

Switchgear Maintenance Information

SMI NO. 18-79

OCTOBER 26, 1979

SUBJECT AK Breaker Primary Disconnect Assemblies -
Maintenance and Repair.

Description:

The subject primary disconnect assemblies consists of pairs of horizontally opposed, silver plated (silver build in 1 mill) copper contact fingers. These are mounted to the primary breaker copper by 1 (AK-15/25) or 2 (AK-50) 1/4 x 20 bolt(s) which passes through both the disconnect assembly contact pressure springs and the copper bar.

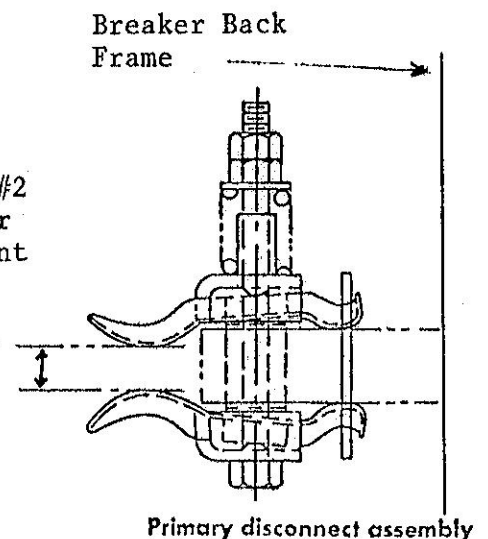
Retainers and spacers are used to hold the contact fingers in proper alignment to insure correct engagement with the cubicle mounted primary copper studs. Contact pressure is determined by the degree to which the contact springs are compressed by the bolt, flat washer, double nut hardware arrangement.

Servicing:

When it becomes necessary to dismantle the primary disconnect assembly and remove the contact fingers, be positive to --

1. Carefully count the number of threads from the end of the 1/4 - 20 bolt to the first (closest) 1/2 x 20 nut, and record this information.
2. Measure that same distance using a 6" scale and record that dimension in 64ths of an inch.

See note #2
for proper
measurement



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DETERMINING DATA

- 9 LEADS: 3 WIRES EACH LEAD - 1-2 Y LOOK FOR Y 1Y
- 9 LEADS: 2 WIRES EACH LEAD - 2-4 Y LOOK FOR Y 2Y
- 9 LEADS: EACH LEAD HAVING EQUAL NUMBER OF WIRES IS ALWAYS Y CONNECTION. NUMBER OF Y'S SHOULD BE SAME AS NUMBER OF WIRES ON ANY LEAD.

- 9 LEADS: 3 HAVING 2 WIRES AND 6 HAVING 1 WIRE IS 1-2 DELTA
- 9 LEADS: 3 HAVING 4 WIRES AND 6 HAVING 2 WIRES IS 2-4 DELTA
- 9 LEADS: 3 HAVING 6 WIRES AND 6 HAVING 3 WIRES IS 3-6 DELTA

9 LEAD DELTA CONNECTED STATORS WILL HAVE 3 LEADS WITH TWICE THE NUMBER OF WIRES AS ARE ON THE OTHER 6 LEADS.

4 Pole	36 slot	1 to 8
	48	1 to 11
	72	1 to 13

3 LEAD STATORS

- 3 LEADS WITH 1 WIRE EACH IS 1 Y
- 3 LEADS WITH 2 WIRES EACH IS 1 DELTA OR 2 Y - LOOK FOR Y'S
- 3 LEADS WITH 3 WIRES EACH IS 3 Y
- 3 LEADS WITH 4 WIRES EACH IS 2 DELTA OR 4 Y - LOOK FOR Y'S
- 3 LEADS WITH 5 WIRES EACH IS 5 Y
- 3 LEADS WITH 6 WIRES EACH IS 3 DELTA OR 6 Y - LOOK FOR Y'S

EVEN NUMBER OF WIRES ON 3 LEAD STATOR CAN BE Y OR DELTA - LOOK FOR Y
ODD NUMBER OF WIRES SIGNIFIES A "Y" CONNECTION.

