Practice Quiz Questions:

3 Phase Power & Miscellaneous

1. T **F** There is a 180 degree phase shift between each phase of a three phase system.

Explanation: There is 120 degrees between the phases of three phase power.

2. Which of the following three phase voltages are the most common used in industry? (Choose 3)
   - **a. 240 V**
   - b. 600 V
   - c. 575 V
   - **d. 208 V**
   - e. 120 V
   - **f. 480 V**
   - g. 277V

Explanation: The three predominant three phase voltages in an industrial environment is: 208V, 240 V, and 480 V. This is the measured phase voltage on each of these systems. 208V three phase is used for motors and as utility voltage on a 4 wire system that powers outlets and switches. 240V is typically motors and heating elements. 480V is typically motors and heating elements (usually two, 240V in series).

3. T **F** 120V is a common three phase voltage used on motor circuits.

Explanation: 120 V is not a three phase voltage. It is a single phase voltage used for utility and lighting devices.

4. What are the letter designation on the three phase wires coming from a bus bar?
   - **a. L1, L2, L3**
   - b. M1, M2, M3
   - c. T1, T2, T3
   - d. A1, A2, A3

Explanation: L1, L2 & L3 is the primary three phase power source designation. The "L" stands for Line, so Line 1, Line 2 & Line 3.

5. On a three phase system, if one fuse blows, how many phases are left?
   - **a. One**
   - b. Two
   - c. Three
   - d. A blown fuse will take out all three phases

Explanation: If one fuse blows, the circuit will lose two phases, thus only single phase is left.

6. **T** F An overload is a larger than normal current that flows in the normal circuit path.

Explanation:
An overload is larger that the normal current that will flow within the normal circuit path. As an example, if a motor becomes mechanically overloaded, which will slow the shaft down, less counter EMF is generated, which will increase the line current within the normal circuit path. A short circuit is higher than normal current (much higher than an overload) that flows outside the circuit path. An example would be if the insulation of a winding breaks down inside a motor, current can flow to ground outside of the normal circuit path. This is a short circuit. A fuse should blow.

