Title: **Electrical Measurement** Job: 4

Course: Electrical Applications Unit: Electrical Shop CLO: 7

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Grade \_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Objectives**

1. Student shall measure and record various voltages within the residential shop.
2. Student shall perform measurements using a solenoid (Wiggy) type tester.
3. Student shall relate all Lock-Out and Tag-Out requirements to safety standards.
4. Student shall understand wire identification as it relates to electrical drawings.

**Assessment**

Students shhhall demonstrate a comprehension of the objectives listed above by scoring a minimum of 75% on this Job. Grading shall be based on Instructor evaluation.

**Materials**

|  |  |
| --- | --- |
| Student Provided Materials | **Department Provided** |
| Fuse Puller | Electrical Safety Gloves |
|  | Solenoid Tester |

**Instructions – Electrical Measurement**

**Safety First:** Remember this saying **“Live-Dead-Live”**. If you remember this, and put it into practice, you while keep yourself and your co-workers safe. Here is how it works;

1. Never assume a meter works.
   1. Test any meter against a known **“Live”** circuit.
   2. Ensure the meter is working properly. If so, go the step 2 else get another meter and repeat step 1.
2. Test the circuit that you think is de-energized, i.e. **“Dead”**.
   1. Test for voltage to ground.
   2. Test for voltage phase-to-phase if appropriate.
   3. Test even for voltage neutral to ground.
3. If all indications are that the circuit is de-energized, test the meter again on a known **“Live”** circuit.
   1. Never assume that the meter that once tested fine in Step 1 is still working properly.
   2. Testing against a known energized circuit ensures that the meter was not damaged in Step 2.
   3. This step is the one most often skipped by electrical workers. **DO NOT SKIP THIS STEP**. Your life and the life of those around you depends upon it.

In this shop job, we shall be using a solenoid type voltage tester (provided by the department). This is a meter that requires no batteries whatsoever. The line voltage, whether AC or DC, will energize the meter and indicate the voltage level. In the field, like lots of other tools and equipment, this meter is known by a popular manufactures name. Square D produces a popular solenoid tester with the brand name of *Wiggy* and has become so popular that universally a solenoid tester is most often referred to as a *Wiggy* in the field.

The most common electrical circuit measurement taken in the field is for voltage. Most voltage measurements are taken with reference to ground. The term ground can either be the equipment ground, bare or green, and the circuit grounded conductor, white or gray. The ground reference point is in respect to the current carrying or “hot” conductor.

**CAUTION:** Extreme care must be used when taking measurements on a live circuit. We shall be using electrical safety gloves during all live measurements. You are working on a live circuit. DO NOT place any part of your body on the metal parts of the disconnect or load center. Touching live conductors or live disconnect components without proper personal protective equipment (PPE) will allow a path of current to flow to ground through your body.

**Part I**: Voltage measurements at the fused disconnect.

1. Put on the electrical safety gloves plus the leather liners.
2. Ensure the fused disconnect side-arm is open (Off/Down).
3. Take these measurements from the terminals/lugs at the top of the fuse panel:

Black to Green \_\_\_\_\_\_\_\_\_ Black to metal or conduit \_\_\_\_\_\_\_\_\_

Red to Green \_\_\_\_\_\_\_\_\_ Red to metal or conduit \_\_\_\_\_\_\_\_\_

Black to Red \_\_\_\_\_\_\_\_\_

1. Take these measurements from the terminals/lugs at the bottom of the fuse panel:

Black to Green \_\_\_\_\_\_\_\_\_ Black to metal or conduit \_\_\_\_\_\_\_\_\_

Red to Green \_\_\_\_\_\_\_\_\_ Red to metal or conduit \_\_\_\_\_\_\_\_\_

Black to Red \_\_\_\_\_\_\_\_\_

1. Close the fused disconnect side-arm (On/Up).
2. Take these measurements from the terminals/lugs at the top of the fuse panel:

Black to Green \_\_\_\_\_\_\_\_\_ Black to metal or conduit \_\_\_\_\_\_\_\_\_

Red to Green \_\_\_\_\_\_\_\_\_ Red to metal or conduit \_\_\_\_\_\_\_\_\_

Black to Red \_\_\_\_\_\_\_\_\_

1. Take these measurements from the terminals/lugs at the bottom of the fuse panel:

✓ Make sure both (2) fuses are inserted.

