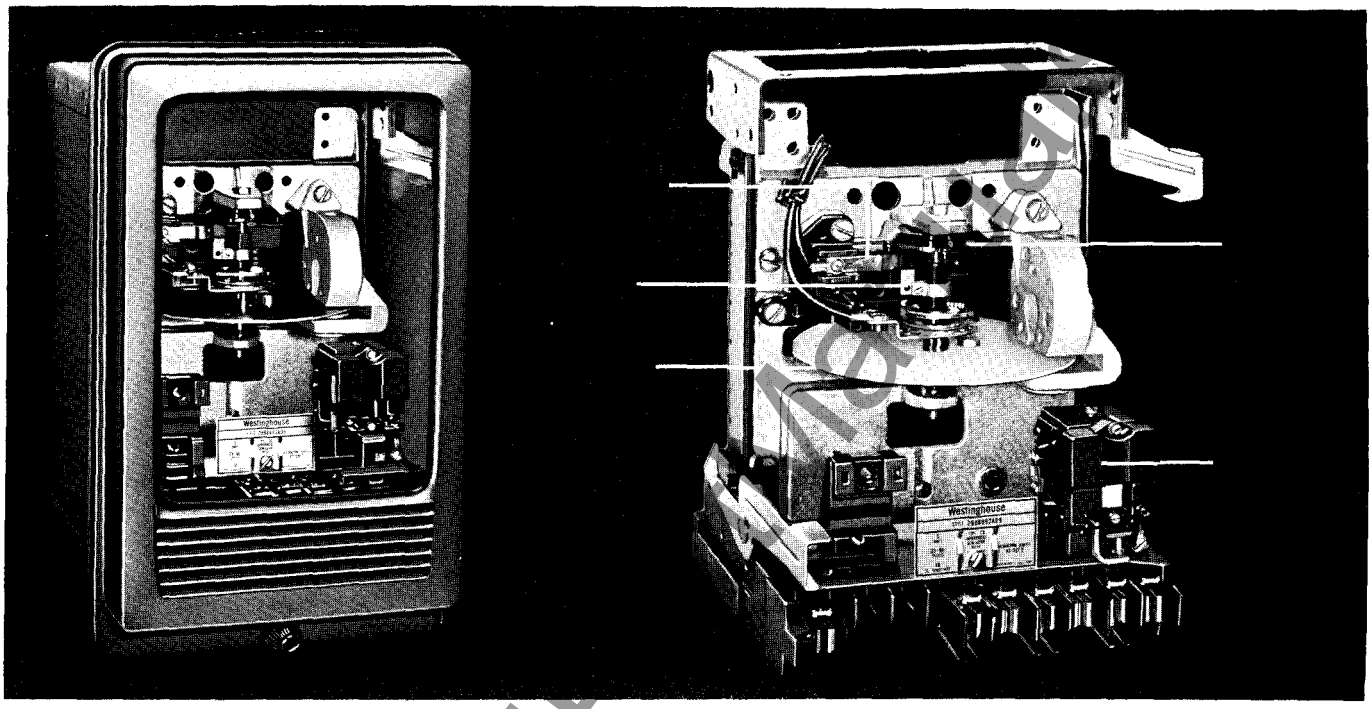
Westinghouse

Type CA Generator Differential Relay



Application

The Westinghouse CA generator differential relay is a single phase, induction disc type with inverse timing characteristics. It is provided with one operating winding and two restraining windings without taps.

The type CA has a constant percentage differential characteristic, with either 10% or 25% sensitivity, which represents the percentage of the smaller of the two restraining currents required to trip the relay.

The 10% relay is used where current transformer ratio errors are small. The 25% relay is used where the current transformer performance may produce error currents in excess of the pickup of the 10% type. A study of current transformer performance under fault conditions will indicate whether the 10% or the 25% relay should be applied.