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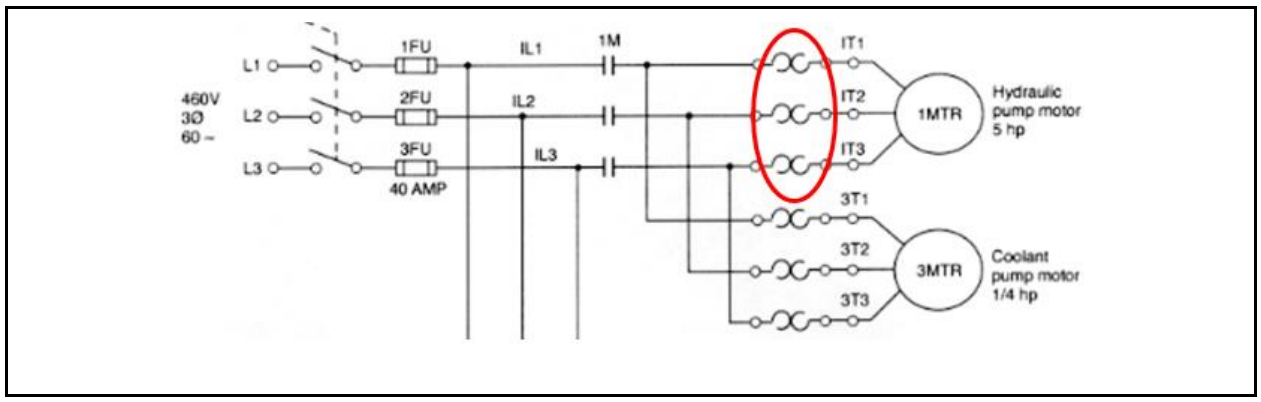
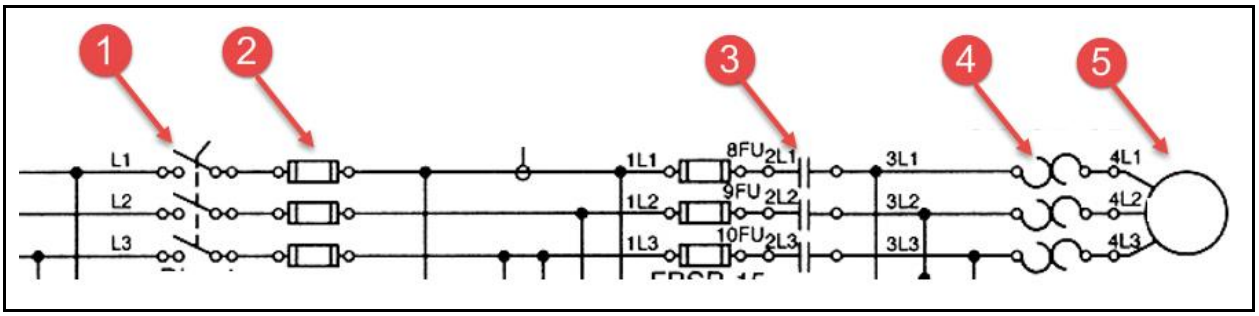
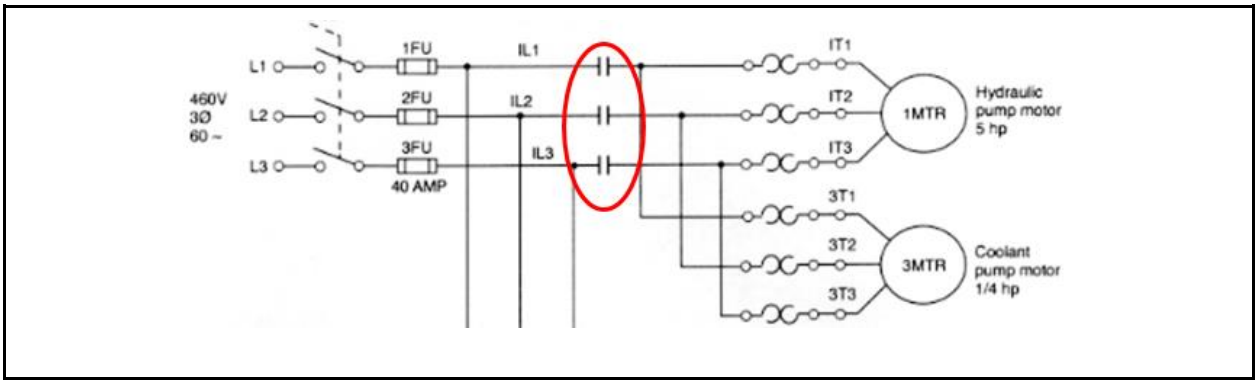


8. In this motor branch circuit, what are the devices that are circled?
   a. Fuses
   b. Power Contacts
   c. Heaters
   d. Circuit breaker
   e. Disconnect



Explanation: #1 is the three phase disconnect that will power the motor branch circuit. #2 is the fuses. These fuses protect the circuit from a short circuit or a high surge overload current. #3 is the power contacts (sometimes called the contactor contacts) that will power the motor when the coil, that controls these contacts, in the control circuit is energized. #4 is the heaters that are found on the overload relay. These heaters are sized based on the FLA rating on the motor. When the line current exceeds this rating, enough heat will be generated that it will trip the O/L relay, thus opening the overload contact, causing the starter coil to loose power. In an IEC starter, there is an adjustment to set the overload trip, versus putting heaters in a NEMA starter. #5 is the 3 phase motor.