60 CYCLES $\frac{7200}{\text{Speed}} = \text{Poles}$ EX: $\frac{7200}{1800} = 4 \text{ POLE}$

25 CYCLES $\frac{3000}{\text{Speed}} = \text{Poles}$ EX: $\frac{3000}{750} = 4 \text{ POLE}$

NUMBER OF POLES X COILS PER GROUP X PHASES = COILS
EX: 2 POLES X 6 COILS 3 PHASE = 36 COILS

$\frac{\text{NUMBER OF COILS}}{\text{COILS PER GROUP X PHASES}} = \text{NUMBER OF POLES}$

EX: $\frac{36 \text{ COILS}}{6 \text{ COILS PER GROUP X 3 PHASE}} = 2$

440/220 - the higher the voltage, the lower the connection.



568B736R
DRAWING NO.

GENERAL ELECTRIC

568B736R

NOTE-BKR SHOWN IN OPEN POSITION WITH SPRING DISCHARGED
DRAWOUT-BKR

1. THIS DRAWING SHOWS ELECTRICAL CONNECTIONS ONLY. THE EXACT LOCATION OF APPARATUS MUST BE OBTAINED FROM THE PROJECT SPECIFICATIONS.
2. NUMBERED TERMINALS ARE NEARLY IDENTICAL UNLESS OTHERWISE NOTED AND ARE NECESSARILY IDENTIFIED BY LETTERS.
3. INTERNAL CONNECTIONS OF DEVICES ARE INCLUDED WITH THE EXCEPTORY CLAUSE.
4. DEVICE FUNCTION NUMBERS AND ABBREVIATIONS ARE AS SHOWN ON THE DATA SHEET.

CONT. ON SHEET
C4. NO. 12

TITLE
CONN & ELEM DIAGRAM
FIRST MADE FOR AKR-75/100 QUICK CLOSE

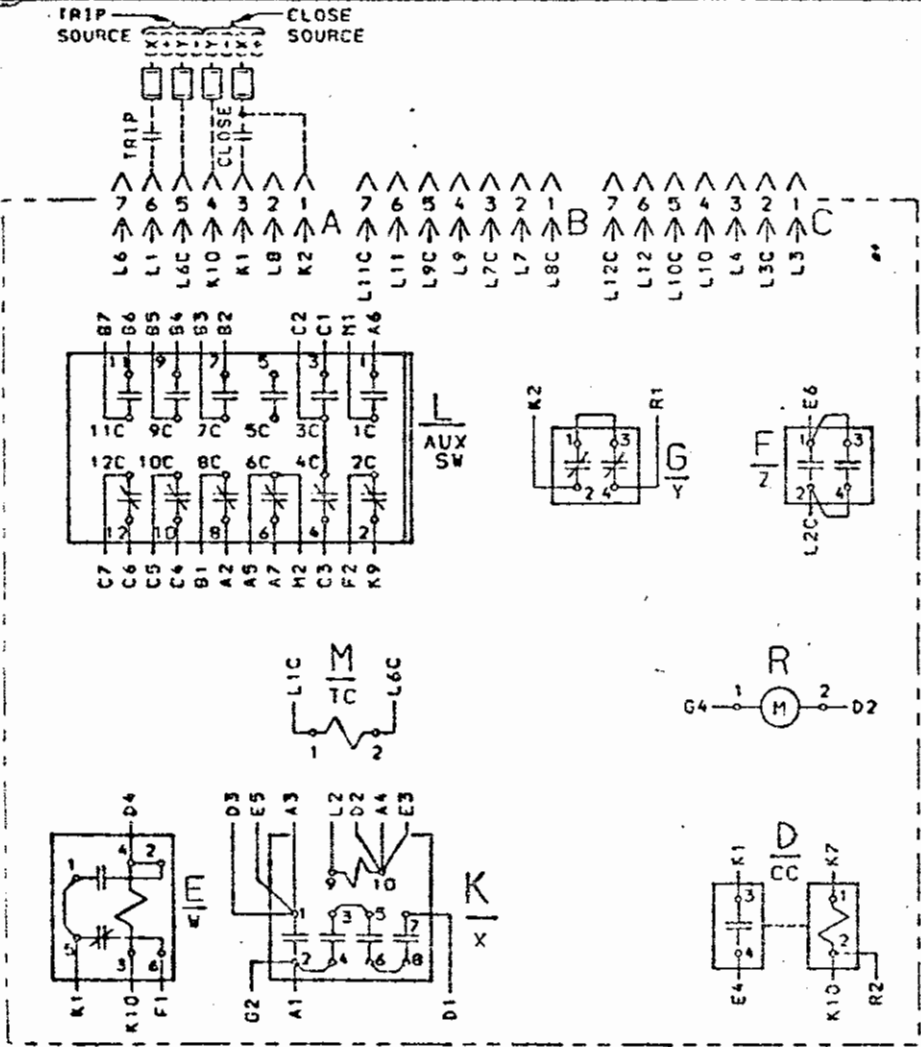


FIG. 1 - CONNECTION DIAGRAM (FRONT VIEW)

