INSTALLATION • OPERATION • MAINTENANCE

INSTRUCTIONS

TYPE CWC AND CWP DIRECTIONAL GROUND RELAYS

CAUTION Before putting relays into service, remove all blocking which may have been inserted for the purpose of securing the parts during shipment, make sure that all moving parts operate freely, inspect the contacts to see that they are clean and close properly, and operate the relay to check the settings and electrical connections.

APPLICATION

The Type CWC and CWP relays are induction disc type relays used for directional ground fault protection on grounded neutral power systems. The type CWC relay is polarized by current from a suitably grounded power transformer bank neutral. Therefore, its application does not require potential transformers. The type CWP relay is potential polarized by residual voltage obtained across the open corner of the delta winding of a grounded star-delta potential transformer.

At stations where the power transformer bank neutral is grounded, the residual voltage will be small generally, and the type CWC relay is recommended. At ungrounded stations, or at ground stations where the power transformer bank neutral is not available, the type CWP relay is applicable.

CONSTRUCTION AND OPERATION

The Type CWC and CWP relays consist of an induction disc type element, a contactor switch, an operation indicator and an instantaneous trip attachment when supplied. In addition an external phase shifting capacitor is supplied with the type CWP relays.

Induction Element

The induction disc of this element is a thin four-inch diameter disc mounted on a vertical shaft. The shaft is supported on the lower end by a steel ball bearing riding between concave sapphire jewel surfaces, and on the upper end by a stainless steel pin.

The moving contact is a small silver hemisphere fastened on the end of an arm. The other end of this arm is clamped to an insulated section of the disc shaft. The element is not geared. The electrical connection is made from the moving contact thru the arm and spiral spring. One end of the spring is fastened to the arm, and the other to a slotted spring adjuster disc which in turn fastens to the element frame.

The stationary contact assembly consists of a silver contact attached to the free end of a leaf-spring. This spring is fastened to a moulded block mounted on the element frame. A small set screw permits the adjustment of contact follow. When double trip is required, another leaf spring is mounted on the moulded block and a double contact is mounted on the rigid moving arm. Then the stationary contact set screws permit adjustment so that both circuits will be made simultaneously.

The moving disc is rotated by an electromagnet in the rear and damped by a permanent magnet in front. The operating torque for the CWC relay is obtained by energizing the lower pole coil with residual current (usually obtained from the line current transformer) and the 2 tapped upper pole coils with residual current from the current transformer in the power transformer bank neutral. For the CWP relay the operating torque is obtained by energizing the upper pole coils with residual current (usually obtained from the line current transformer) and the lower pole with residual voltage.

Contactor Switch

The d-c contactor switch in the relay is a

SUPERSEDES I.L. 41-290 G
*Denotes change from superseded issue.

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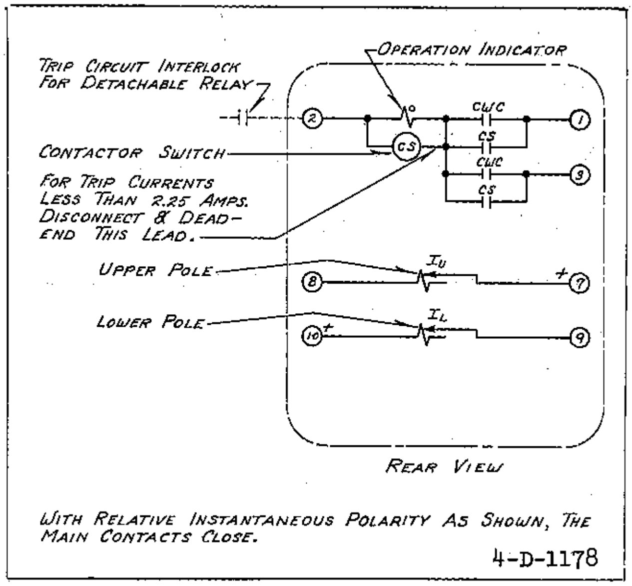


Fig. 1—Internal Schematic of the Double Trip Type CWC Relay in the Standard Case. The Single Trip Relays Have Terminal 3 and Associated Circuits Omitted.

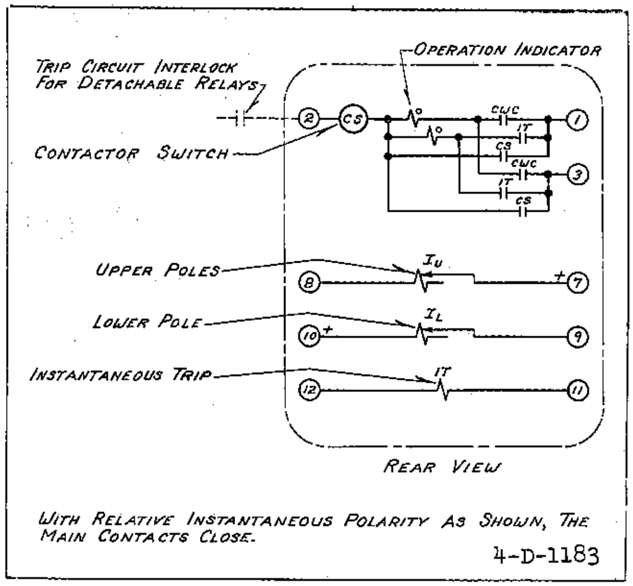


Fig. 2—Internal Schematic of the Double Trip Type CWC Relay with Instantaneous Trip in the Standard Case.

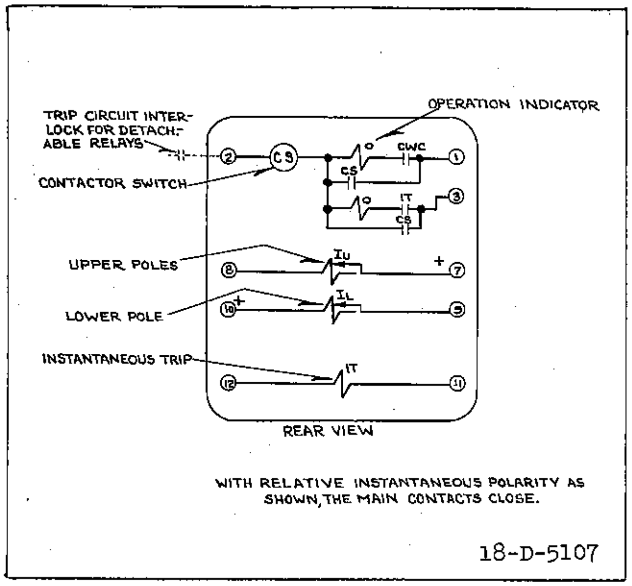


Fig. 3—Internal Schematic of the Single Trip Type CWC Relay with Instantaneous Trip in the Standard Case.

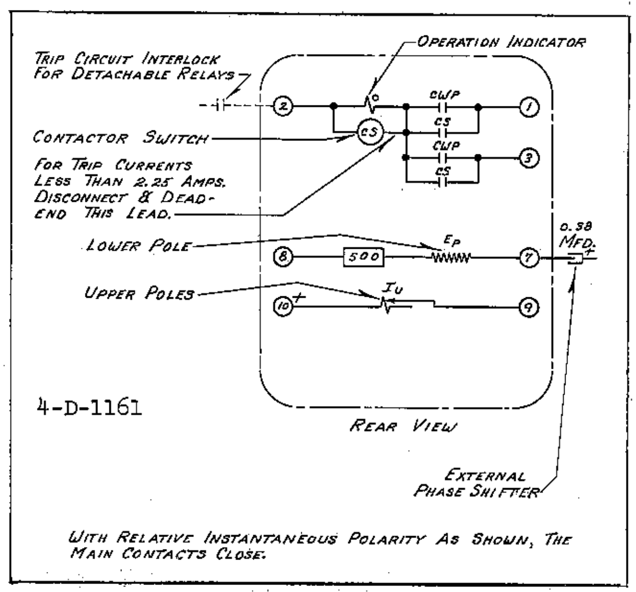


Fig. 4—Internal Schematic of the Double Trip Type CWP Relay in the Standard Case. The Single Trip Relays Have Terminal 3 and Associated Circuits Omitted.

small solenoid type switch. A cylindrical plunger with a silver disc mounted on its lower end moves in the core of the solenoid. As the plunger travels upward, the disc bridges three silver stationary contacts. The coil is in series with the main contacts of the relay and with the trip coil of the breaker. When the relay contacts close, the coil becomes energized and closes the switch contacts. This shunts the main relay contacts, thereby relieving them of the duty of carrying tripping current. These contacts remain closed until the trip circuit is opened by the auxiliary switch on the breaker.

