

ET 438B
Ladder Diagrams Homework

Attached are two typical control and wiring diagrams. Drawing 1 is the control diagram for a power circuit breaker and Drawing 2 is a control and power wiring diagram for a motor starting circuit. Refer to these drawings to answer the following questions.

Refer to Drawing 1 for questions 1 to 13

- 1.) The voltage for the breaker trip/close circuit is (Include level and type of current is _____)
- 2.) List the terminal block stud numbers that connect the voltage to the breaker heater circuits.
- 3.) List the terminal block stud numbers that connect the voltage to the breaker trip/close circuits.
- 4.) How many 51 devices are there in the trip circuit of the breaker?
- 5.) CS/T stands for what function in the diagram?
- 6.) What are the ratings of the fuses in the breaker trip/close circuit?
- 7.) At what temperature does the thermostat operate in the breaker control circuits?
- 8.) What is the function of the 52X device?
- 9.) What are the terminal numbers of the 52X relay coil?
- 10.) According to the diagram, how many studs for external connections exist on the breaker terminal block?

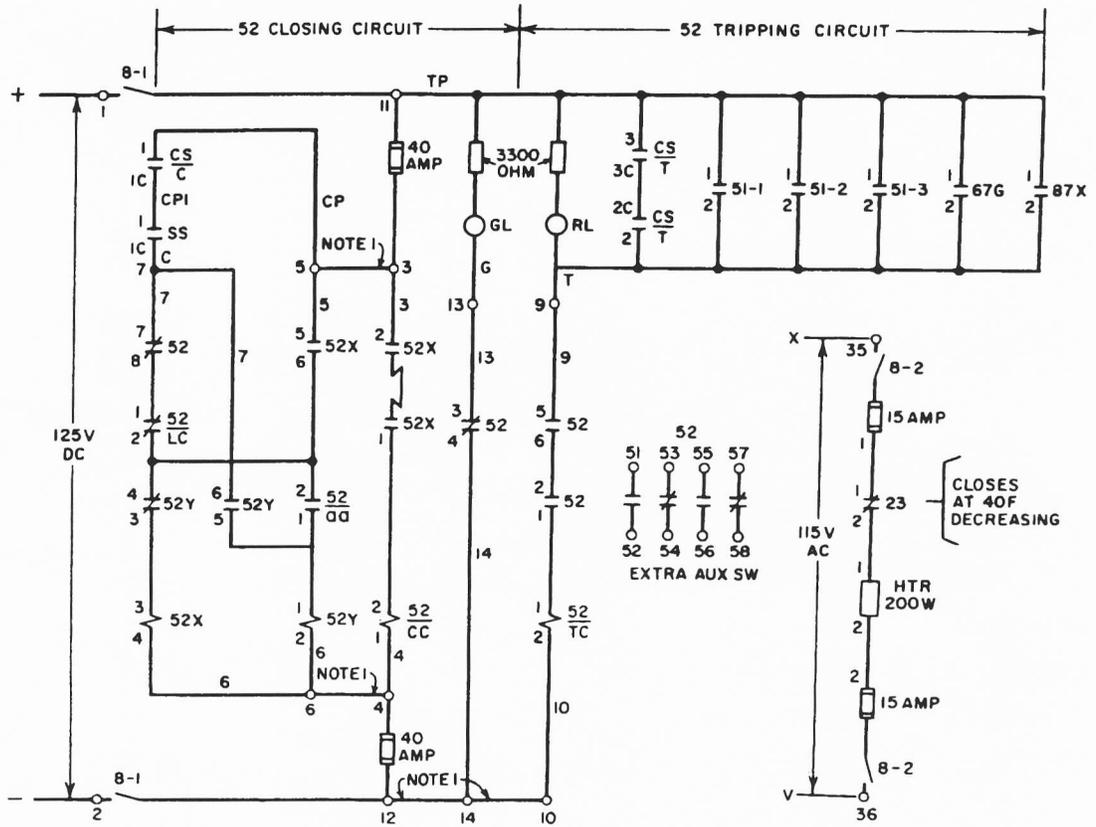
- 11.) What is the name of the 67G device?
- 12.) What is the wire number on the wire that connects stud number 10 to terminal 2 on the breaker trip coil?
- 13.) What value of resistance in series with the indicator lights on the control diagram?