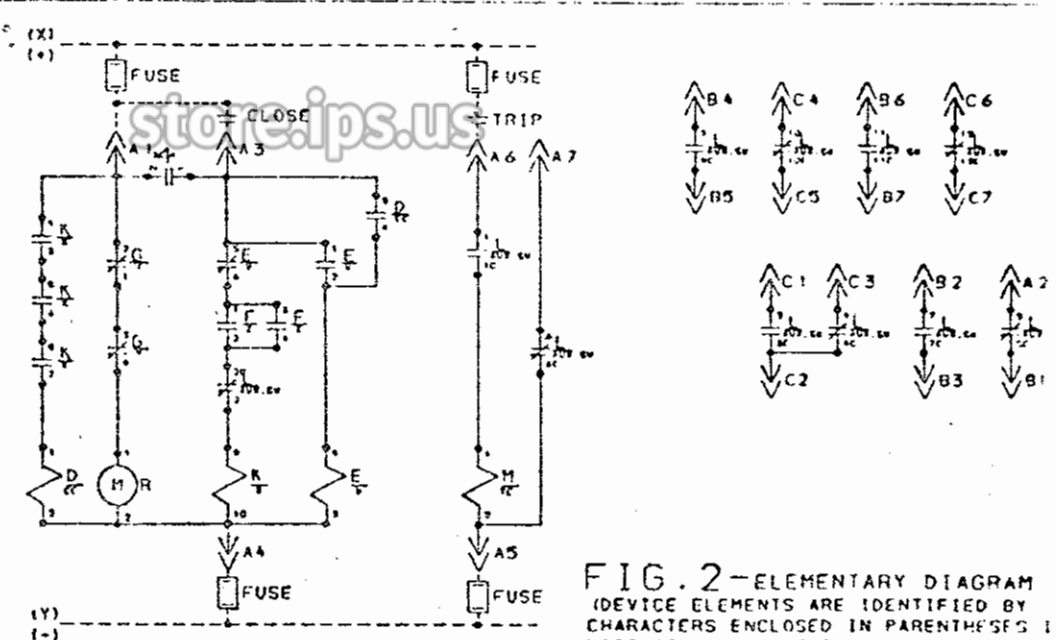


FIG. 2 - ELEMENTARY DIAGRAM (DEVICE ELEMENTS ARE IDENTIFIED BY CHARACTERS ENCLOSED IN PARENTHESES IN LIST OF ABBREVIATIONS)

- STANDARD LIST OF ABBREVIATIONS (SOME DEVICES MAY NOT BE INCLUDED IN DIAGRAMS):
- (A) - SEC. DISC. LOCATED TOP LEFT, FRONT VIEW
 - (B) - SEC. DISC. LOCATED TOP CENTER, FRONT VIEW
 - (C) - SEC. DISC. LOCATED TOP RIGHT, FRONT VIEW
 - F - (Z) CUT-OFF SWITCH
 - G - (Y) CUT-OFF SWITCH
 - H - (BA) BELL ALARM OR LOCKOUT DEVICE OPERATED WHEN BKR IS TRIPPED BY ANY MEANS OTHER THAN SHUNT OR MANUAL TRIP. CONTACTS SHOWN IN RESET POSITION. CONNECTIONS ARE SHOWN WHETHER SWITCHES ARE BOTH NORMALLY OPEN, BOTH NORMALLY CLOSED, OR ONE OF EACH TYPE.
 - J - (UV) UNDERVOLTAGE TRIP DEVICE. TIME DELAY OR INSTANTANFOUS
 - K - (X) CLOSING RELAY
 - L - (AUX SW) "A" CONTACTS TAKE POSITION OF BKR CONTACTS. "B" CONTACTS OPPOSITE TO BKR CONTACTS
 - M - (IC) SHUNT TRIP DEVICE
 - R - (M) CLOSING SPRING CHARGING MOTOR
 - P - (FS) PUSH BUTTON CLOSING SWITCH ON BKR
 - D - (CC) CLOSING RELAY
 - E - (V) ANTI-PUMP RELAY