Figure 2 shows the differential characteristic of the 10% relay, and Figure 3 shows that of the 25% relay. Note in Figure 2 that 10% of the smaller restraining current must flow in the operating coil to cause tripping when the restraining currents are in phase. Similarly, in Figure 3, 25% of the smaller restraining current is required for the relay to close its contacts. Thus this relay is relatively insensitive to error currents flowing in the operating winding as a result of high external fault currents.

Inverse time characteristics are shown in Figures 4 and 5, with restraint currents 180° out of phase. These curves also apply where current flows in only one restraint coil and the operating coil.

Construction

The CA generator differential relay consists of an induction disc type differential unit and an Indicating Contactor Switch.

Referring to Figure 1, the differential unit is an induction disc element with an electromagnet that has poles both above and below the disc. Two restraining coils, connected in series, are placed on the lower left-hand pole. The series connection junction point is connected to the operating coil which is mounted on the lower right-hand pole. A transformer winding is also supplied on both the left-hand and right-hand lower poles, and these are connected in parallel to supply current to the upper pole windings.

The magnetic flux generated by the upper pole windings is in quadrature with the lower pole resultant flux, and these two fluxes react to produce a torque on the disc.

Current in the operating coil circuit produces a contact closing-closing torque. Conversely, current flowing in the two restraining windings in the same direction produces contact opening torque

Operation

Under normal operating conditions current will flow in the restraining coil circuits and very little, if any, current will flow in the operating coil circuit.

Under external fault conditions, the restraining coil currents will increase but will be in the same direction and will produce a strong restraining torque. The current that flows in the operating coil circuit under this condition would be due to the unbalance in current transformer performance under fault current conditions. In applications where this unbalance current would exceed 10% of the smaller restraint current, the less sensitive 25% relay should be used.

Under internal fault conditions, the current in one restraint circuit will reverse and a relatively larger current will flow in the operating coil circuit, producing contact closing torque and tripping the relay.

Time of operation is inversely proportional to the current in the operating and restraint circuits, and is shown in Figures 4 and 5.

When the relay trips, the dc Indicating Contactor Switch is energized, bridging the main relay contacts and relieving them of carrying the relatively large trip coil current. When the Indicating Contactor Switch closes, its armature deflects a spring which allows an operation indicating target to drop. This target is reset manually from the outside of the relay case

Device No. 87

March, 1972
Supersedes DB 41-331 and DB 41-331A, dated October, 1968
E. D. C/2015/DB