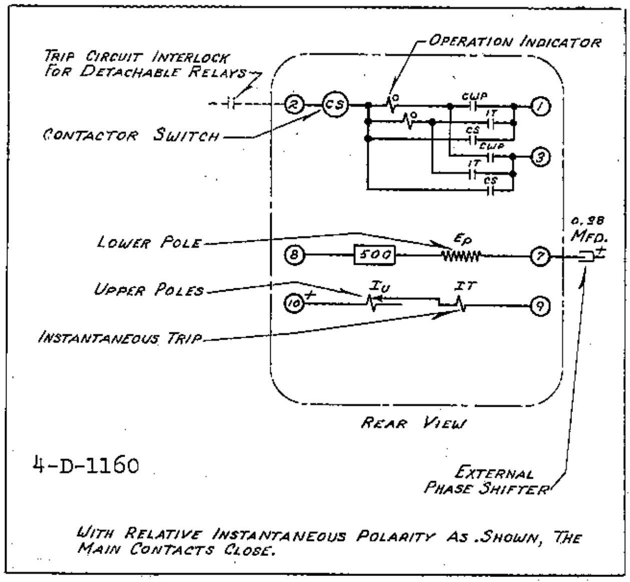


Fig. 5—Internal Schematic of the Double Trip Type CWP Relay with Instantaneous Trip in the Standard Case.

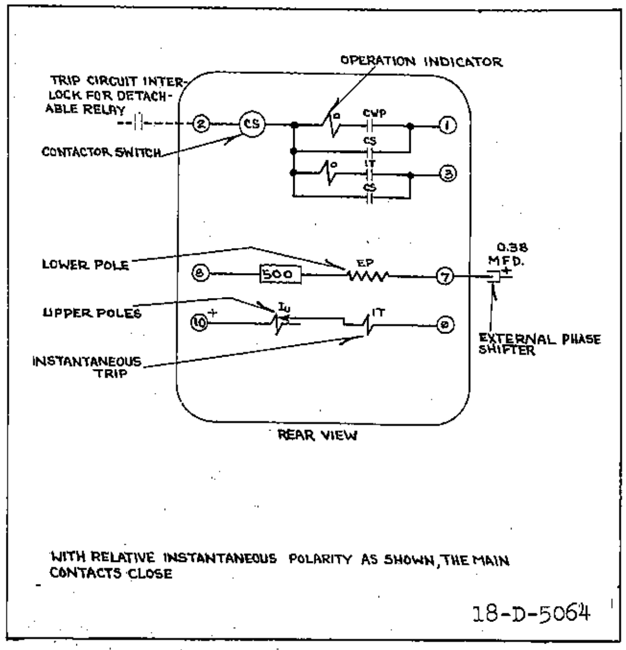


Fig. 6—Internal Schematic of the Single Trip Type CWP Relay with Instantaneous Trip in the Standard Case.

Operation Indicator

The operation indicator is a small solenoid coil connected in the trip circuit. When the coil is energized, a spring-restrained armature releases the white target which falls by gravity to indicate completion of the trip circuit. The indicator is reset from outside of the case by a push rod in the cover or cover stud.

Instantaneous Trip (When Supplied)

The instantaneous trip attachment is a small solenoid type element. A cylindrical plunger rides up and down on a vertical guide rod in the center of the solenoid coil. The guide rod is fastened to the stationary core, which in turn screws into the element frame. A silver disc is fastened to the moving plunger through a helical spring. When the coil is energized with minimum trip current or above, the plunger moves upward carrying the silver disc which bridges three conical-shaped stationary contacts. In this position, the helical spring is compressed and the plunger is free to move while the contact remains stationary. Thus, a-c vibrations of the plunger are prevented from causing contact bouncing. A Micarta disc screws on the bottom of the guide rod and is locked in position by a small nut. Its position determines the pick-up current of the element.

CHARACTERISTICS

Type CWC Relay

The type CWC relay has two taps on the upper pole and four on the lower pole. They are marked in amperes which is the current thru both windings in series at minimum pick-up, and in product which is the minimum pick-up product of two equal or unequal currents.

Type CWC Relay Ranges and taps are:

.5 to 2 ampere (.25 to 4 Product) Range

Amperes	.5	.6	.8	1.0	1.2	1.6	2.0
Product	.25	.36	.64	1.0	1.44	2.56	4.0

1.5 to 6 ampere (2.25 to 36 Product) Range

Amperes	1.5	2.0	2.5	3.0	4.0	5.0	6.0
Product	2.25	4.0	6.25	9.0	16.0	25.0	36.0

The first four values are marked on the lower pole top plate. The upper pole tap

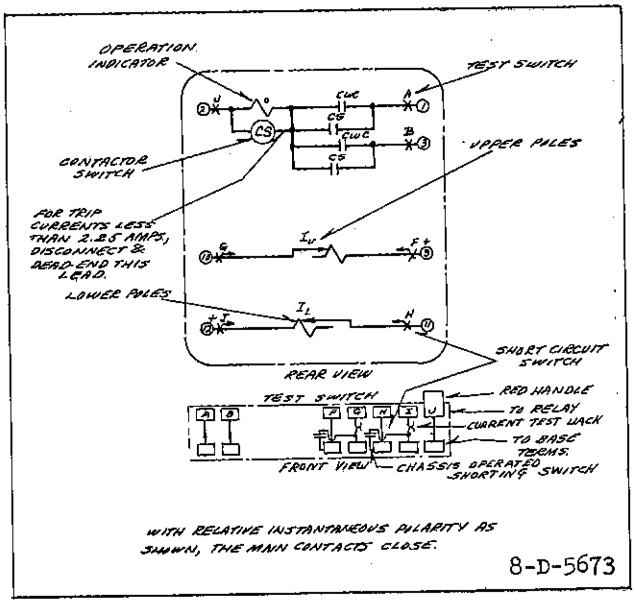


Fig. 7—Internal Schematic of the Double Trip Type CWC Relay in the Type FT Case. The Single Trip Relays Have Terminal 3 and Associated Circuits Omitted.

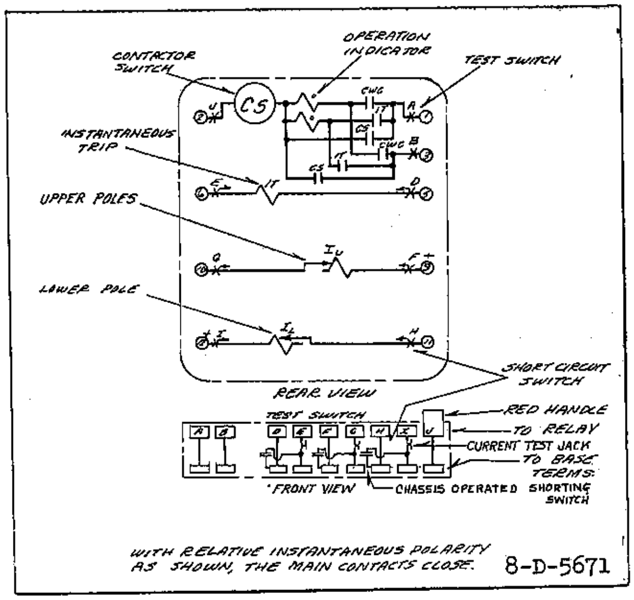


Fig. 8—Internal Schematic of the Double Trip Type CWC Relay with Instantaneous Trip in the Type FT Case.

plate is marked x1 and x2 (x1 and x4 Product). The last four values are obtained by using the x2 tap with the four lower pole taps.

Typical 60 Cycle time-product curves for the type CWC relay are shown in Fig. 14. These curves are taken at maximum torque which occurs with the currents in phase. For residual and Ground currents out of phase the relay operating time may be obtained by determining the operating time corresponding to the product pl = P Cos θ, where P is the actual relay product in amperes squared, and θ is the angle between the residual and polarizing currents.

The limits for which these curves are accurate within ± 7% are shown in Fig. 15.

Type CWP Relay

The type CWP relay taps are on the upper pole current coil. They represent the minimum pick-up product of current times voltage at maximum torque when the current lags the voltage by 60°. The ranges and taps are:

Product Range	Tap Markings						
20 - 150	20	30	40	50	75	100	150
75 - 600	75	100	150	200	300	400	600

Typical 60 cycle time product curves for the type CWP relay are shown in Fig. 16. These curves are taken at maximum torque which occurs with the current lagging the voltage 60°. For currents not lagging by this angle, the relay tripping time may be obtained by determining the operating time corresponding to the product pl = P Cos (60° - θ), where P is the actual relay V.A. product and θ is the angle the current lags the voltage. The curves are accurate within ±7% if the multiple of tap product does not exceed the voltage on the relay coil.