Black to Green \_\_\_\_\_\_\_\_\_ Black to metal or conduit \_\_\_\_\_\_\_\_\_

Red to Green \_\_\_\_\_\_\_\_\_ Red to metal or conduit \_\_\_\_\_\_\_\_\_

Black to Red \_\_\_\_\_\_\_\_\_

1. Ensure the fused disconnect side-arm is open (Off/Down).

🡪 Using the fuse pullers, remove both fuses.

1. Close the fused disconnect side-arm (On/Up).
2. Take these measurements from the terminals/lugs at the bottom of the fuse panel:

Black to Green \_\_\_\_\_\_\_\_\_ Black to metal or conduit \_\_\_\_\_\_\_\_\_

Red to Green \_\_\_\_\_\_\_\_\_ Red to metal or conduit \_\_\_\_\_\_\_\_\_

Black to Red \_\_\_\_\_\_\_\_\_

🡪 Replace both fuses

**Part II**: Voltage measurements at the load center otherwise termed the breaker panel.

1. Ensure the fused disconnect side-arm is open (Off/Down)
2. Take the following measurements at the lugs located above the top of each circuit breaker:

Black to Green \_\_\_\_\_\_\_\_\_ Black to metal or conduit \_\_\_\_\_\_\_\_\_

Red to Green \_\_\_\_\_\_\_\_\_ Red to metal or conduit \_\_\_\_\_\_\_\_\_

Black to Red \_\_\_\_\_\_\_\_\_

1. Close the fused disconnect side-arm (On/Up)
2. Take the following measurements at the lugs located above the top of each circuit breaker:

Black to Green \_\_\_\_\_\_\_\_\_ Black to metal or conduit \_\_\_\_\_\_\_\_\_

Red to Green \_\_\_\_\_\_\_\_\_ Red to metal or conduit \_\_\_\_\_\_\_\_\_

Black to Red \_\_\_\_\_\_\_\_\_

1. Ensure both circuit breakers are open (Off/Down)
2. Take the following measurements from the terminal on the bottom of each circuit breaker:

Black Conductor Breaker Red Conductor Breaker

Terminal to White \_\_\_\_\_\_\_\_\_ Terminal to White \_\_\_\_\_\_\_\_\_

Terminal to Green \_\_\_\_\_\_\_\_\_ Terminal to Green \_\_\_\_\_\_\_\_\_

1. Close both circuit breakers (On)
2. Take the following measurements from the terminal on the bottom of each circuit breaker:

Black Conductor Breaker Red Conductor Breaker

Terminal to White \_\_\_\_\_\_\_\_\_ Terminal to White \_\_\_\_\_\_\_\_\_

Terminal to Green \_\_\_\_\_\_\_\_\_ Terminal to Green \_\_\_\_\_\_\_\_\_

1. Open the fused disconnect side-arm (Off/Down) and remove both fuses.
2. Close the fused disconnect side-arm (On/Up) and close both circuit breakers (On).
3. Take the following measurements from the terminal on the bottom of each circuit breaker:

Black Conductor Breaker Red Conductor Breaker

Terminal to White \_\_\_\_\_\_\_\_\_ Terminal to White \_\_\_\_\_\_\_\_\_

Terminal to Green \_\_\_\_\_\_\_\_\_ Terminal to Green \_\_\_\_\_\_\_\_\_

1. Open both circuit breakers (Off) and open the fused disconnect sidearm (Off/Down)

🡪 Replace both fuses

**Instructions - Electrical Drawings**

All circuits shall be drawn by hand. This will help in designing the project and assimilation of the knowledge and techniques being taught in each shop job. Drawing each circuit prior to wiring is a technique used in industry world-wide. By drawing the circuit first and reviewing the design with the instructor, one can eliminate the chance of making errors in wiring. If the circuit does not work on paper, it will not work when wired. Neatness is imperative in the electrical field. These drawings are no exception. The use of a straight edge is required. The stencil provided within the toolkit is also very useful. Since we will be using only a single color pencil, the following representations will be utilized to identify the different conductors:



If a given circuit only contains a black “hot” wire and a white “neutral” wire, it is not necessary to identify the black wire with the letter “B”. If a given circuit contains a black “L1-hot”, a red “L2-hot” and a white “neutral” wire, the black wire shall be denoted with the letter “B” and the red wire shall be denoted with the letter “R”. Since it is a given that all circuits have equipment grounding conductors (EGC) and that all “equipment” is bonded, it will not be necessary to draw the ground (EGC) for these projects. If a student decides to include the EGC on any drawing, that practice shall be continued for all drawings.