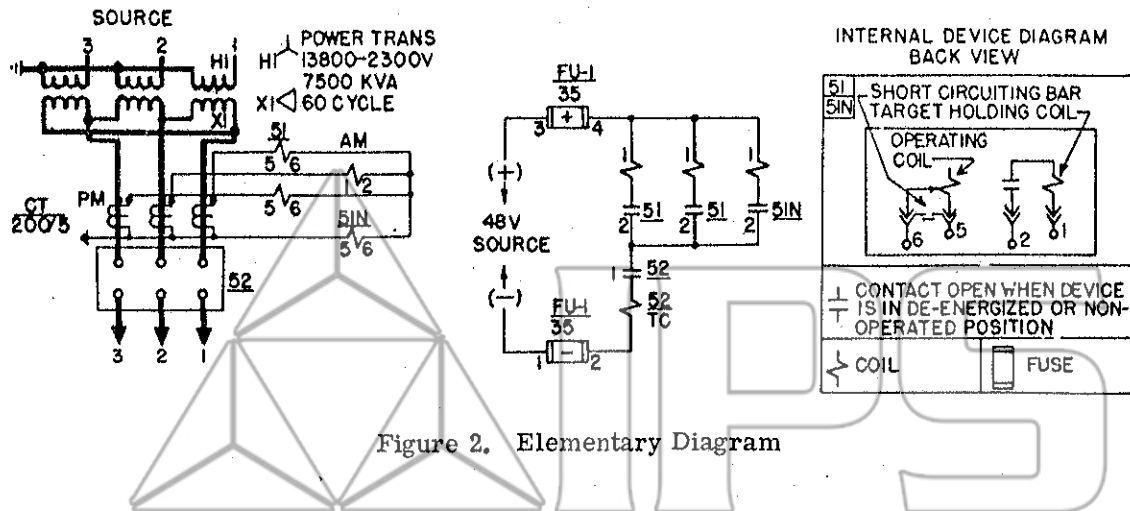
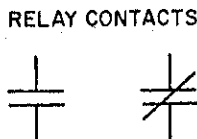
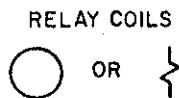
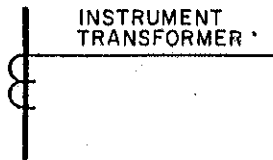
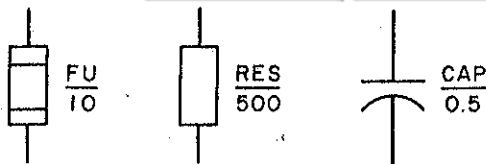
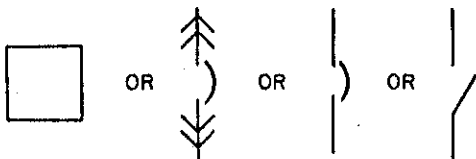


Figure 2. Elementary Diagram

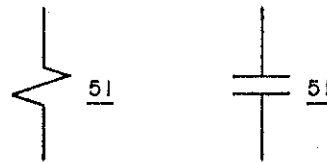
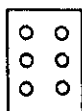
2. Wherever applicable, devices are designated by American Standard Device Function Numbers and the elements are identified by these numbers.



CIRCUIT BREAKERS



TERMINAL BOARDS



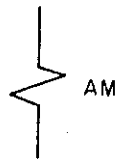
51 A-C Time Overcurrent Relay
(From list of American Standard Device Function Numbers)

Descriptions of auxiliary devices with suffixes CL, OP, X, Y and Z indicate the nature of the auxiliary function if a few words suffice for such a description; otherwise, the term "auxiliary" is used. For example:

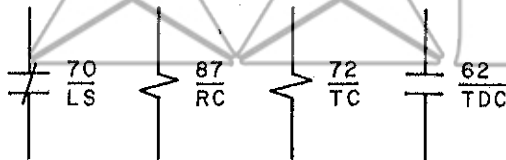
- 52X -- Closing relay for 52
- 52Y -- Cut-off relay for 52
- 52CL -- "a" auxiliary switch relay for 52 (a)
- 52CS -- Control switch for 52
- 52OP -- "b" auxiliary switch for relay for 52 (b)
- 27X -- Auxiliary relay for 27

In order to prevent any possible conflict, one letter or combination of letters has only one meaning on an individual equipment. Furthermore, its meaning is clearly designated in the device function number list and/or the diagram abbreviations. All other words beginning with the same letter are written out in full each time or some other distinctive abbreviation is used.