* INSTALLATION

The relays should be mounted on switchboard panels or their equivalent in a location free from dirt, moisture, excessive vibration and heat. Mount the relay vertically by means of the two mounting studs for the standard cases and the type FT projection case or by means of the four mounting holes on the flange or the semi-flush type FT case. Either of the studs or the mounting screws may be utilized for grounding the relay. The electrical connections may be made direct to the terminals by means of screws for steel panel mounting or to terminal studs furnished with the relay for ebony asbestos or slate panel mounting. The

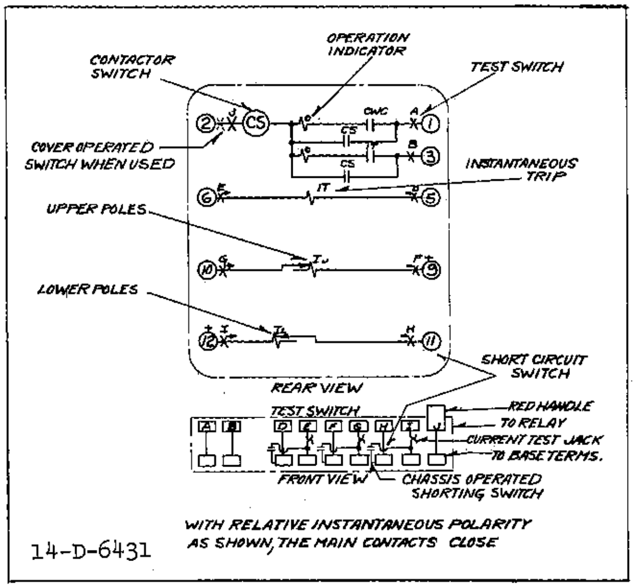


Fig. 9—Internal Schematic of the Single Trip Type CWC Relay with Instantaneous Trip in the Type FT Case.

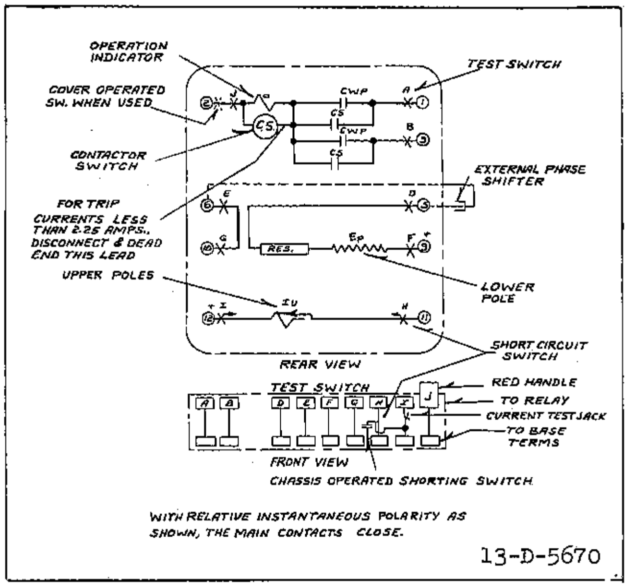


Fig. 10—Internal Schematic of the Double Trip Type CWP Relay in the Type FT Case. The Single Trip Relays Have Terminal 3 and Associated Circuits Omitted.

terminal studs may be easily removed or inserted by locking two nuts on the studs and then turning the proper nut with a wrench.

The relays without instantaneous trip attachments are normally supplied with the universal operation indicator, which consists of the 0.2 ampere indicator (Resistance = 2.8 ohms) and the 2.0 ampere contactor switch (Resistance = .25 ohms) in parallel. This provides a trip circuit resistance of approximately 0.25 ohms, and is suitable for all trip currents above 2.25 amperes d-c. If the trip current is less, disconnect the contactor switch coil by removing the lower pole on the front stationary contact of the switch and dead-end it under the small filister head screw located in the Micarta base of the switch. To disconnect the coil in the Type FT case relays, remove the coil lead at the spring adjuster and dead-end it under the screw near the top of the moulded bracket.

These relays are non-geared. For applications requiring quick opening contacts, the contact set screw should be adjusted so that the follow is reduced to a minimum.

SETTINGS

The following information is required to set these relays:

1. The maximum and minimum ground fault currents for faults at the relay and at the remote bus. These values should be residual current which is three times the zero sequence current.

2. The maximum and minimum polarizing current or voltage values for the faults above. The values should be residual currents or voltage which are three times the zero sequence values.

3. The current transformer ratios of the main and polarizing current transformers for the type CWC relay applications or the main current transformer ratio and the polarizing potential transformer ratio for the type CWP relay application.

Each relay should be set to operate as rapidly as possible for ground faults on the transmission lines near the breaker. The product available for the relay in these cases should be large enough to represent a large multiple of the tap product value so the operating times can be in the range of 0.05 to 0.20 second as seen from the curves of Figs. 14 and 16.

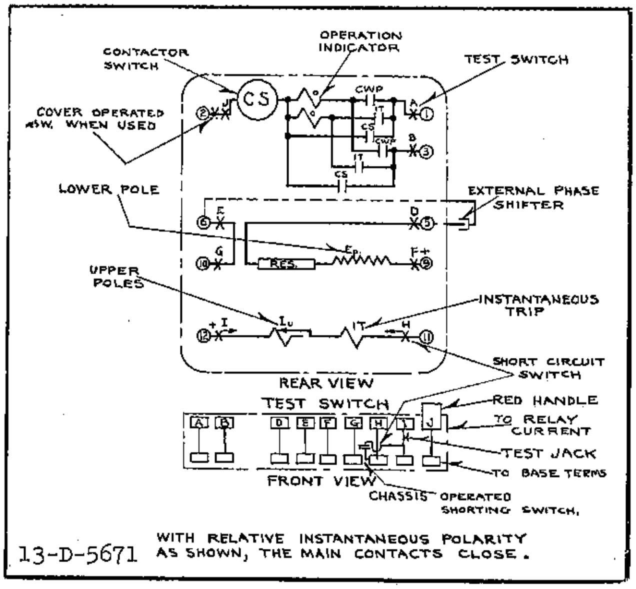


Fig. 11—Internal Schematic of the Double Trip Type CWP Relay with Instantaneous Trip in the Type FT Case.

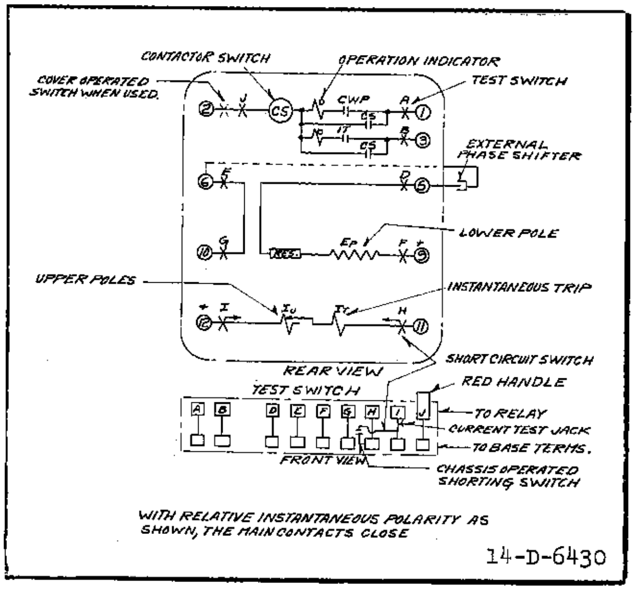


Fig. 12—Internal Schematic of the Single Trip Type CWP Relay with Instantaneous Trip in the Type FT Case.

However, the relays cannot distinguish between a fault on the line near the remote breaker for which they should operate, and a similar fault on the bus or adjacent line for which they should not operate until the bus differential or adjacent line relays have had an opportunity to operate and clear the fault. This requires an increased time setting of the relay for faults near the remote terminal. The product available for the relay in these cases will be smaller than that for the close faults and should represent a smaller multiple of the tap product previously chosen so the operating time can be from .4 to .75 second longer than the remote line or bus relay operating time. This .4 to .75 second interval is known as the coordinating time interval. It includes the circuit breaker operating time plus a factor allowing for difference between actual fault currents and calculated values, differences in individual relay performance, etc. For 8 cycle breakers the value of .4 second is commonly used, while for 30 cycle breakers .75 second is used.

