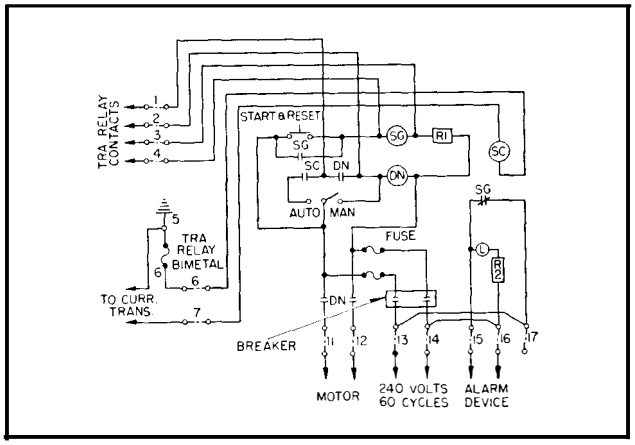

FIG. 2. Wiring Diagram

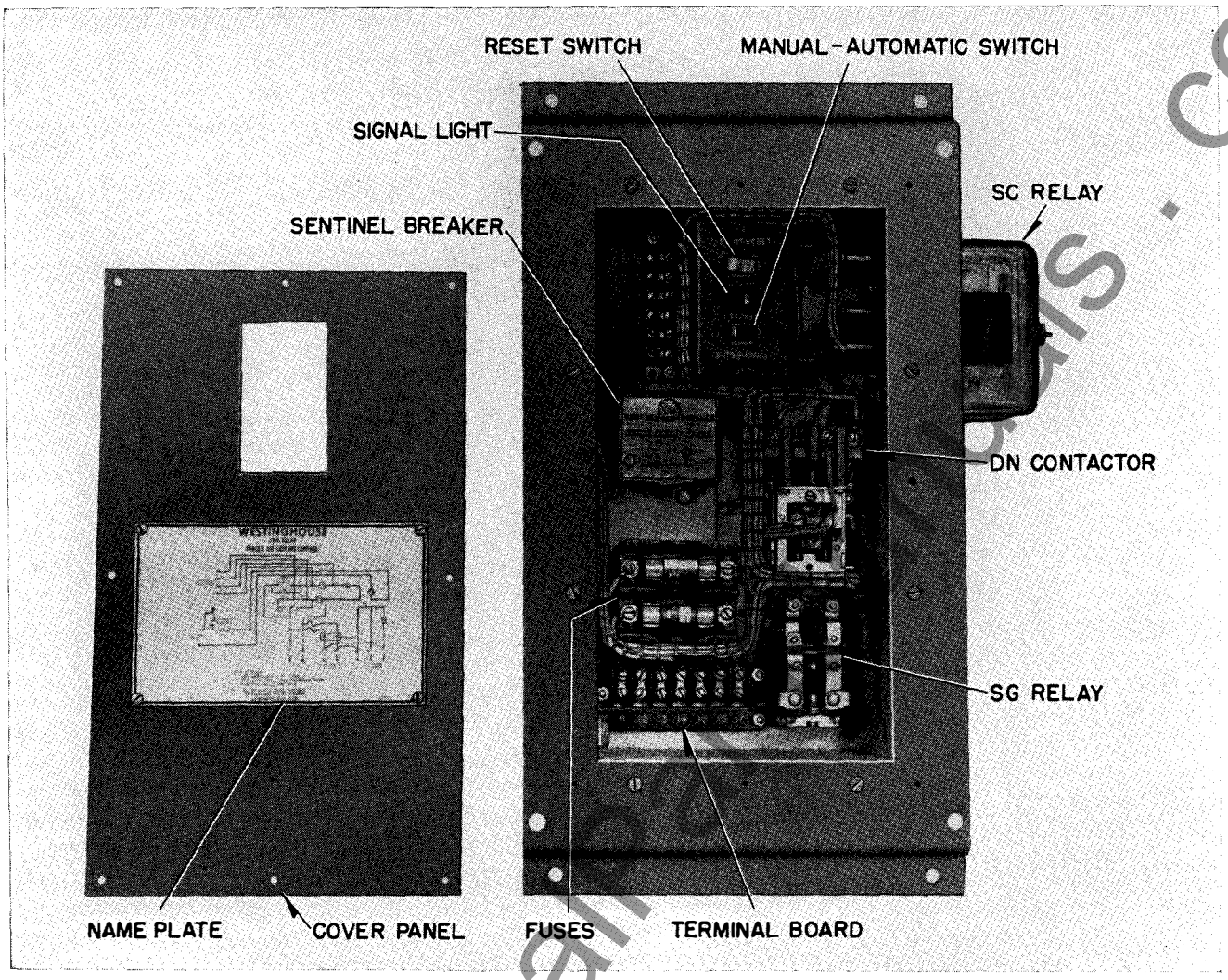

FIG. 3. TRA Relay Forced Air Cooling Control, Front View with Cover Removed

CONSTRUCTION AND ARRANGEMENT

The components of this control are grouped at three points on the transformer structure. The current transformer which supplies current to the TRA relay bimetal and to the type SC relay coil is usually mounted in the transformer bus structure. The TRA relay mechanism, which consists of a porcelain block on which is mounted a metal housing, terminals, and two bimetal strips, is mounted directly above the transformer coils on one transformer leg. The rest of the control components are contained in a metal cabinet which is normally mounted on the wall of the transformer case. The manual-automatic selector switch, the start and reset switch, and the warning light in the alarm circuit are mounted at the front of this cabinet, and are plainly visible and accessible from outside the transformer. At the rear of this cabinet are located the auxiliary relay and contactor, circuit breaker, fuses and terminal boards. The type SC current relay is mounted on the side of this cabinet with its terminals projecting into the cabinet.

