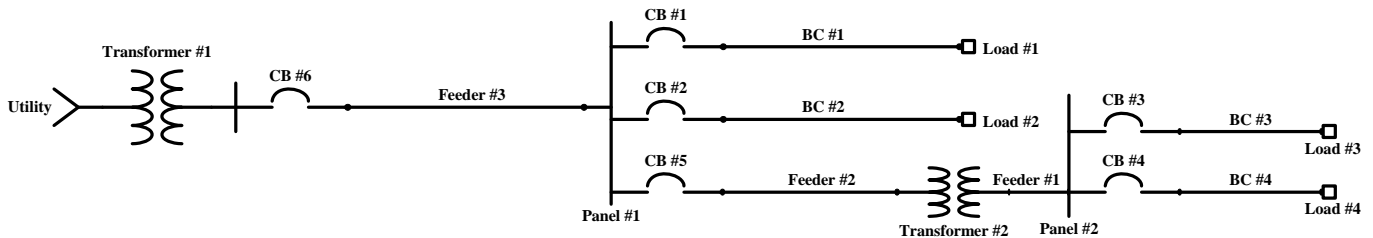


**Part A:** To be completed individually by Sept. 21<sup>st</sup>.

Determine the minimum conductor sizes, circuit breaker ratings, and transformer ratings for the following 3Φ distribution network in order to properly serve the loads specified below.



<u>Load #</u>	<u>Load Requirements</u>
1	460V, 45kVA, 0.92 lagging p.f. (continuous load)
2	460V, 200kW, unity p.f.
3	200V, 30kVA, 0.85 lagging p.f. (continuous load)
4	200V, 30kVA, 0.85 lagging p.f.

**Note** – choose 3+1 individual, THHN, copper conductors for all circuits (instead of 3Φ cable), and assume all conductors will be fed through separately-run aluminum conduit except for Branch Circuits 3 & 4 which will be fed through the same conduit. Also assume an ambient temperature of 30°C for all circuits except for Branch Circuits 3 & 4 for which an ambient temperature of 38°C will be applied.

**Part A Results:**

**Circuit #1** – current \_\_\_\_\_ conductor size \_\_\_\_\_      **CB#1** – rating \_\_\_\_\_  
**Circuit #2** – current \_\_\_\_\_ conductor size \_\_\_\_\_      **CB#2** – rating \_\_\_\_\_  
**Circuit #3** – current \_\_\_\_\_ conductor size \_\_\_\_\_      **CB#3** – rating \_\_\_\_\_  
**Circuit #4** – current \_\_\_\_\_ conductor size \_\_\_\_\_      **CB#4** – rating \_\_\_\_\_  
  
**Feeder#1** – current \_\_\_\_\_ conductor size \_\_\_\_\_  
**Feeder#2** – current \_\_\_\_\_ conductor size \_\_\_\_\_      **CB#5** – rating \_\_\_\_\_  
**Feeder#3** – current \_\_\_\_\_ conductor size \_\_\_\_\_      **CB#6** – rating \_\_\_\_\_  
  
**Transformer #1** – 13,800V–480V ratings \_\_\_\_\_ kVA \_\_\_\_\_%Z  
**Transformer #2** – 480V–208V ratings \_\_\_\_\_ kVA \_\_\_\_\_%Z

## REFERENCES

### 240.6 Standard Ampere Ratings.

(A) Fuses and Fixed-Trip Circuit Breakers. The standard ampere ratings...:

**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.**

**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
51–55	0.41	0.67	0.76	123–131
56–60	—	0.58	0.71	132–140

**Table 1.2. Impedance Data for Three Phase Transformers**

KVA	%R	%X	%Z	X/R
3.0	3.7600	1.0000	3.8907	0.265
6.0	2.7200	1.7200	3.2182	0.632
9.0	2.3100	1.1600	2.5849	0.502
15.0	2.1000	1.8200	2.7789	0.867
30.0	0.8876	1.3312	1.6000	1.5
45.0	0.9429	1.4145	1.7000	1.5
75.0	0.8876	1.3312	1.6000	1.5
112.5	0.5547	0.8321	1.0000	1.5
150.0	0.6657	0.9985	1.2000	1.5
225.0	0.6657	0.9985	1.2000	1.5
300.0	0.6657	0.9985	1.2000	1.5
500.0	0.7211	1.0816	1.3000	1.5
750.0	0.6317	3.4425	3.5000	5.45
1000.0	0.6048	3.4474	3.5000	5.70
1500.0	0.5617	3.4546	3.5000	6.15
2000.0	0.7457	4.9441	5.0000	6.63
2500.0	0.7457	4.9441	5.0000	6.63

**Note:** UL Listed transformers 25KVA and greater have a ±10% tolerance on their nameplate impedance.