As an example, a type CWC relay is to be connected at Station A and set to protect the line running to Station B. It must select or coordinate with the type CWP relay connected at Station B and set to protect the line running to Station C. The fault currents and voltage for single line-to-ground faults under minimum conditions for this system are shown in Fig. 13.

In setting the type CWC and CWP relays, it is convenient to set up Table as shown. The relay location is shown in Column 1 and the fault location in Column 2. The primary line residual current available for the relay is recorded in Column 3. The ratio of these current transformers is specified in Column 4.

The primary fault current or voltage available for the polarizing winding is shown in Column 5 and the associated current or potential transformer ratio in Column 6. All of these fault values are residual values or three times the zero sequence current or voltage. The relay current for the lower pole windings is the value of Column 3 divided by the ratio of Column 4. The value is recorded in Column 7. The upper pole relay current is the value of Column 5 divided by the ratio of Column 6, and is recorded in Column 8. The relay operating product is the values of Column 7 and 8 multiplied together and recorded in Column 9. For the type CWC relays, the ratio of $\frac{I_L}{I_U}$ is written in Column 10. All

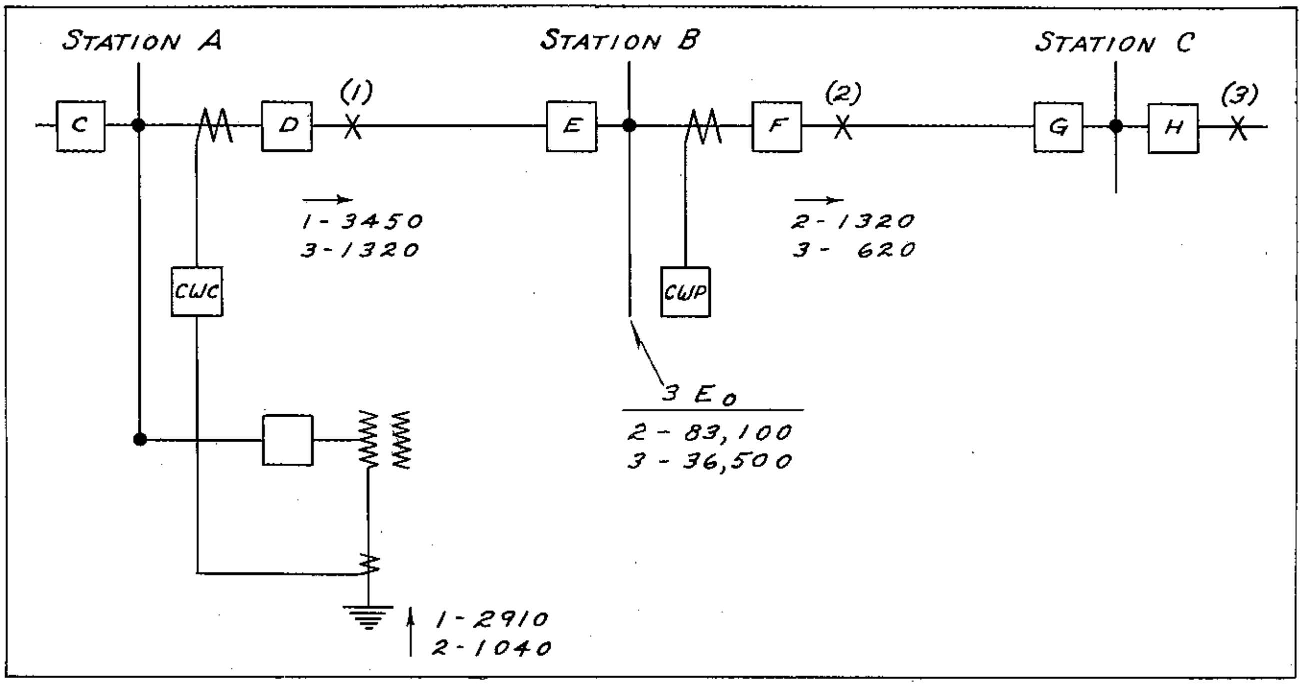


Fig. 13—Typical System for Setting Types CWC and CWP Relays.

TABLE I

1 Relay Location	2 Fault No.	3 Line Primary Amps.	4 Line C.T. Ratio	5 Polarizing Primary Amps. or Volts	6 Polarizing C.T. or P.T. Ratio	7 Line Secondary Amps. (I_L)	8 Polarizing Secondary Amps. (I_U)	9 Product $I_U \times I_L$	10 $\frac{I_L}{I_U}$	11 Tap	12 Multiples of Tap Product	13 R	14 Lever	15 Time In Seconds
D	1	3450	300/5	2910	300/5	57.5	48.5	2285	1.19	36	63.5	4.76	2-1/4	.16
D	2	1320		1040		22.0	17.3	381	1.27		10.6	5.1		.56
F	2	1320	100/5	83,100V	1000/1	66.0	83.1V.	5485	-	300	18.3	-	3/4	.16
F	3	620		36,500V		31.0	36.5V.	1130	-		3.8			.53

of this data is fixed by the system constants and characteristics, and is preliminary to making the actual relay setting.

The choice of a tap recorded in Column 11 and of the time lever in Column 14 is a matter of trial and error. The breakers on this system have 8 cycle operating time so that the coordinating time interval should be about .4 second. The tap should be chosen so that the relay times for the close in fault and remote fault product values will differ by about the coordinating time interval or .4 second in this case. Practically this can be accomplished by several taps with equal results. Tap 36 was selected in this example. The product value divided by the tap is recorded in Column 12. This value is the abscissa of the time product relay curves. From these curves the lever Column 14 and relay operating time Column 15 were chosen so that the relay would operate at about .16 second for close-in faults and about .57 second for the remote faults. These times for the type CWC relay were obtained using time lever setting no. 2-1/4.

With the selection of a satisfactory tap value, the curves of Fig. 15 will quickly show if the combination of tap and current values provide relay operating times as indicated by the curve. The value of Column 10 multiplied by N = 4.0 for tap 36 gives the R values of Column 13. These are within the curve of Figure 15.

The same process is allowed in setting the type CWP relay at Station B on breaker F. Here tap 300 was selected with lever 3/4 to provide relay operating times of 0.16 and 0.53 seconds respectively for close-in and remote faults. The operating limits using this tap