3. Devices to which function numbers are not applicable, such as meters and instruments, are given abbreviations; i. e., AM for ammeter. The element is indicated thus:



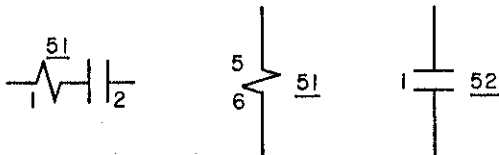
4. Device function numbers are underscored to distinguish them from device terminal or device element numbers.
5. Distinguishing features of device elements are frequently placed beneath the function number thus:



the abbreviations being descriptive of the feature indicated as:

- LS -- Limit switch
- RC -- Restraining coil
- TC -- Trip coil
- TDC -- Time delay closing

6. Device terminal or element numbers, derived from the internal device diagram, are usually placed at the left of, or below the symbol thus:



7. Main power circuits, and their component device elements, are usually drawn separate from control circuits, and may be shown at the beginning of the drawing.
8. The contacts of all devices are shown in their de-energized or non-operated positions, including those that operate in response to other than electrical quantities, such as temperature, speed, pressure, flow, level and vibration. The contacts of these devices are shown in the position they assume when the quantities to which they respond are at their lowest level. The contacts of those devices which have no de-energized or non-operated positions, such as manually operated switches or auxiliary switches on circuit breaker housings, are shown normally open with sufficient identifying

information present on the diagram to indicate when the contacts open and close.

CONNECTION DIAGRAMS (SEE FIGURE 3)

A connection diagram is one which shows the connections of an installation or its component devices and equipment.

GE switchgear connection diagrams show the general physical arrangement of devices, and accessory items such as terminal boards, fuse blocks, resistors, etc.

It will be noted that Fig. shows the relative location of the devices on the panel, the origin and destination of the actual wires used in making the connections between devices, and the terminal board provided for the purpose of joining the connections on the panel to those leading from the panel to the external apparatus.

The connection diagram is primarily an instrument of manufacture. While it has some value to the user of switchgear as a record of the general physical arrangement of the connections of a switchgear equipment assembly, including such accessory items as terminal boards, fuse blocks, resistors, etc., it is not intended nor adaptable as a means of tracing circuits through various device elements. Such tracing of circuits is accomplished better from the elementary diagram.

There are, however, a number of conventions which promote uniformity and facilitate reading the connection diagram.

1. Each device on a unit of a switchgear assembly, such as a metal-clad switchgear unit or a panel of a duplex board, is assigned an arbitrary identification letter or pair of letters. Such letters are also assigned to each terminal board, fuse block, resistor, or other accessory device to which wires are attached. The letters can be assigned consecutively from left to right and top to bottom or top to bottom, left to right. First letters of the alphabet are usually assigned to terminal boards. A few letters between terminal board and device designations remain unassigned depending upon the size of the equipment, for designating terminal boards which may be added in the future. After all the letters of the alphabet have been used, double letters, AB, AC, AD, etc. are used or double letters may be used to designate specific circuits or positions. Referring to Fig. 3 as an example, the terminal board is assigned the letter "A"; the devices, letters "C", "D", "E" and "F"; and the fuse block, "UA".

