

Lab Assignment #02

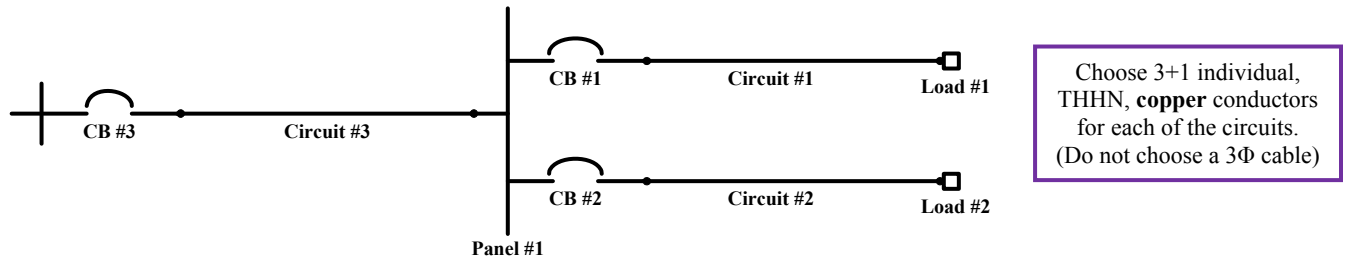
INSTRUCTIONS: This assignment is to be completed individually and submitted by Thursday, Sept. 14th.

Assignments submitted after the deadline will be considered “late” as defined by course-policy.

All work must be neatly shown on blank paper and stapled to the back of this cover-sheet.

A box must be drawn around all final answers on the work pages, and then all of the final answers must be copied into the answer-blanks provided below.

Problem Statement: Two loads are served out of Panel #1 by a pair of individual branch circuits, as shown in the figure below:



<u>Load #</u>	<u>Load Ratings</u>
1	3Φ, 460V, 45kVA, 0.92 lagging p.f. (continuous)
2	3Φ, 460V, 100kW, unity p.f. (non-continuous)

Part 1: Determine the magnitude of each load current.

Load#1 = _____ A Load#2 = _____ A

Part 2: a) Determine the minimum-sized conductors and the smallest standard-sized circuit breakers that can be used for each of the (branch) circuits supplying the loads if a separate conduit is utilized for each of the circuits and the ambient temperature is 30°C:

Circuit #1: conductor size _____ CB#1 rating _____ A

Circuit #2: conductor size _____ CB#2 rating _____ A

b) Assuming that (feeder) circuit #3 must serve both loads, determine the minimum-sized conductors and the smallest standard-sized circuit breaker that can be used for circuit #3:

Circuit #3: conductor size _____ CB#3 rating _____ A

Part 3: Repeat the steps specified in Part 2 (a and b), but with the following system changes:

- i) The conductors for the branch circuits (#1 and #2) are fed through the same conduit, and
- ii) The ambient temperature is 38°C:

Circuit #1: conductor size _____ CB#1 rating _____ A

Circuit #2: conductor size _____ CB#2 rating _____ A

Circuit #3: conductor size _____ CB#3 rating _____ A

(Note – do NOT turn-in the following reference pages when you submit this assignment)

NEC 2014 REFERENCES

210.19(A)(1) – Conductors – Minimum Ampacity & Size

Branch-circuit conductors shall have an ampacity not less than the maximum load to be served. Conductors shall be sized to carry not less than the larger of (a) or (b):

- (a) Where a branch circuit supplies continuous loads or any combination of continuous and non-continuous loads, the minimum branch-circuit conductor size shall have an allowable ampacity not less than 100% of the non-continuous load plus 125% of the continuous load.
- (b) The minimum branch-circuit conductor size shall have an allowable ampacity not less than the maximum load to be served after the application of any adjustment or correction factors.