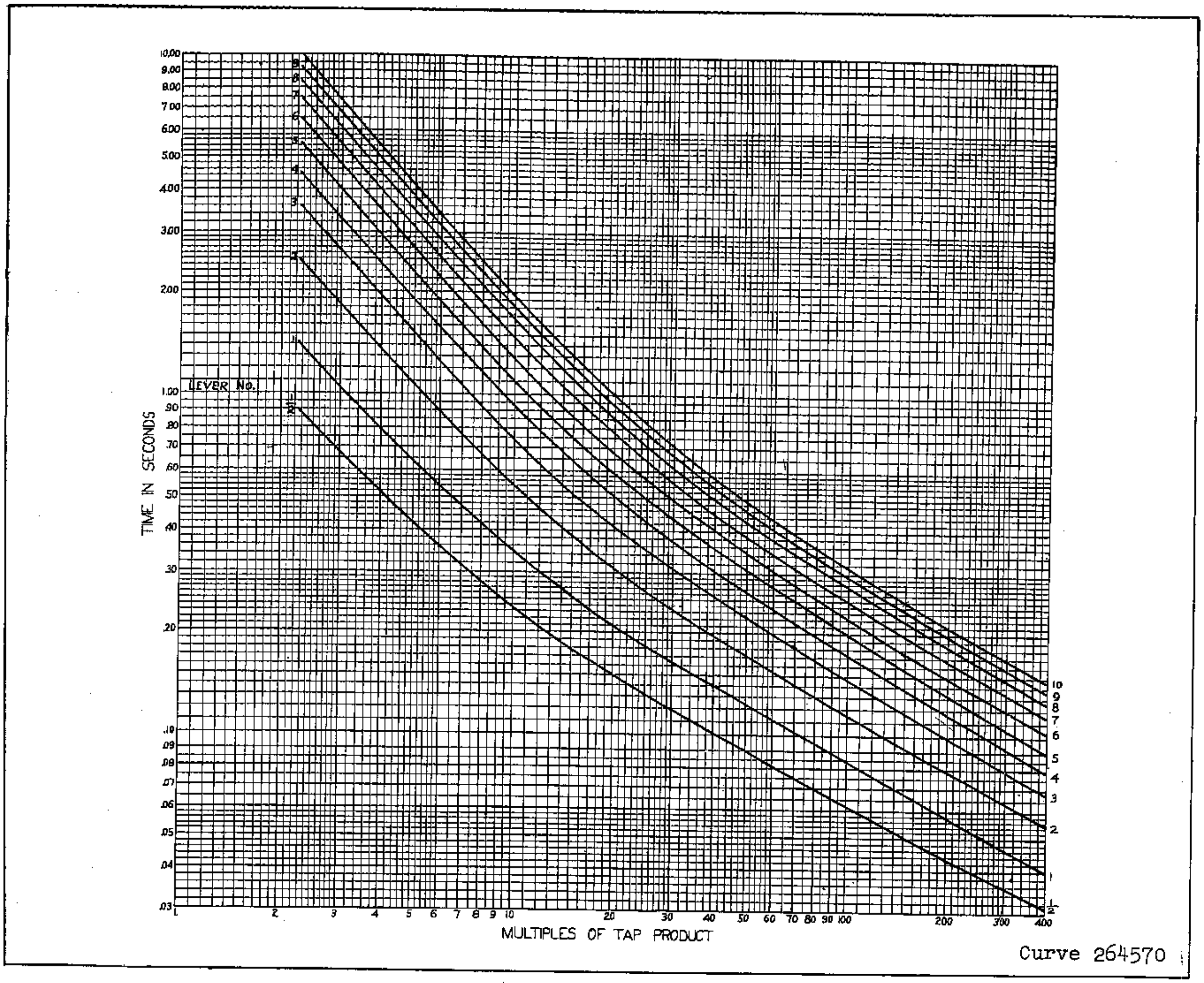


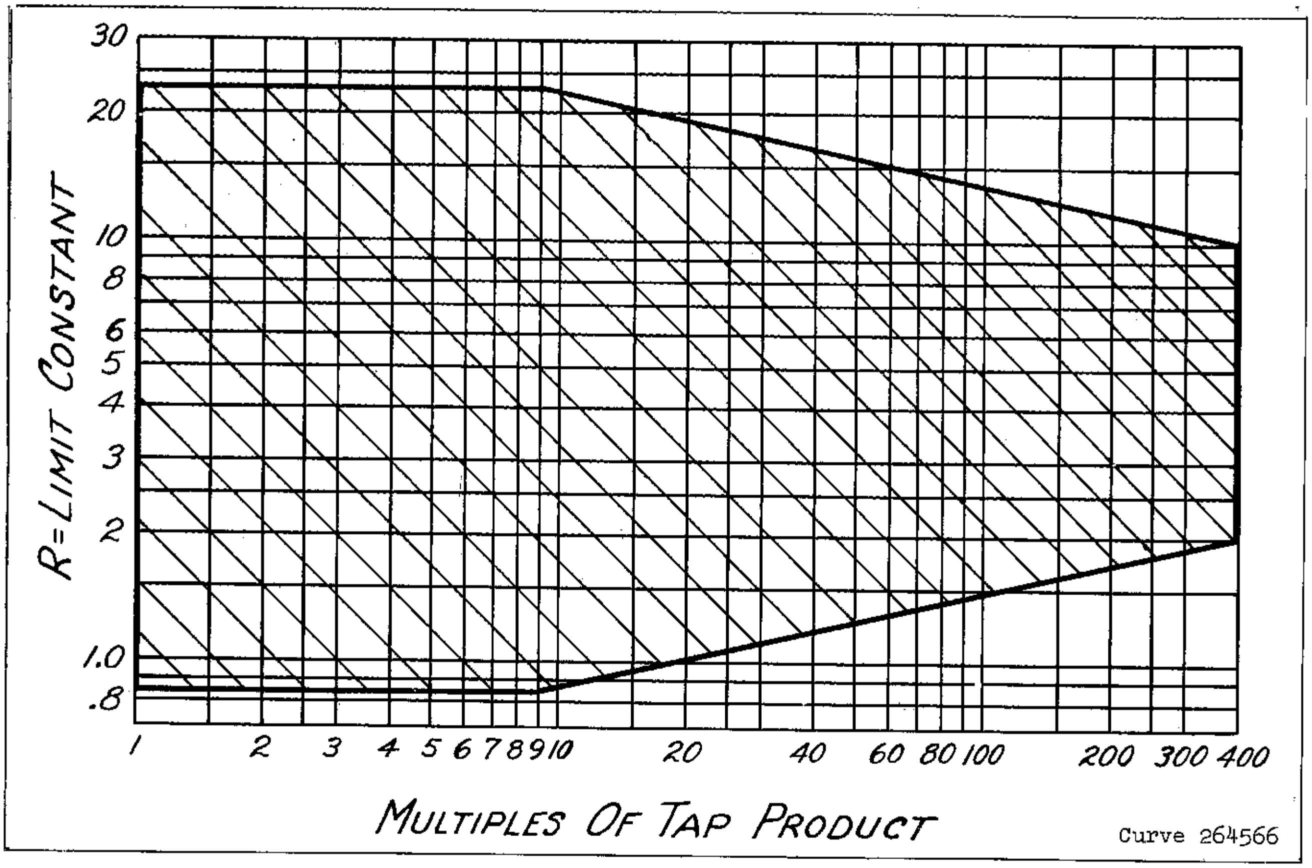
Fig. 14—Typical 60 Cycle Time-Product Curves of the Type CWC Relay with Two Windings in Series.

are fulfilled since neither multiples of tap product value (Column 12) is greater than the polarizing voltage (Column 8).

After individual relay settings are made, it is necessary to check to see if the relays select properly with associated relays. In the example the coordinating time interval was 0.4 second. Therefore, for fault 2, the relay at D should not operate before the relay at F plus the coordinating time interval. In other words, the operating time of D should be not less than 0.16 second plus 0.40 = 0.56 second.

Similarly the time of the relay at breaker H should not be greater than 0.13 second in order to select with relay F for fault 3. If the time of relay H is greater, then the time of relay at F must be increased to provide proper selection. This change may be accomplished by a change in the time lever setting only, although often a new tap and lever setting may provide a more satisfactory setting. Changing the setting of relays at B probably will require a change in the setting of the relay at Station A.

After the settings are made for all the relays under minimum generating conditions, then it is necessary to check the relay operating time and coordination under the maximum generating conditions. Often additional changes in



For the 0.25 to 4 Product Range

$$R = M \frac{I_L}{I_U}$$

where I_L = the lower pole current.
I_U = the upper pole current.
M = value from the table below for various tap combinations.

Tap Product	Upper Pole Product Tap	Lower Pole Product Tap	M	K
.25	1	.25	4.0	10
.36	1	.36	2.78	12
.64	1	.64	1.56	16
1.0	1	1.0	1.0	20
1.0	4	.25	16.0	20
1.44	4	.36	11.1	24
2.56	4	.64	6.25	32
4	4	1.00	4.0	40