Westinghouse

Characteristic Curves

Differential Characteristic: 10% Relay

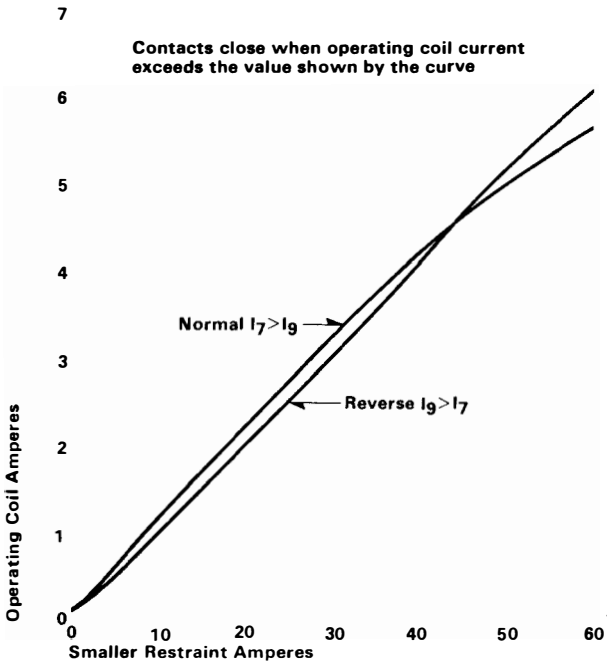


Figure 2 Curve 260208

Differential Characteristic: 25% Relay

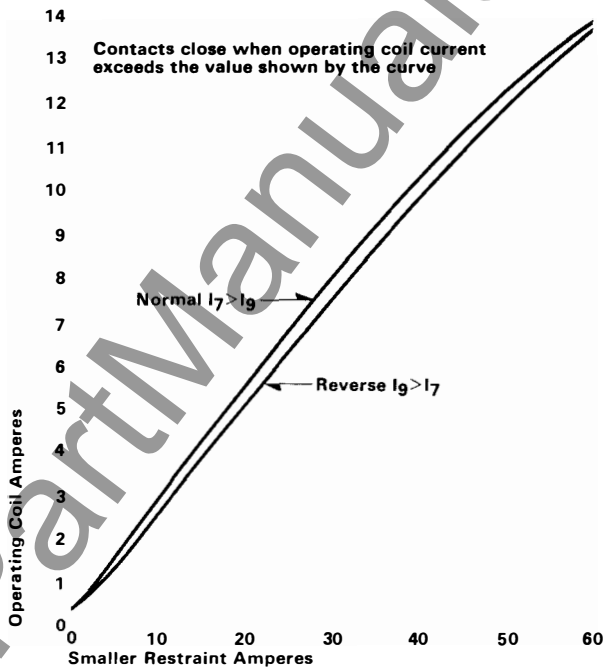


Figure 3 Curve 252217