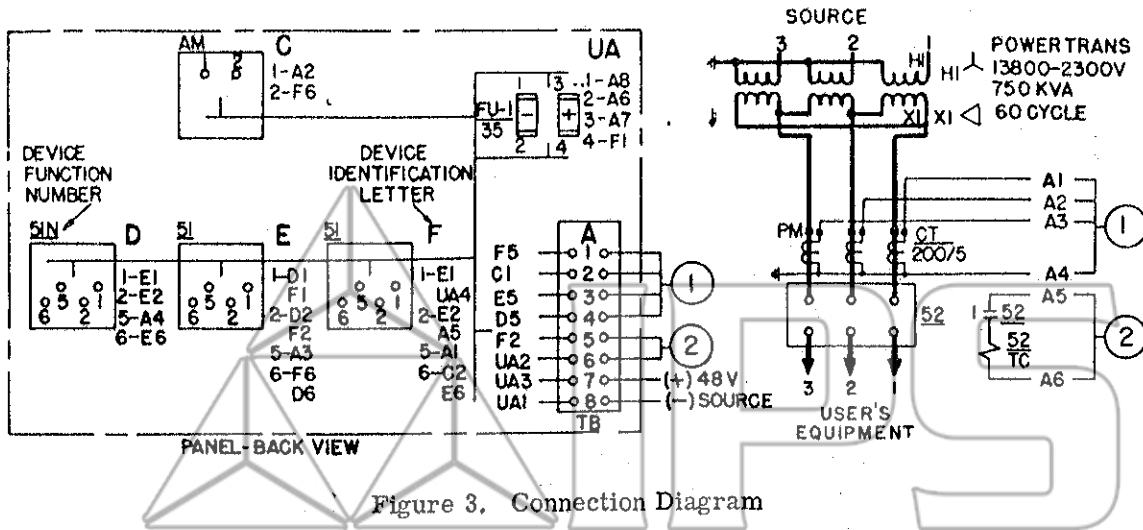


Figure 3. Connection Diagram

Fuse blocks that are not part of device assemblies are designated by letter combinations beginning with "U", and resistors are designated by letter combinations beginning with "R". Indicating lamps associated with a control switch are designated by the switch letter followed by letters representing the lamp's color; for example, if the switch letter is D, the red lamp is DR, and the green lamp is DG. Lamps that are not associated with a switch may be given separate letters, or a group of lamps may be given a letter with colors designated as above.

2. Each stud on a device, indicating instrument or meter is assigned a number from left to right and top to bottom. However on some devices, for manufacturing reasons, the stud identification is not in the above stated order; in these cases the stud numbers are as indicated on the internal device diagram.
3. Connections are indicated by designations which are derived from the identification letters of the devices and their stud or terminal numbers. A lead connecting Point #1 on terminal board "A" to stud #5, device "F", is designated on the terminal board as connecting to F5 and on device "F" in the stud number assignment as connecting to A1.

Short jumpers such as connections between terminals on the same device are usually shown in full and do not bear any lead identifications.

Terminal boards provided for shipping breaks of a structure too large to be handled as one complete unit are not given identification letters and therefore not used as such for lead identification, and furthermore, may not appear on the connection diagram. Temporary identification is

provided by means of tags to facilitate reconnection in the field.

The method outlined for tracing out a circuit on the simple diagram of Fig. 3 also holds for more complicated diagrams. With the aid of the respective elementary diagram while tracing through circuits of the connection diagram, a marked proficiency in reading the diagrams will result and a better knowledge of circuits will follow.

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INTERCONNECTION DIAGRAMS (SEE FIGURE 4)

An interconnection diagram is one which shows the complete connections between equipment units, or unit assemblies, and associated apparatus. The internal connections of the units or unit assemblies may be omitted.

Interconnections between unit assemblies and remote equipment are shown as terminating in numbered circles. These numbered circles are merely convenient lead groupings and do not necessarily represent conduits. The termination of the outgoing connections is usually indicated by note or reference to other drawings placed near the numbered circle.

Interconnections from one panel or unit to another are identified by adding panel or unit numbers to the lead identification. For illustration, a wire connecting from terminal point 3 of terminal board designated "X" of unit #7 to terminal point 3 of terminal board designated "X" of unit #8, is marked 8X3 in unit 7 and 7X3 in unit 8.

FOR INTERNAL CONNECTIONS OF UNITS SEE RESPECTIVE UNIT DRAWINGS, OR REFER TO TABULATED WIRING LIST.

