AUTOMATIC A-C
NETWORK PROTECTOR
TYPES MG-8 and MG-9
NETWORK PROTECTORS AND RELAYS

These instructions are for network protectors rated at 277/460 volts, 60 cycles, for operation on a 3-phase, 4-wire network system. Instruction books GEH-1808 on Network Protectors and GEK-33973 on Network Relays are included for standard 125/216 volt, 60 cycle, 3-phase, 4-wire network systems. The places wherein it is necessary to deviate from these standard instruction books to make them applicable to this voltage, are listed:

1. Typical wiring Diagram (See pages 12 and Figure 7).

Use wiring diagram, Figure 1A, which shows the standard protector and relays adapted to this higher voltage by the use of potential transformers.

2. Inspection and Testing (See page 9)

There are two methods of testing the 277/480 volt Network Protector. One of these permits the unit to be tested in the identical manner in which the 125/216 volt protector is tested. The second method closely parallels that described in GEH-1808. The variations that exist will be noted below.

First Method

Proceed as described in GEH-1808 after the following steps are taken:

1. Remove all insulated test caps. There are an additional 10 of these on the 277/480 volt unit.

2. Connect jumper wires between terminals 11 and 11A, 6B and 6A, and 41A and 41. These jumpers short out certain values of resistance in the control circuits, making them the equivalent of those in the 125/216 volt units.

3. Apply the test voltages between switch terminals 11 and 21 and also between 11 and 3A, rather than 11 and 12, using the same voltage values given in GEH-1808.

NOTE: AFTER TESTING HAS BEEN COMPLETED, DO NOT FAIL TO REMOVE THE JUMPER WIRES FROM 11, 11A, 6B, 6A, 41A AND 41. FAILURE TO DO SO BEFORE THE PROTECTOR IS PUT INTO SERVICE WILL RESULT IN SERIOUS DAMAGE TO CONTROL COMPONENTS.

Second Method

Item 4, (page 10)

Tightly fasten down an insulated cap on test switch terminal 3A. Apply 460 volts, 60 cycles to stud 11 and 21 and proceed with the electrical operation test as described under this item.

Figure 8 illustrates a test auto transformer for use in testing the control circuit with the various voltages required on standard 125/216 volt network protectors. The table on Figure 8 also designates the percent of the line voltage used when testing protectors above 216 volts line to line.

Item 5, (page 11)

Apply 7-1 2/3% of line voltage

Item 6, (page 11)

Apply 73% of line voltage

Item 7, (page 11)

Apply 77% of line voltage for non-pickup and 80% of line voltage for positive pickup.

3. Testing the Master and Phasing Network Relays

In order to insure proper functioning of the network protector, the network relays should be periodically inspected and tested. This can be done in the laboratory and complete instructions for this method of testing are given in Relay Instruction Book GEK-33973. A spare set of relays is recommended for use on the protector while laboratory tests and adjustments are being made.

In some cases where laboratory testing facilities are not available, or for other reasons, it may be desirable to test the network relays in the field on the particular protector with which they are used. A recommended procedure for field testing of the relays is outlined in the following paragraphs.

Potential for the operation of the Master and Phasing relays is obtained with potential transformers which transforms the voltage to 125/216 volts. This permits the use of standard relays. The control circuit for closing and tripping the breaker utilizes the line voltage.

Field Testing Circuit

Field test connections are shown on Figure 2, and give a test circuit suitable for testing the network relays while mounted on the network protector. Three phase test power is obtained directly from the network.

The network protector unit should be disconnected from both the transformer and the network. Also all of the insulated test caps should be removed from the potential and test switches except those to terminals D, E, F and 3A which should be tightened. This opens the switches and makes the test wiring terminals available for making test connections.

Tests on the Network Master Relay

a. Potential alone (Protector open)

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company. To the extent required the products described herein meet applicable ANSI, IEEE and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.
Close switch $S_6$ to energize the potential coils only. The movable contacts should come to rest, at a position where the gap at the tripping contacts is about 1/16" to 1/32".

b. Reclosing Voltage (Protector Open)

The Master Relay will reclose on a 2, 3 or 4 volt difference of the line voltage and on a 1, 1.5, or 2 volt difference when operated thru the potential transformers. It is then necessary to determine whether 2, 3 or 4 volt minimum reclosure resistors are used in the protector to be tested. This will allow the selection of the correct test values from Table "A".