Inverse Time Characteristic: 25% Relay

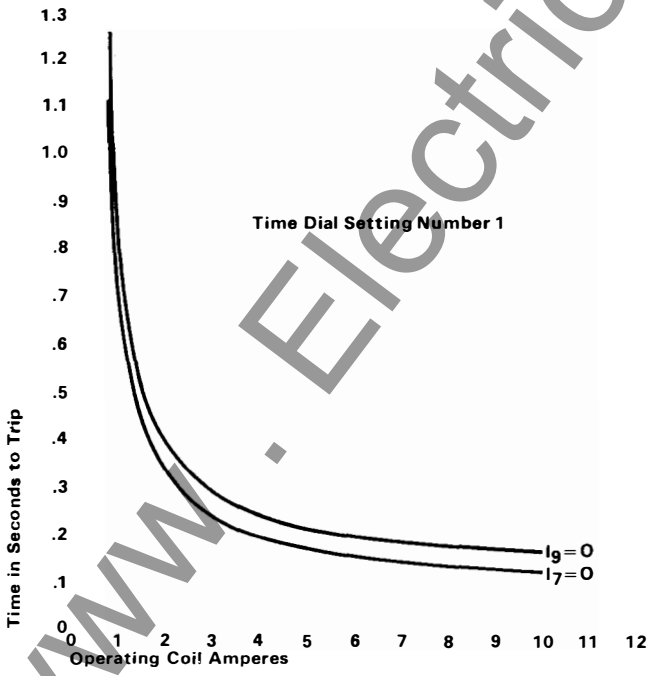


Figure 4 Curve 187A777

Inverse Time Characteristic: 10% Relay

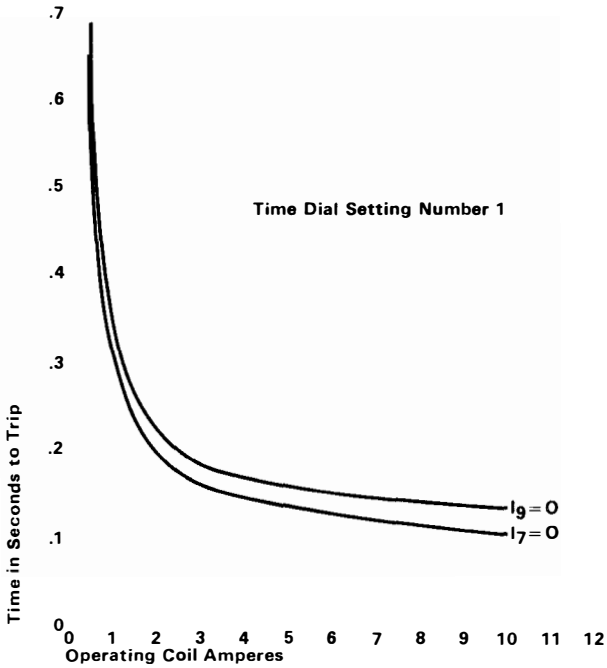


Figure 5 Curve 187A776

Type CA Generator Differential Relay

Burden Curves: 10% Relay