210.20 – Overcurrent Protection

Branch-circuit conductors and equipment shall be protected by overcurrent protective devices that have a rating or setting that complies with (A) – (D):

- (A) **Continuous and Non-continuous Loads:** Where a branch circuit supplies ... any combination of both continuous and non-continuous loads, the rating of the overcurrent device shall not be less than 100% of the non-continuous load plus 125% of the continuous load.

240.4 – Protection of Conductors

Conductors ... shall be protected against overcurrent in accordance with their ampacities specified in 310.15, unless otherwise permitted or required in (A) – (G):

- (B) **Devices Rated 800A and Less:** The next higher standard overcurrent device rating (above the ampacity of the conductors being protected) shall be permitted, provided all of the following conditions are met:
 - (1) The conductors being protected are not part of a multi-outlet branch circuit supplying receptacles for cord-and-plug-connected portable loads.
 - (2) The ampacity of the conductors does not correspond with the standard ampere rating of a fuse or a circuit breaker without overload trip adjustments above its rating.
 - (3) The next higher standard rating selected does not exceed 800 amperes.
- (C) **Devices Rated Over 800A:** Where the overcurrent device is rated over 800A, the ampacity of the conductors it protects shall be greater than or equal to the rating of the overcurrent device defined in 240.6.

240.6 Standard Ampere Ratings

(A) **Fuses and Fixed-Trip Circuit Breakers.** The standard ampere ratings for fuses and inverse time circuit breakers shall be considered:

15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600, 700, 800, 1000, 1200, 1600, 2000, 2500, 3000, 4000, 5000, and 6000 amperes.

NEC 2014 REFERENCES

(continued)

Table 310.15(B)(16) (Condensed) Allowable Ampacities of Insulated Conductors Rated Up to and Including 2000 Volts, 60°C Through 90°C (140°F Through 194°F), Not More Than Three Current-Carrying Conductors in Raceway, Cable, Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)*

Size AWG or kcmil	Temperature Rating of Conductor [See Table 310.104(A).]						Size AWG or kcmil
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, RHH, RHW-2, THHN, THHW, USE-2, XHH, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, RHH, RHW-2, THHN, THHW, USE-2, XHH, XHHW-2, ZW-2	
COPPER			ALUMINUM				
14**	15	20	25	—	—	—	—
12**	20	25	30	15	20	25	12**
10**	30	35	40	25	30	35	10**
8	40	50	55	35	40	45	8
6	55	65	75	40	50	55	6
4	70	85	95	55	65	75	4
3	85	100	115	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	145	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	195	230	260	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	350	420	475	285	340	385	600
700	385	460	520	315	375	425	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	445	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	525	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	555	665	750	470	560	630	2000

*Refer to 310.15(B)(2) for the ampacity correction factors where the ambient temperature is other than 30°C (86°F).

**Refer to 240.4(D) for conductor overcurrent protection limitations.

Table 310.15(B)(2)(a) Ambient Temperature Correction Factors Based on 30°C (86°F)

For ambient temperatures other than 30°C (86°F), multiply the allowable ampacities specified in the ampacity tables by the appropriate correction factor shown below.

Ambient Temperature (°C)	Temperature Rating of Conductor			Ambient Temperature (°F)
	60°C	75°C	90°C	
10 or less	1.29	1.20	1.15	50 or less
11–15	1.22	1.15	1.12	51–59
16–20	1.15	1.11	1.08	60–68
21–25	1.08	1.05	1.04	69–77
26–30	1.00	1.00	1.00	78–86
31–35	0.91	0.94	0.96	87–95
36–40	0.82	0.88	0.91	96–104
41–45	0.71	0.82	0.87	105–113
46–50	0.58	0.75	0.82	114–122

Table 310.15(B)(3)(a) Adjustment Factors for More Than Three Current-Carrying Conductors

Number of Conductors ¹	Percent of Values in Table 310.15(B)(16) through Table 310.15(B)(19) as Adjusted for Ambient Temperature if Necessary
4–6	80
7–9	70
10–20	50
21–30	45
31–40	40
41 and above	35