For the 2.25 to 36 Product Range

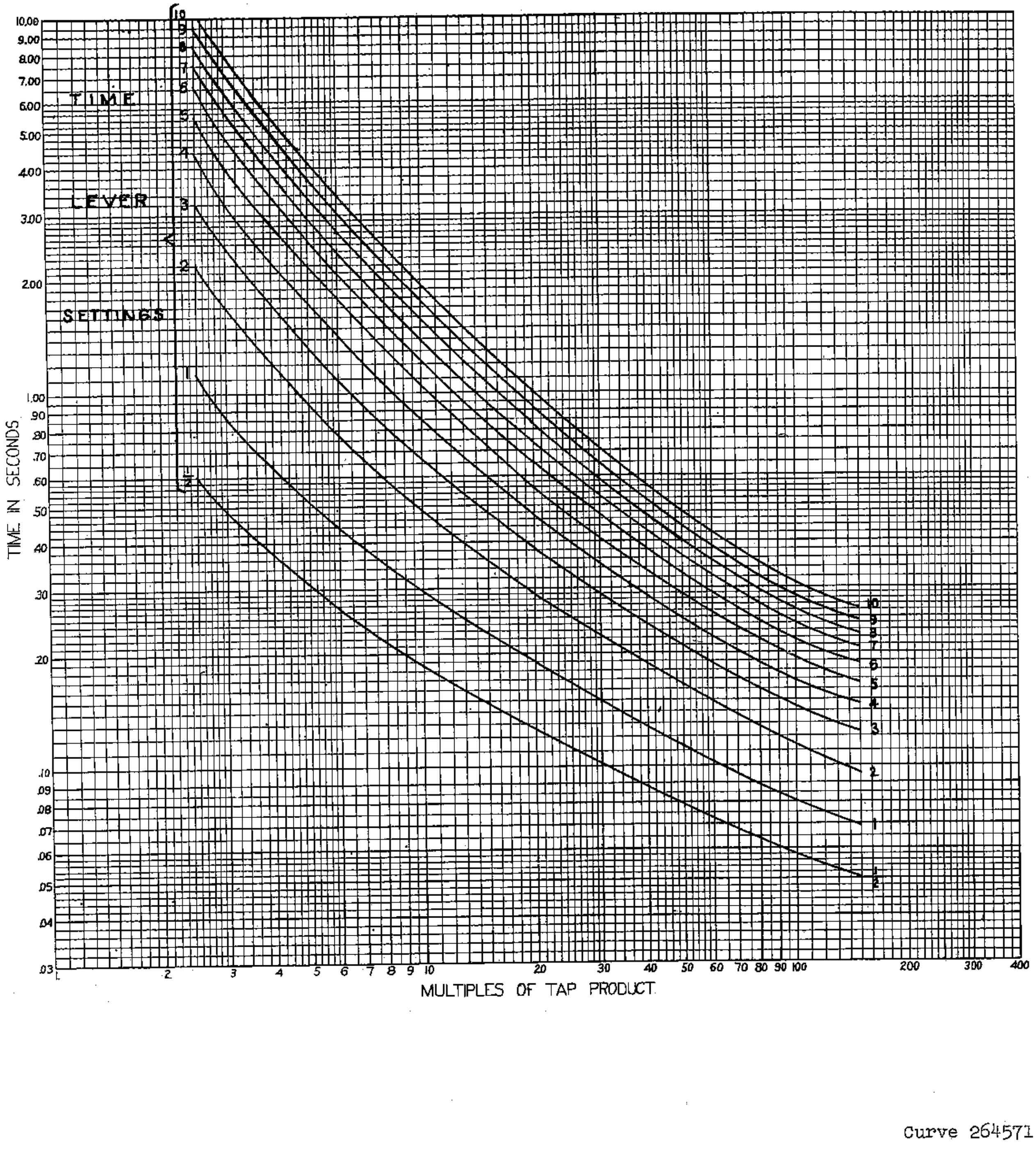
$$R = N \frac{I_L}{I_U}$$

where I_L = the lower pole current
I_U = the upper pole current
N = value from the table below for various tap combinations.

Tap Product	Upper Pole Product Tap	Lower Pole Product Tap	N	K
2.25	1	2.25	4.0	30
4.0	1	4.0	2.25	40
6.25	1	6.25	1.44	50
9.0	1	9.0	1.0	60
9.0	4	2.25	16.0	60
16.0	4	4.0	9.0	80
25.0	4	6.25	5.76	100
36.0	4	9.0	4.0	120

The Typical time curves for the Type CWC Relay are valid if the values of R falls within the shaded area of the curve above, and if neither relay current is greater than K in amperes.

Fig. 15—Operating Limits of the Type CWC Relay.



These Curves are valid if the multiple of tap Product (volt-amperes) does not exceed the voltage on the relay polarizing coils.

Fig. 16—Typical 60 Cycle Time-Product Curves of the Type CWP Relay at Maximum Torque.

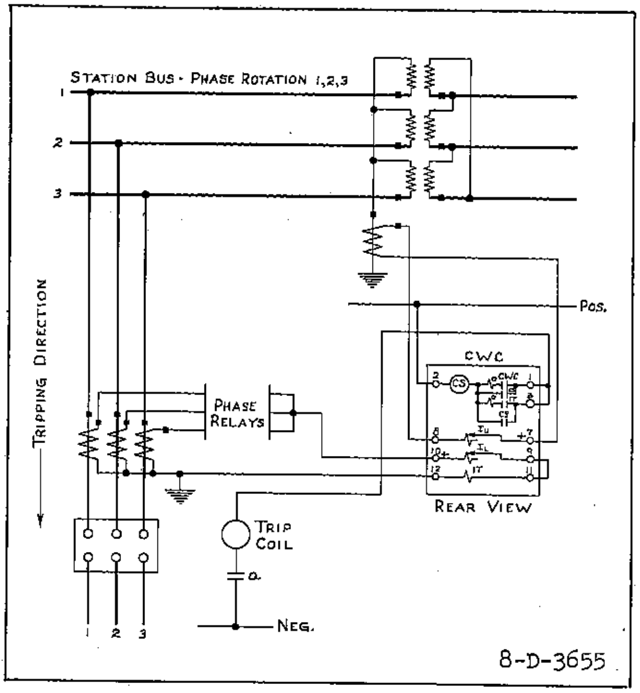


Fig. 17—External Connections of the Type CWC Relay in the Standard Case for Ground Fault Protection.

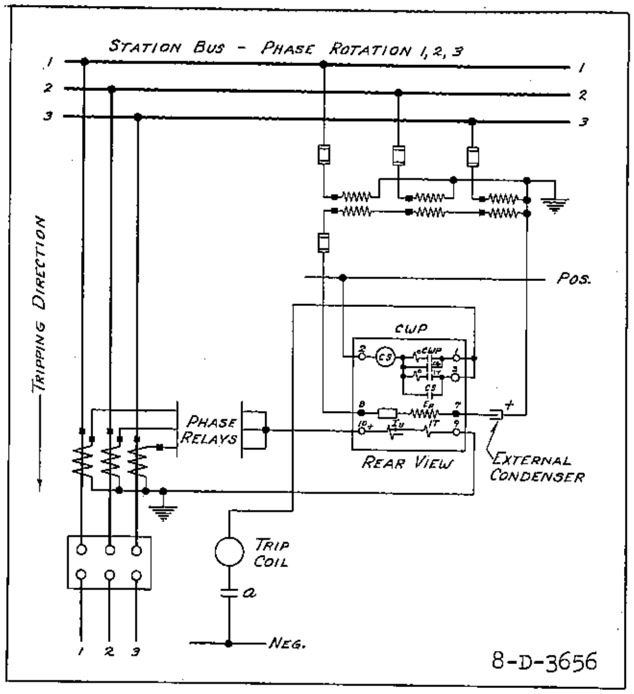


Fig. 18—External Connections of the Type CWP Relay in the Standard Case for Ground Fault Protection.

tap and lever settings are required, particularly if the maximum and minimum fault values are quite different.

ADJUSTMENTS AND MAINTENANCE

The proper adjustments to insure correct operation of this relay have been made at the factory and should not be disturbed after receipt by the customer. If the adjustments have been changed, the relay taken apart for repairs, or if it is desired to check the adjustments at regular maintanance periods, the instructions below should be followed.

All contacts should be periodically cleaned with a fine file. S#1002110 file is recommended for this purpose. The use of abrasive material for cleaning contacts is not recommended, because of the danger of embedding small particles in the face of the soft silver and thus impairing the contact.

Type CWC Relay

The upper bearing screw should be screwed down until there is only 3 to 5 thousandths inch clearance between it and the shaft and then securely locked in position with the lock nut. This adjustment can be made best by carefully screwing down the top bearing screw until the disc fails to turn freely and then backing up a fraction of a turn. Great care must be taken in making this adjustment to prevent damage to the bearings.

Adjust the contacts to just barely touch when the time lever is set on zero by shifting the position of the contact stop on the time lever. This should be done with approximately the required contact follow. Final adjustment of the contacts can be more easily made by the contact follow set screw after the contact stop is securely fixed.

A maximum contact follow of approximately 5/64 inch is obtained when the set screw on the stationary contact is all the way out. Where rigid contacts for quick reopening are required, the set screw should be all the way in to hold the stationary contact against the Micarta bracket. Readjust the zero setting after this is done.

Connect the upper and lower poles in series

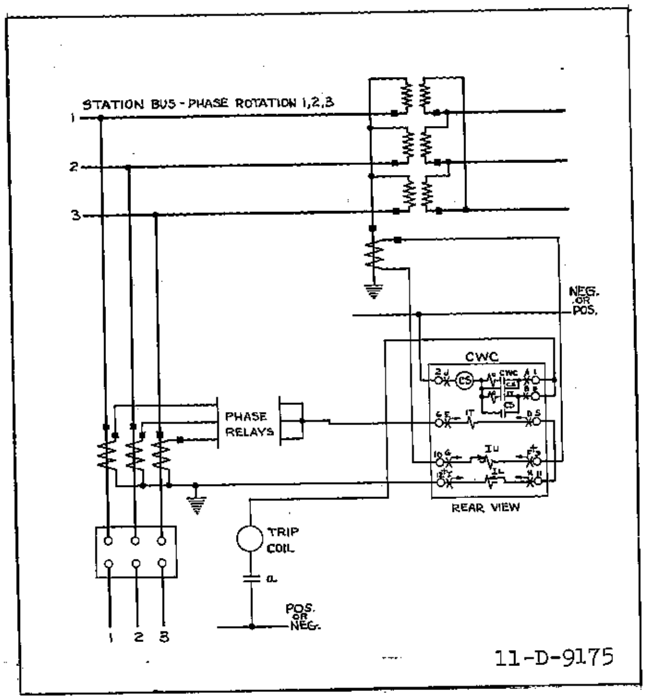


Fig. 19—External Connections of the Type CWC Relay in the Type FT Case for Ground Fault Protection.