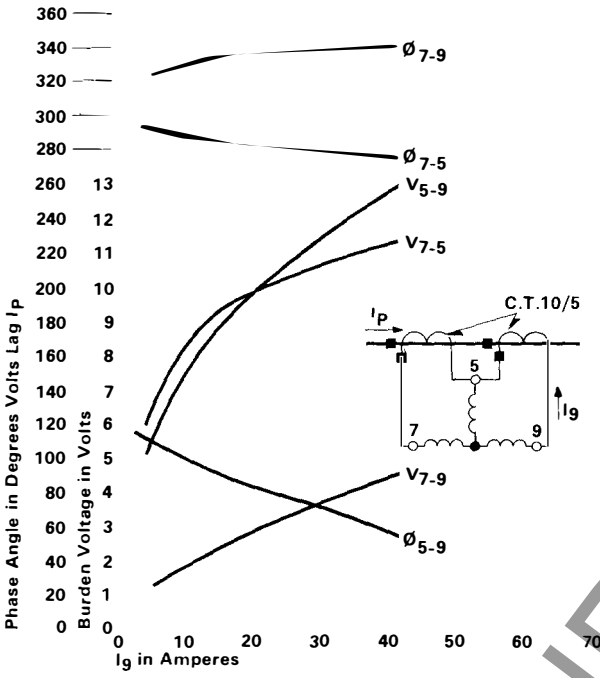


Figure 6 Curve 282554

Burden Curves: 25% Relay

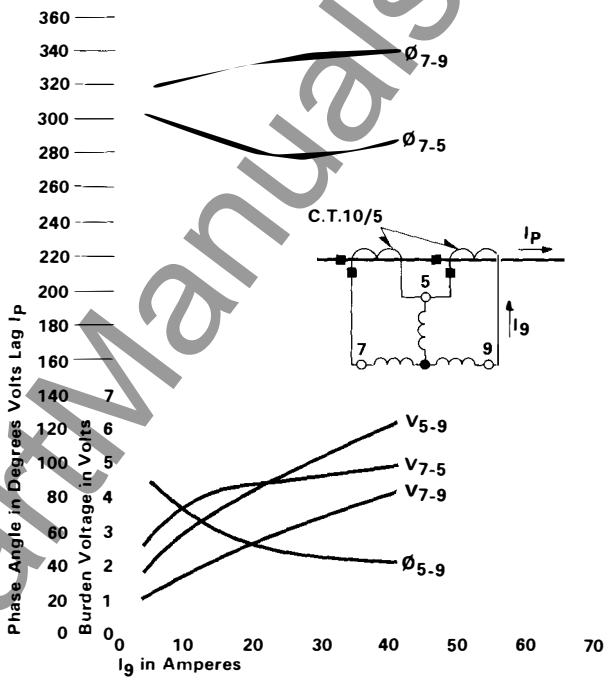


Figure 7 Curve 282555

Saturation Curves

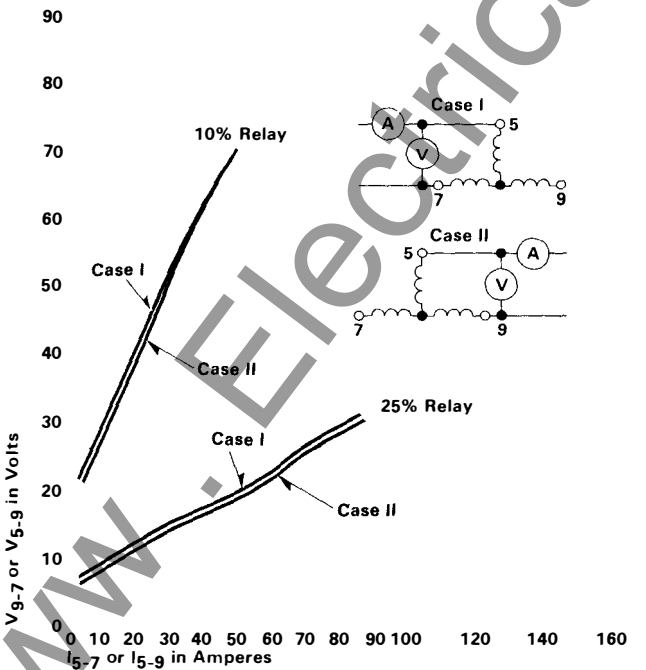
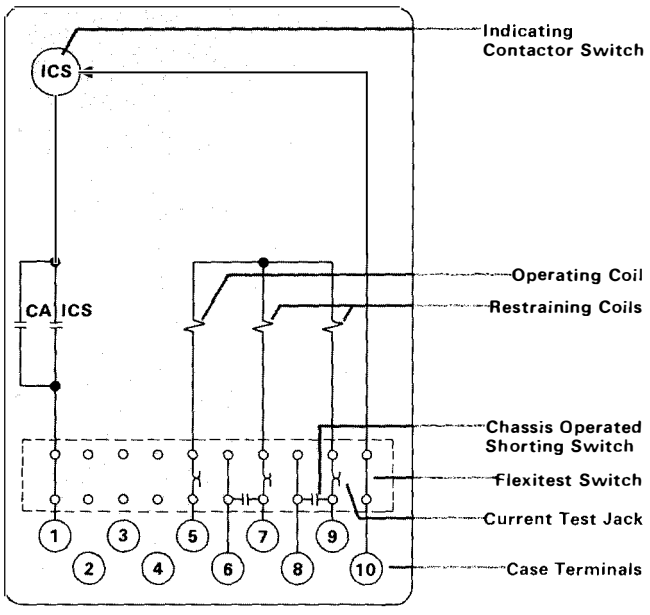