Provision for a one inch conduit connection is made at the bottom of the cabinet. Terminals for the control power supply and the alarm circuit connections are located on the seven point terminal board in the lower portion of the cabinet.

OPERATION

The TRA relay consists of two low energy switches, and two bimetal strips, arranged so that a rise in temperature in the bimetal strips causes them to deflect and close the switches. The temperature at which the bimetal strip closes each switch is calibrated by adjusting the distance between the bimetal strip and the switch. The adjustment is made and locked at the factory.

The relay is mounted directly above the transformer coils so that hot air from the coil cooling ducts passes over and heats the bimetal strips. Additional heating in the bimetal strips is obtained by circulating a current through them which is proportional to the load current. Circulating current for the bimetal is obtained from the current transformer supplied with the apparatus. With this arrangement the temperature acquired by the bimetal strips is a function of the temperature of the air passing through the transformer and also of the load on the transformer. Because the temperature of the winding is also a function of the air temperature and the load on the transformer, the TRA relay can be so adjusted that the limiting load which the transformer is allowed to carry under self-cooled conditions is coordinated with the hot spot temperature of the windings.

The first bimetal strip operates its switch to turn on the fans when the transformer approaches a limiting temperature under self cooled operating conditions. The forced air cooling then brings the transformer temperature down to a safe value and increases the load capacity of the transformer to its rating under the condition of forced air cooling. If the fans do not act to cool the transformer the TRA relay remains in control, and the second bimetal strip will energize the alarm circuit before the limiting operating temperature is reached.

The function of the type SC relay is to switch off the fans when the transformer load has been reduced to a safe value for self cooled operation. The coil of the type SC relay is placed in series with the TRA relay bimetal across the secondary of the current transformer. The contacts of the type SC relay are adjusted at the factory to open at a current corresponding to 100% load on the transformer, and the adjusting mechanism is locked at that setting. Therefore, when the transformer load is such that the forced air cooling is no longer needed, the fans are switched off through the medium of the SC relay.

To set the control in operation a 240 volt, 60 cycle supply must be connected to the proper terminals in the control cabinet. The control circuit breaker, located inside the cabinet must then be thrown to the ON position. Access to this circuit breaker may be had by removing the nameplate at the front of the supply cabinet. The manual-automatic selector switch is then set for the type of operation desired. Finally the start-reset switch is operated to place the alarm circuit in operation.

When shipped from the factory, the alarm circuit is normally connected across the 240 volt supply terminals. A red lamp on the control cabinet provides a visual indication if the transformer is operating at an excessively high temperature when the fans are not running. A remote alarm device may be connected to this same circuit at the terminal board inside the control cabinet. The relay contacts for switching the alarm circuit are normally closed. If the control circuit is not functioning properly for any reason other than a lack of a 240 volt power supply, then the alarm circuit will indicate the trouble. For example, if the fuses in the control cabinet should blow, the alarm circuit would immediately close, indicating trouble in the forced air cooling control regardless of the load on the transformer.

A power source independent of the one used to supply the fans may be used to actuate the alarm circuit. To do this, the jumpers connecting the source of power for the fan motors to the alarm circuit are removed at the terminal board. The independent power source is then connected at the terminal board to terminals 16 and 17. With this type of connection the alarm circuit will indicate trouble due to any cause including a failure of the power supply to the fan motors.

INSTALLATION

The TRA relay, the current transformer, the control cabinet and all internal wiring are normally installed at the factory. The relays for switching the fans on and off and for actuating the alarm circuit are calibrated at the factory. The adjustments on these relays should not be changed.

Note: All blocking of movable elements should be removed before placing the unit in operation.

In some installations the transformer supplies power for operating the control circuit. If this is not the case, an external single-phase power supply of 240 volts, 60 cycles of sufficient capacity to drive the fan motors, and to operate the control relays and the alarm devices must be wired to the proper terminals in the control cabinet. If a remote alarm device is used, it too must be wired to the proper terminals in the control cabinet. The location of the terminals is shown on the instruction plate which is mounted on the control cabinet.

The contact rating of the switching devices in this control should not be exceeded. The motor

switching contactor has a rating of ¾ horsepower at 240 volts. The circuit breaker has a rating of one horsepower at 240 volts. The relay contacts in the alarm circuit will carry 10 amperes continuously, and will interrupt 18 amperes at 220 volts. The foregoing ratings are for 60 cycle alternating current. On direct current the relay contacts in the alarm circuit will interrupt 2.4 amperes at 115 volts and ¾ ampere at 230 volts.

The control system will operate satisfactorily in the voltage range 200-240 volts, 60 cycles.

MAINTENANCE

The switching duty imposed on the TRA relay and the relays and contactor in the control cabinet is very light, so that the contact wear should be negligible. However, a periodic inspection of the contacts should be made to insure that pitting and inclusions of dirt have not occurred. Also, a periodic check of the fan circuit operation can be made simply by throwing the control selector switch to the "manual" position.

The motors used with this control 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 about two-year intervals. Fill the plug hole with grease, press in firmly with the thumb and replace the plug. A high grade of grease, such as Westinghouse grease #5612-2, should be used as a lubricant.

RENEWAL PARTS

If, for any reason, renewal parts are required, transmit the description of the particular part and the transformer serial number to the nearest District Office or Service Shop of the Westinghouse Electric Corporation.

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