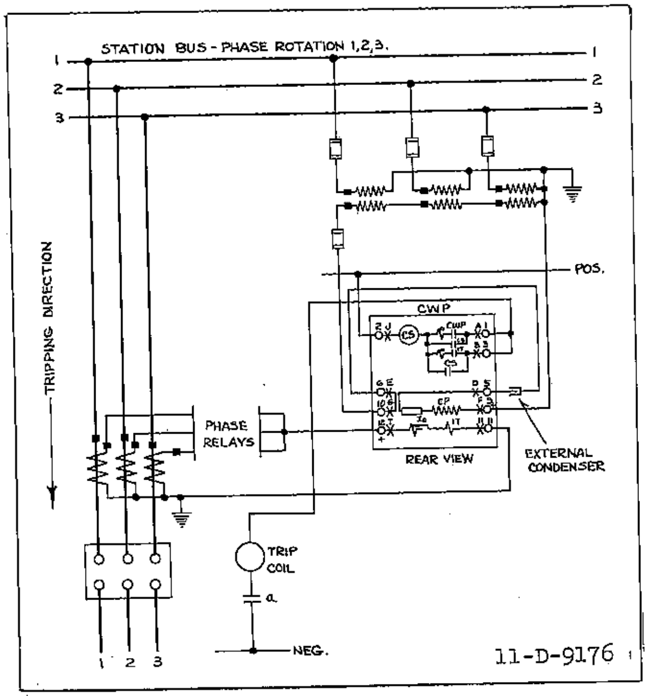


Fig. 20—External Connections of the Type CWP Relay in the Type FT Case for Ground Fault Protection.

and pass current with the polarity indicated on the diagrams. With one tap screw in the 1 multiplier position and the other screw in the .36 product tap for the .25-4 product range or the 4 product tap for the 2.25-36 product range apply current and adjust the spring tension so that the contacts just close with tap value of current flowing. This is 0.6 ampere, 60 cycles, on the .25-4 product range or 2.8 amperes, 60 cycles, on the 2.25-36 product range. The spring tension may be changed by means of a screw driver inserted in one of the notches of the plate to which the outside convolution of the spring is fastened.

Various points on the typical time-product curves can be checked approximately with the test connections above. The multiples of tap product will be the square of the current passed thru the two coils, divided by the tap product. The timing can be checked with a cycle counter by averaging a number of trials. Make sure that the coils do not over heat, otherwise the curves cannot be checked. The position of the permanent magnet over the disc will affect the timing and shape of the curves.

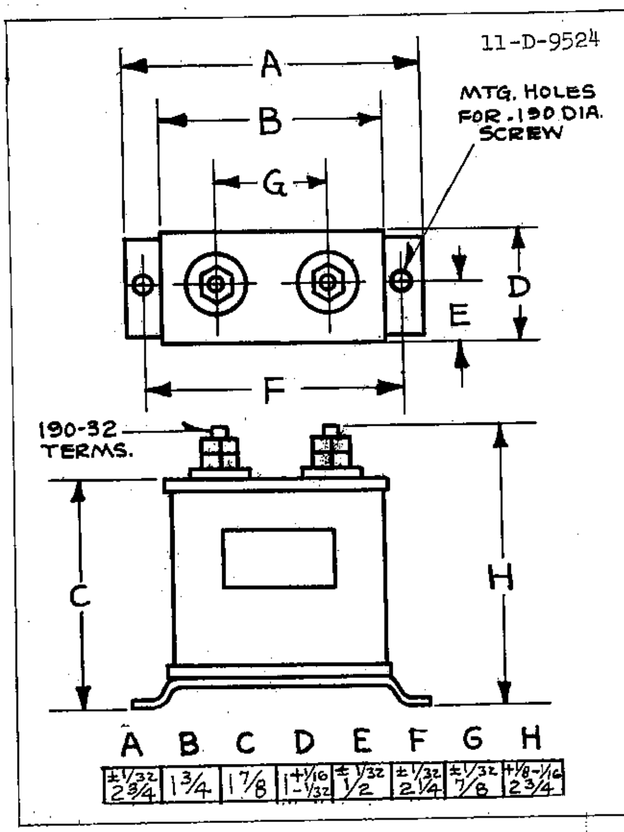


Fig. 21—Outline and Drilling Plan of the External Phase Shifting Capacitor for the Type CWP Relay. For Reference Only.

Type CWP Relay

Adjust the upper bearing screw and contacts as outlined in the first three paragraphs under type CWC relay.

Connect 115 volts across the relay potential coil and the external condenser. Apply approximately 5 times the minimum pick-up-current (tap value divided by 115) with the polarity shown and see that zero torque occurs when current leads the voltage between 19 and 36 degrees. There should be no spring tension on the relay for this test.

With the connection above apply 100 volts and current lagging 60° behind the voltage. With the tap screw in the lowest tap, adjust the spring tension so that the contacts just close with correct value of current flowing. This current will be tap value divided by 100 or 0.20 ampere, 60 cycle, for the 20-150 product range, or 0.75 ampere, 60 cycle, for the 75 to 600 product range. The spring tension may be changed by means of a screw driver inserted in one of the notches of the plate to which the outside convolution of the spring is fastened.

The typical time-voltampere curves may be checked in a manner similar to that described above under the type CWC relay.

Contactor Switch

Adjust the stationary core of the switch for a clearance between the stationary core and the moving core when the switch is picked up. This can be most conveniently done by turning the relay up-side-down. Screw up the core screw until the moving core starts rotating. Now, back off the core screw until the moving core stops rotating. This indicates the point where the play in the moving contact assembly is taken up, and where the moving core just separates from the stationary core screws. Back off the stationary core screw one turn beyond this point and lock in place. This prevents the moving core from striking and sticking to the stationary core because of residual magnetism. Adjust the contact clearance for 3/32 inch by means of the two small nuts on either side of the Micarta disc. The switch should pick up at 2 amperes d-c. Test for sticking after 30 amperes d-c have been passed thru the coil. The coil resistance is approximately 0.25 ohm.

Operation Indicator

Adjust the indicator to operate at 0.2 ampere d-c gradually applied by loosening the two screws on the underside of the assembly, and moving the bracket forward or backward. If the two helical springs which reset the armature are replaced by new springs, they should be weakened slightly by stretching to obtain the .2 ampere calibration. The coil resistance is approximately 2.8 ohms.

Operation Indicator (When Inst. Trip Attachment is Supplied)

Adjust the indicator to operate at 1.0 ampere d-c gradually applied by loosening the two screws on the underside of the assembly, and moving the bracket forward or backward. If the two helical springs which reset the armature are replaced by new springs, they should be weakened slightly by stretching to obtain the 1 ampere calibration. The coil resistance is approximately 0.16 ohm.

RENEWAL PARTS

Repair work can be done most satisfactorily at the factory. However, interchangeable parts can be furnished to the customers who are equipped for doing repair work. When ordering parts, always give the complete nameplate data.