Figure 8 Curve 282553

Internal Wiring: 10% or 25% CA Relay FT-21 Case

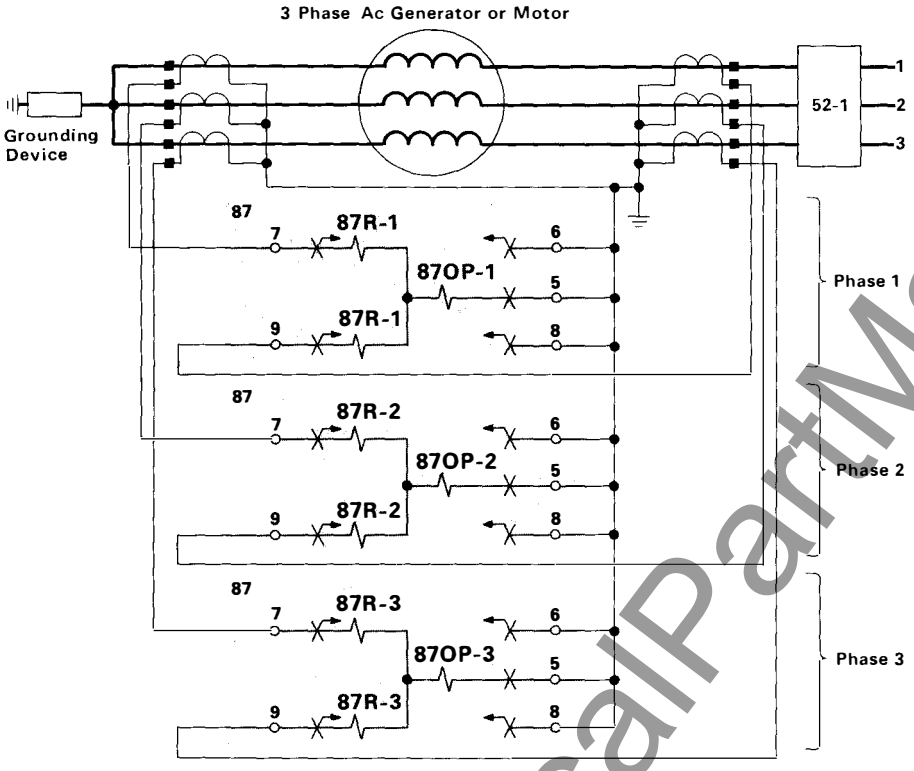


Note: Terminals 5, 6 and 8 are to be Jumpered at Relay Case

Figure 9 57D4553

Type CA Generator Differential Relay

External Wiring



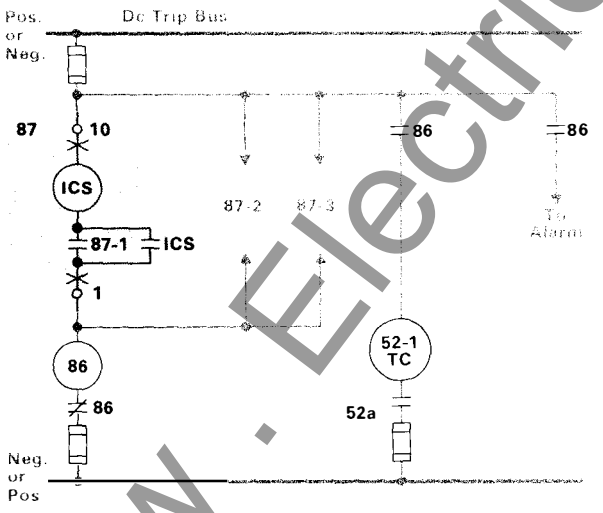


Figure 10 182A809

Device Number Chart

- 87—Generator Percentage Differential Relay Type CA
- 87R—Restraining Coil of Type CA Relay
- 87OP—Operating Coil of Type CA Relay
- 86—Auxiliary Tripping Relay, Type WL
- 52—Power Circuit Breaker
- a—Breaker Auxiliary Contact
- TC—Breaker Trip Coil
- ICS—Indicating Contactor Switch

Characteristics

Operating Time
See Figures 4 and 5.

Sensitivity
10% or 25% (no ratio taps).

Differential Characteristics
See Figures 2 and 3.

Minimum Trip
0.18 amps for 10% relay.
0.45 amps for 25% relay.

Burden
See Figures 6 and 7.

Thermal Capacity
Restraint circuits: 10 amps continuous

Operating circuits:

	Continuous	For 1 second
10% relay	2.5 amps	70 amps
25% relay	5.0 amps	140 amps

Saturation Characteristics
See Figure 8.

Relay Settings

No setting is required for the percentage differential unit except that of the time dial, which should be set to the number 1 position.

Each relay is designed for its specific sensitivity and once the correct relay is chosen for a given application, no further adjustment is necessary. However, the spring tension controlling minimum operating current may be altered slightly if required.

In general, the aforementioned study of the current transformer characteristic curves under short circuit conditions should indicate whether the high sensitivity (10%) or low sensitivity (25%) relay should be used. If ac saturation causes more than 1% ratio error in either set of current transformers, use the 25% relay.

Further Information

Prices, Ordering Information: PL 41-020
Application Data: AD 41-300
FT-21 Case Dimensions: DB 41-075
Instructions: IL 41-331.2
Other Protective Relays: Selector Guide 41-000A, B & C

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