Refer to Drawing 2 for the remaining questions. This is a motor starting circuit that uses a reactor to limit the starting current to the motor while it is accelerating up to speed. After a predetermine time interval, which should be long enough to allow the motor to accelerate, the starting reactors are removed from the circuit by shorting them out. The motor draws a large load current, so current transformers are used to couple the overload relay sensors to the main ac power. The control schematic is labelled with wire numbers 1 to 10 to help designers and maintenance personnel identify the circuit connections.

- 14.) According to the drawing legend, what is the function of the TR coil in the control wiring schematic?
- 15.) According to the drawing legend, what is the function of the A coil in the control wiring schematic?
- 16.) Energizing the (A, M, 1CR) _____ relay will directly connect the ac power to the motor?
- 17.) If the overload devices in the ac power schematic have detected an overload, the OL contacts in the control wiring will be (open, closed)?
- 18.) For the TR relay to be energized by the start button the A relay must be (energized, de-energized)
- 19.) The time closing contact connects voltage to the (1CR, 2CR, TR) _____ relay coil.

- 20.) How will the ac power circuit be effected when the A relay is energized in control schematic?
- 21.) To keep the motor running at normal operating speed, which of the following relays must remain energized (A, M, both)? _____
- 22.) Is the ladder control voltage circuit fused?
- 23.) If there is no voltage connected to the ac power circuit will an operator be able to start the motor? Explain your answer
- 24.) The overload contact in the control wiring is connected to the control voltage transformer by wire number _____?
- 25.) For the motor to keep running, control relay (1CR, 2CR) _____ must remain energized

Schematic 1



- | | | | |
|-----|--|--------|--|
| 8 | CONTROL POWER DISCONNECTING SWITCH | 87X | DIFFERENTIAL PROTECTIVE AUXILIARY RELAY |
| 23 | TEMPERATURE CONTROL DEVICE | CS | CONTROL SWITCH |
| 51 | AC TIME OVERCURRENT RELAY | C | CLOSE |
| 52 | AC CIRCUIT BREAKER | T | TRIP |
| 00 | AUXILIARY SWITCH OPEN WHEN THE OPERATING MECHANISM IS IN THE NON-OPERATED POSITION | HTR | HEATER |
| CC | CLOSING COIL | SS | SYNCHRONIZING SWITCH |
| LC | LATCH CHECK SWITCH | — | AC CIRCUIT BREAKER TERMINAL BLOCK STUDS FOR EXTERNAL CONNECTIONS |
| TC | TRIP COIL | GL | GREEN LIGHT |
| 52X | CLOSING RELAY | RL | RED LIGHT |
| 52Y | ANTI-PUMP RELAY | NOTE 1 | JUMPERS INSTALLED BY MANUFACTURER |
| 67G | AC DIRECTIONAL OVERCURRENT GROUND RELAY | | |
- DRAWING REFERENCES
 AC SCHEMATIC DIAGRAM..FIG 9-9
 DEVICE INTERNAL CONNECTION DIAGRAM..FIG 10-14

FIGURE 9-10 – TYPICAL POWER SWITCHGEAR DC SCHEMATIC DIAGRAM (USING BOTH TERMINAL AND WIRE DESIGNATIONS)