Close switches $S_2$, $S_3$, $S_4$, $S_5$, and $S_7$ all in the up position and block phasing relay contacts in the closed position. Then slowly vary $R_1$ to increase the reclosing voltage from a very low value until the right hand contacts just close, which will be indicated by the closing of the protector.

The resistance of $R_2$ should be one ohm and the reclosing voltage will be numerically equal to the reading of the ammeter $A_1$. (The voltmeter $V_1$ should be removed while making the reading with $A_1$. This reclosing voltage reading is related to the actual three-phase reclosing voltage as shown in the following tabulation:

<table>
<thead>
<tr>
<th>Nominal</th>
<th>$A_1$ Amperes (and limits)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>1.5 (1.2 - 1.8)</td>
</tr>
<tr>
<td>1.5</td>
<td>2.25 (1.9 - 2.6)</td>
</tr>
<tr>
<td>2.0</td>
<td>3.0 (2.6 - 3.4)</td>
</tr>
</tbody>
</table>

A limited adjustment of the reclosing voltage may be obtained by varying the tension of the control spring. This control spring is adjusted by turning the control spring adjusting shaft clockwise to increase the reclosing voltage setting. In no case, should the spring be set so that the reclosing contacts do not positively close when the relay is completely de-energized.

c. Tripping (Protector open)

The relays are adjusted for sensitive operation requiring a very low in-phase tripping setting and calibration may be obtained by adjustment of the mechanical restraint. The maximum in-phase reverse current setting with the mechanical restraint should not exceed 3 percent of the current transformer rating.

To eliminate the necessity of handling large current through the primaries of the current transformers, a voltage is applied to the phasing circuit which produces the equivalent effect of current through the primary of the current transformer. The values of voltage or phasing winding current used for producing the effect of an equivalent primary current are given in the following table under the "Mechanical Restraint".

**Mechanical Restraint (Sensitive Setting)**

Close switches $S_9$ down, $S_4$, $S_5$, and $S_7$ up; and block the phasing relay contacts open. Adjust the resistor $R$ until the trip contacts just close. This closure will be shown by the indicating lamp (L L in field test connection diagram) which is connected between the top terminal of the network master relay and ground. The voltage applied to the phasing circuit is numerically equal to the indication of ammeter $A_1$. Refer to Table "B" to convert this reading into the equivalent tripping current in per cent of current transformer rating.

When more than 2 volts are required across the phasing circuit, close switch $S_9$ down instead of up, and read the voltage directly at $V_1$ instead of the current at ammeter $A_1$. Table "B" applies to the reading of the voltmeter $V_1$ as well.

<table>
<thead>
<tr>
<th>Equivalent Tripping Current in %</th>
<th>Voltage Applied to Phasing Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>*1</td>
</tr>
<tr>
<td>0.2</td>
<td>0.70</td>
</tr>
<tr>
<td>0.5</td>
<td>1.75</td>
</tr>
<tr>
<td>0.75</td>
<td>2.62</td>
</tr>
<tr>
<td>1.0</td>
<td>3.50</td>
</tr>
<tr>
<td>1.5</td>
<td>5.25</td>
</tr>
<tr>
<td>2.0</td>
<td>7.00</td>
</tr>
<tr>
<td>2.5</td>
<td>8.75</td>
</tr>
<tr>
<td>3.0</td>
<td>10.50</td>
</tr>
</tbody>
</table>

(*) These figures represent the nominal reclosing voltage of the relay. For example, the first column headed "1" would be used when the resistors in the phasing circuit are those prescribed for 1 volt reclosure and so on, for the columns headed "1-1/2" and "2".

If tripping does not occur within (plus or minus) 20 percent of the desired setting, the mechanical restraint can be changed by turning the mechanical restraint adjusting cap. Clockwise direction increases the setting and counter-clockwise decreases it.
Figure 1. (0152C2778) Wiring Diagram - Typical (For Reference only)
Figure 3.

**FIELD TEST CONNECTIONS**

For relays on types MG-8 & MG-9 network protectors 480/277 volts

**NOTE:** THE VOLTMETER $V_1$ SHOULD BE REMOVED FROM THE CIRCUIT WHEN $A_1$ IS USED.