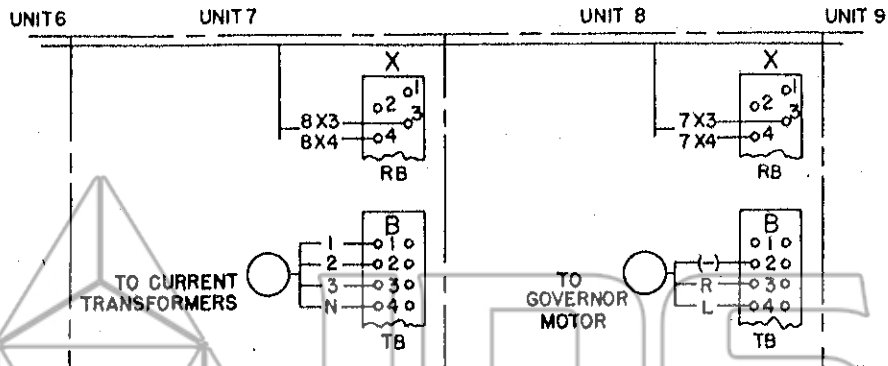


Figure 4. Interconnection Diagram

CROSS REFERENCE FOR LEAD GROUP CONNECTIONS (SEE FIGURE 5)

For convenience in making cross references between diagrams of a given project, all drawings showing interconnections or combined connections and interconnections are consecutively designated by large encircled letters near the title block. Each drawing also carries a reference table listing the drawing numbers and the corresponding drawing reference letter. The lead groups are designated within the group circle by the reference

letter of the first drawing in alphabetical sequence upon which the group appears. Different groups originating on the same drawing are assigned numbers so that the complete group designation consists of a drawing reference letter and a group number, both written within the group circle. Adjacent to each group circle is placed the corresponding drawing reference letter upon which the other end of the lead group may be found.

When the lead group bears only a number, the group originates and terminates on the same

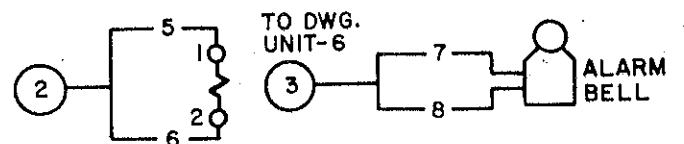
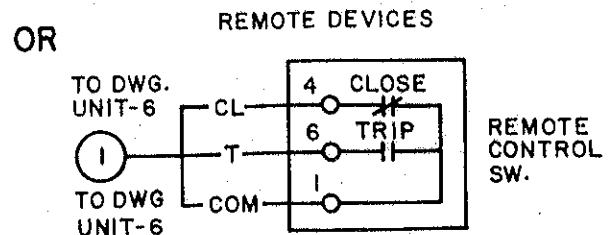
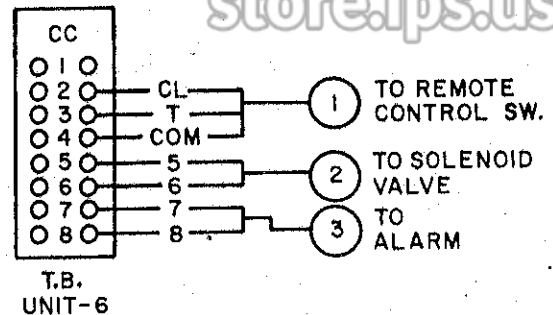
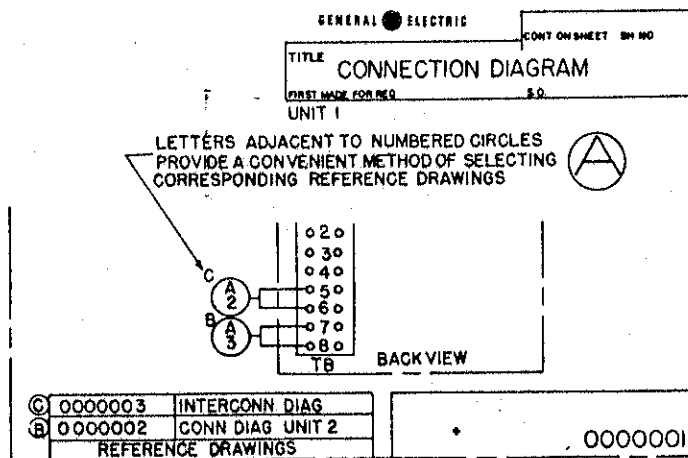


Figure 5. Connection Diagrams