ELECTRICAL AND ELECTRONICS DIAGRAMS

Schematic 2

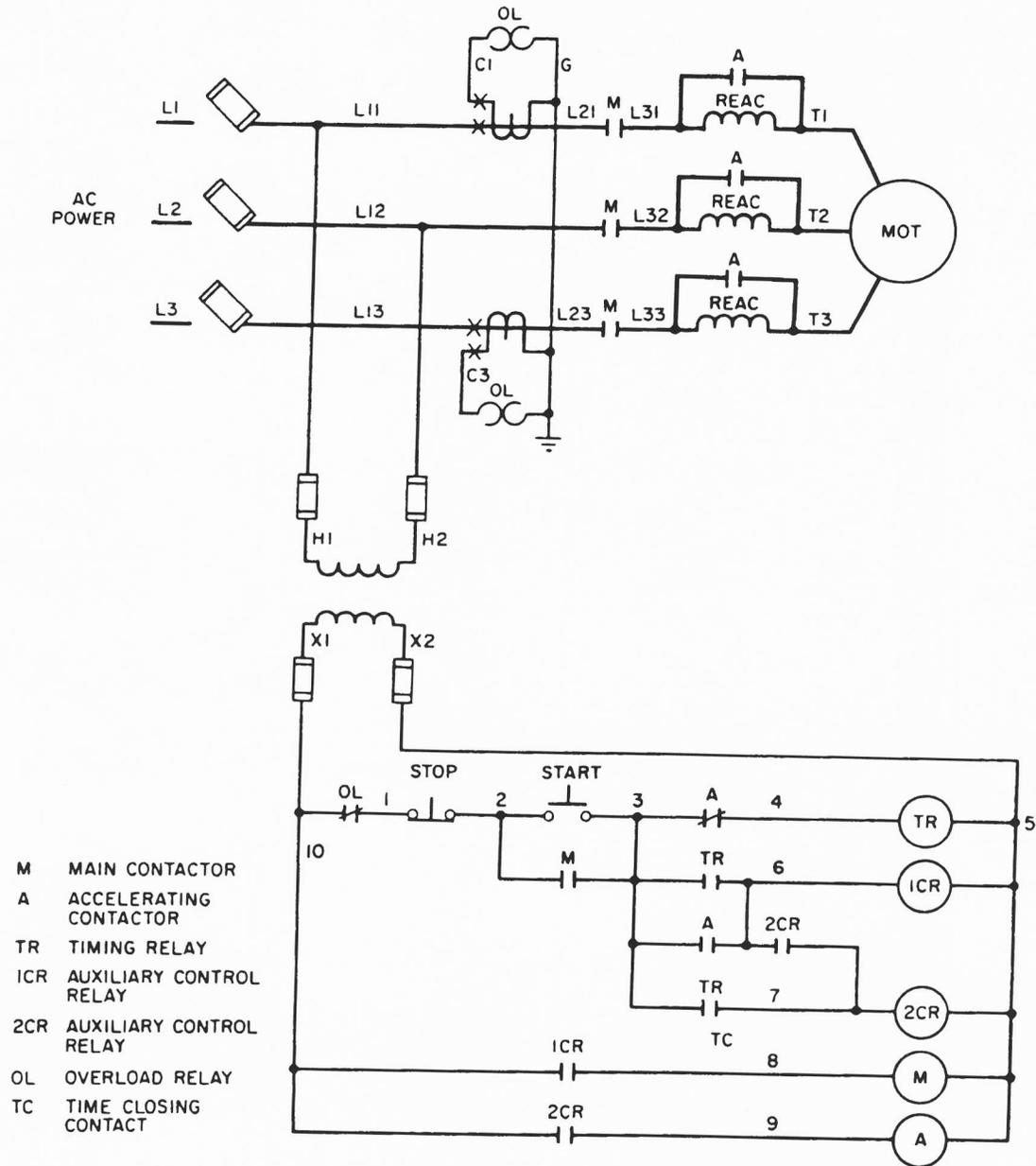


FIGURE 9-11 - TYPICAL INDUSTRIAL CONTROL SCHEMATIC DIAGRAM