ENERGY REQUIREMENTS

The burden of the Type CWC relays at 5 amperes, 60 cycles is as follows:

Lower Pole Windings

Product Range	Product Tap Value	Watts	Vars	Volt-Amperes	P.F. Angle Degrees Lag
.25-4	.25	82.7	29.3	88.0	19.5

Product Range	Product Tap Value	Watts	Vars	Volt-Amperes	P.F. Angle Degrees Lag
	.36	57.3	14.1	59.0	13.8
	.64	32.1	4.43	32.4	7.85
	1.00	20.6	1.83	20.7	5.10
2.25-36	2.25	8.50	3.26	9.1	21.0
	4.0	4.78	1.03	4.89	12.1
	6.25	3.01	0.41	3.04	7.7
	9.0	2.13	0.21	2.14	5.5

Upper Pole Windings

Product Range	Product Tap Value	Watts	Vars	Volt-Amperes	P.F. Angle Degrees Lag
.25-4	1	6.08	8.58	10.5	55
	4	1.52	0.54	1.61	20
2.25-36	1	0.79	0.95	1.24	50
	4	0.20	0.06	0.21	17

The burden of the type CWP relays at 5 amperes, 115 volts, 60 cycles is as follows:

Upper Pole Windings

Product Range	Product Tap Value	Watts	Vars	Volt-Amperes	P. F. Angle Degrees Lag
75-600	75	0.633	0.144	0.660	12.6
	100	0.557	0.095	0.560	9.8
	150	0.494	0.043	0.495	5.0
	200	0.460	0.032	0.460	4.0
	300	0.370	0.013	0.370	2.0
	400	0.340	0.006	0.340	1.0
	600	0.290	——	0.290	0.5
20-150	20	4.70	2.66	5.4	29.5
	30	3.23	1.21	3.45	20.5
	40	2.93	0.87	3.05	16.5
	50	2.31	0.57	2.38	14.0
	75	1.50	0.28	1.52	10.7
	100	1.15	0.11	1.15	5.5
	150	0.80	0.014	0.80	1.0

Lower pole Potential Winding including external 0.38 mfd. phase shifting capacitor.

	Watts	Vars	Volt-Amperes	P. F. Angle Degrees Lead
All ranges -	5.5	2.78	6.15	26.8

The coil ratings are:

Relay	Range	Pole Winding	Continuous Amperes	1 Sec Amperes
CWC	.25-4	All	4	110
CWC	2.25-36	Upper	10	280
		Lower	12.7	370
CWP	20-150	Upper	3.2	88
	75-600	Upper	6.4	185

The potential coil circuit of the type CWP relay will stand 250 volts for 15 seconds.

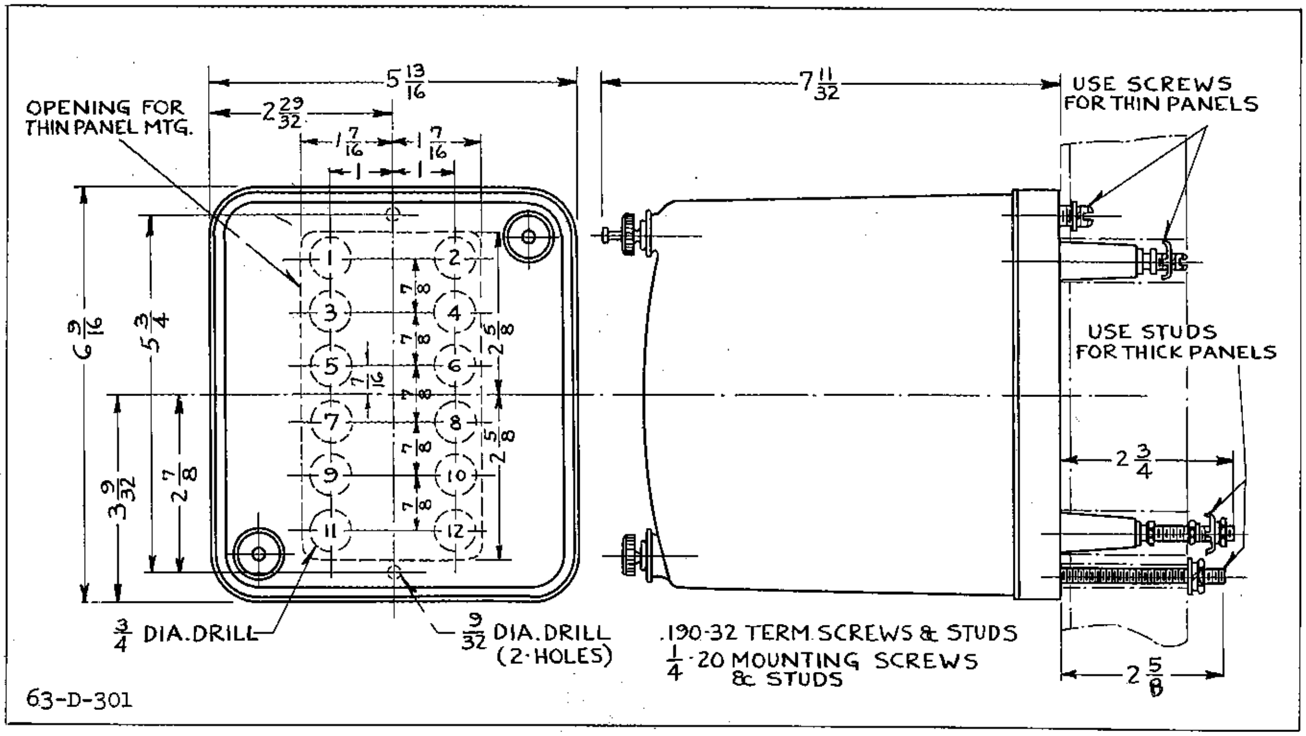


Fig. 22—Outline and Drilling Plan for the Standard Projection Type Case. See the Internal Schematics for the Terminals Supplied. For Reference Only.

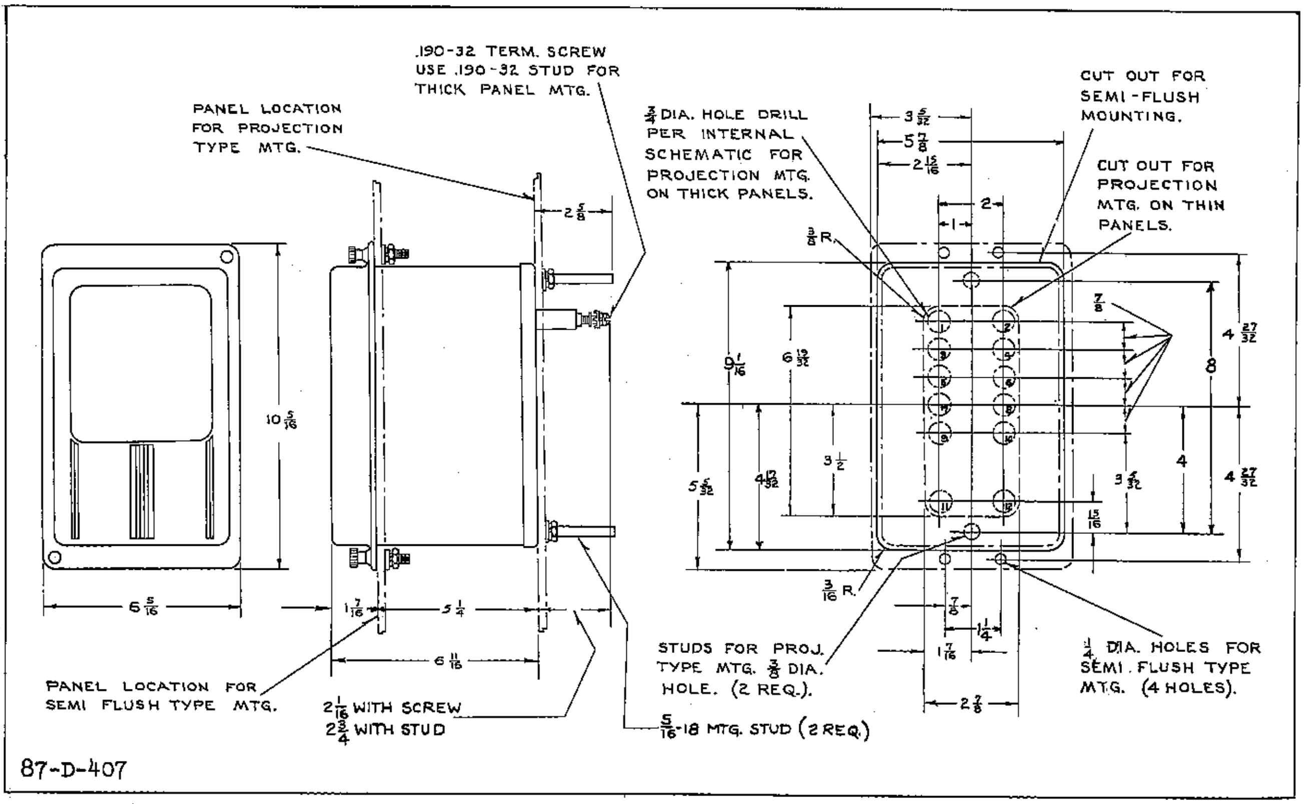


Fig. 23—Outline and Drilling Plan for the S10 Projection or Semi-Flush Type FT Flexitest Case. See the Internal Schematics for the Terminals Supplied. For Reference Only.

WESTINGHOUSE ELECTRIC CORPORATION

METER DIVISION **NEWARK, N.J.**

Printed in U. S. A.