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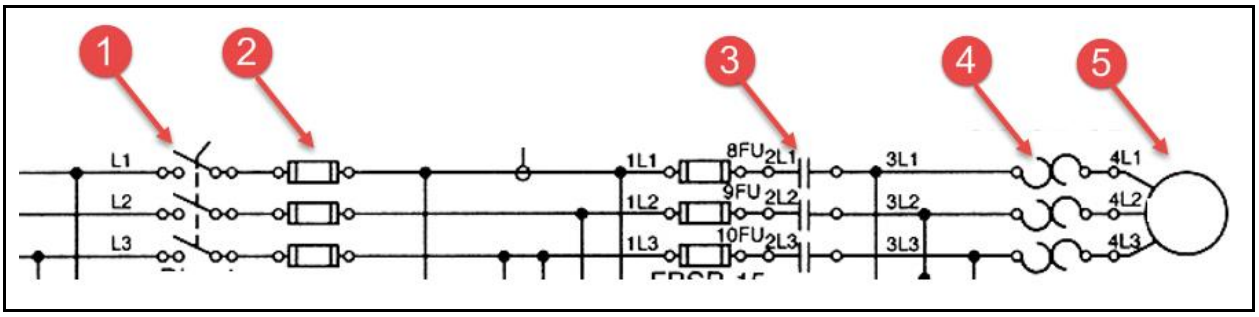

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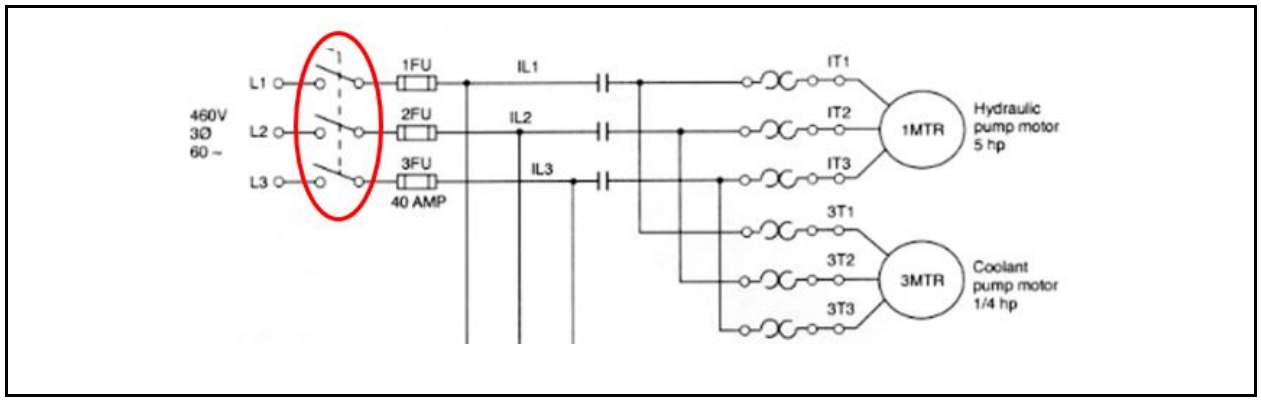

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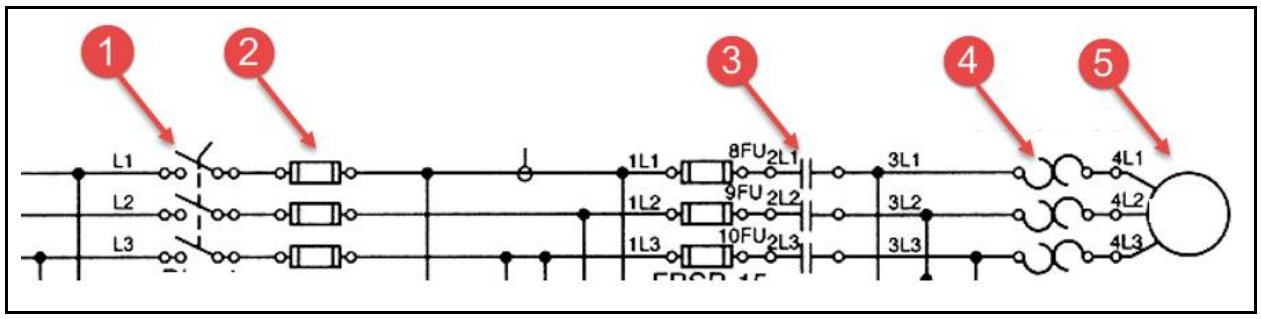

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relay, thus opening the overload contact, causing the starter coil to loose power. In an IEC starter, there is an adjustment to set the overload trip, versus putting heaters in a NEMA starter. #5 is the 3 phase motor.

3 Phase Motors

1. **T** F The line current of a three phase motor will go up if a motor gets more mechanical load (slowing down the motor shaft).
Explanation: In normal operation of a motor, as the shaft speed goes down, there is less counter EMF generated in the motor, thus the current will increase.

2. T **F** When a three phase motor is starting, the current is low, and as the motor gets up to full speed, current goes down.
Explanation: When a motor first starts, there is no counter EMF generated in the motor to limit the line current, thus the highest current will be when voltage is applied to the motor initially. As the shaft speed of the motor increases, the current is decreasing. When the motor gets to full speed (and full load), the current should stabilize at or below the Full Load Amps (FLA) on the motor nameplate.

3. T **F** The motor terminal leads for a three phase motor would be marked as M1, M2 & M3.
Explanation: The terminal leads of a single phase motor should be marked with "T" wires. Typically on a three phase, three wire, it is T1, T2 & T3.

4. **T** F A magnetic motor starter consists of a contactor and an overload relay.
Explanation: A magnetic motor starter will have two parts: A contactor that is used to disconnect power from the motor, or power the motor. The other part is an overload relay, which will be used to protect the motor from an overload condition.

5. A three phase motor that has a dual voltage rating (230V/460V), would have the windings connected in _____ if supplied with the low voltage.

   a. Parallel
   b. Series
   c. Series or Parallel
   d. No internal connections are needed.

Explanation: Most electrical devices that are dual voltage rated (motors and transformers) have dual windings. When the windings are connected for high voltage, they will be connected in series. When the windings are connected for low voltage, they will be connected in parallel.

6. T **F** The two ways to change the speed of a three-phase, motor is by changing the frequency or the amount of voltage applied to the motor.

Explanation: The two ways to safely vary the speed of a three phase motor is the frequency and the number of electrical poles. VFDs will vary the frequency of the voltage that goes to the motor. Reducing the voltage going to a motor will create problems. If the voltage is held to 60Hz, running a reduced voltage will eventually burn the motor up. The number of poles is set by the manufacturer. A 3600 rpm motor will have 2 poles. A four pole machine will run at 1800 rps, and so on.

7. What device typically protects an electric motor circuit from a short circuit?
   a. Fuse
   b. Overload relay
   c. Motor starter
   d. Wire

Explanation: When a short circuit occurs, the circuit needs to be cleared immediately. A fuse has a characteristic curve that the higher the current, the faster it will blow. The other devices, such as an overload relay cannot respond that quickly.

8. **T** F The purpose of a motor starter is to disconnect power to the motor and protect it from overload.

Explanation: The purpose of a motor starter is to disconnect the power to the motor (by dropping out the contactor, or power contacts), and to protect the motor from burning up due to being in a sustained overload condition.

9. T **F** A loaded three phase motor can start with two phases.

Explanation: There is no such thing as two phases. If a fuse blows, it takes out two phases, and one phase is left. A loaded motor usually cannot start on single phase. It can many times keep running on single phase if a fuse wipes out two phases, but will be overloaded, which should trip the overload relay of a starter.

10. T **F** An Ohmmeter can be used to test the resistance of the insulation of windings within a motor.

Explanation: An Ohmmeter can be used to test the continuity of the wire of a motor, but a meggar meter is used to test the strength (resistance) of the insulation. If a motor is running overcurrent for a length of time, the insulation can get weak, which can periodically short to ground. A meggar can determine if a motor needs to be replaced or not.

11. The piece of data on the motor nameplate that will reference to a chart that will determine the distance between mounting holes on the motor bracket is:
   a. DIM
   b. FRAME

c. MOUNT
d. DUTY
e. CODE

Explanation: The FRAME data will have the mounting dimensions of motors. For example, a FRAME 56 must be replaced with another FRAME 56 motor.