Week 8 Meeting

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10/22/18
Team Leader: Ahmed
Other Team Members: Katayi,Nur, Chufu, Tam, YJ
Advisor: Dr. Ajjarapu

Safety Moment: Earthquake

- Take some time to discuss evacuation with your family. Sketch a floor plan of your home; walk through each room and discuss evacuation details.
- Plan a second way to exit each room or area. If special equipment is needed, mark where it is located.
- Mark where your emergency food, water, first aid kits, and fire extinguishers are located.
- Indicate the location of your family's emergency outdoor meeting place.
- Keep several flashlights in easily accessible places around the house.
- Keep a wrench or turn-off tool in waterproof wrap near the gas meter.
- Know whether you live, work or play in a tsunami hazard zone.

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Topics

- Array Wiring Diagram
- Conductor Sizing and Type
- Voltage Drop Calculations
- Collector AutoCAD and Parameters Calculation
- Feeder Drawing
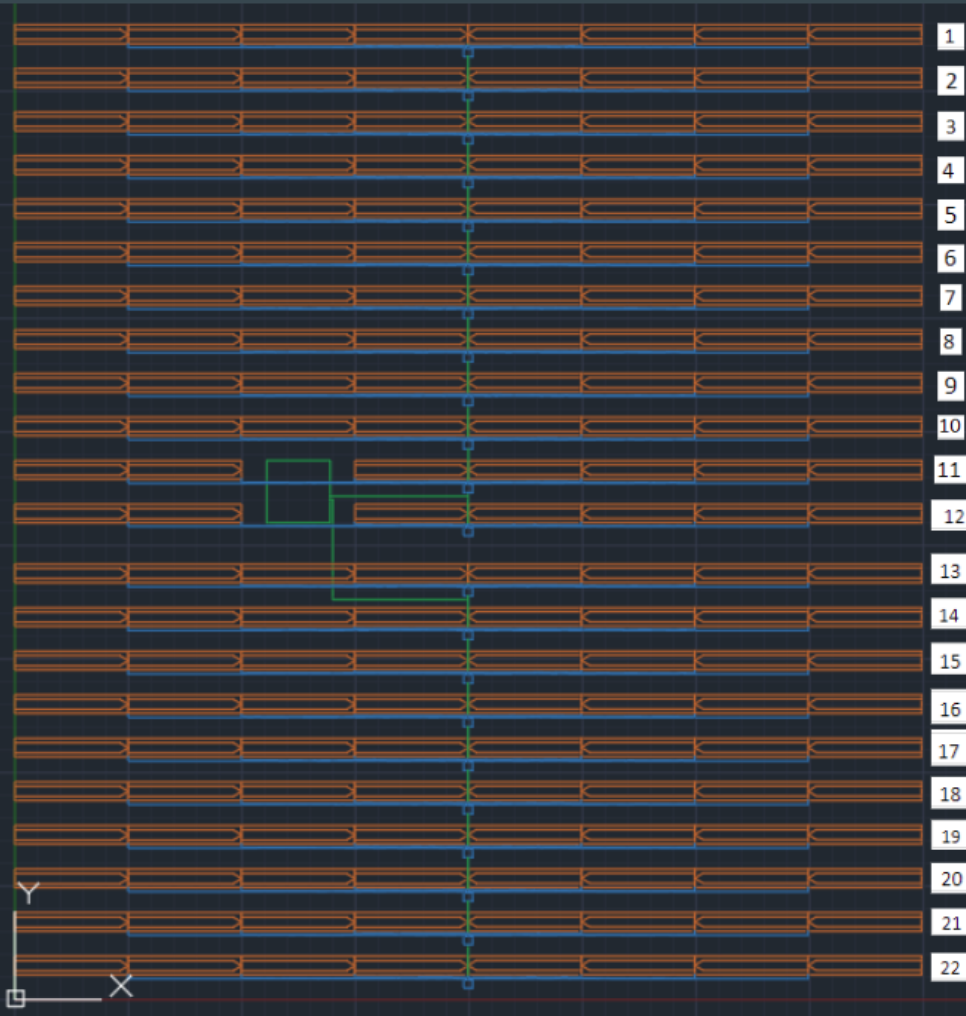
Average of worst-case DCB voltage drop:	2.52%

Conductors	Isc(A)	IMP(A)	Type	Material	AWG
String (Harness)	9.44	14.75	free air	Copper	14
Rack to CB (Jumper)	18.88	29.5	free air	Copper	12
CB to Inverter	75.52	236	Underground	Copper	6

Table 310.106(A) Minimum Size of Conductors

Conductor Voltage Rating (Volts)	Minimum Conductor Size (AWG)	
	Copper	Aluminum or Copper-Clad Aluminum
0–2000	14	12
2001–5000	8	8
5001–8000	6	6
8001–15,000	2	2
15,001–28,000	1	1
28,001–35,000	1/0	1/0

	INVERTER DC FUSE IDENTIFICATION							
Disconnect Combiner Box NUMBER	INPUT DC FUSE SIZE	NUMBER OF STRINGS	NUMBER OF INPUTS	SHORT CIRCUIT CURRENT (ISC)	MAX POWER CURRENT (IMP)	MAX POWER VOLTAGE (VMP)	DC FEEDER WIRE SIZE AND TYPE	ONE WAY DISTANCE NOT TO EXCEED (FT)
DCB#-##	AMP			AMP	AMP	VOLT		
				18.8	29.50	972		
DCB1-01	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-02	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-03	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-04	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-05	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-06	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-07	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-08	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-09	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-10	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-11	210	14	7	131	207	6804	(<1>) - <6 AWG Copper Underground>	
DCB1-12	210	14	7	131	207	6804	(<1>) - <6 AWG Copper Underground>	
DCB1-13	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-14	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-15	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-16	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-17	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-18	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-19	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-20	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-21	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
DCB1-22	240	16	8	150	236	7776	(<1>) - <6 AWG Copper Underground>	
INVERTER 1 TOTALS		348	174	3265	5133	7776		

Note: Left vertical label reads "INVERTER 1".

DCB Information

8 Input Disconnect Combiner Box (CBs 1 - 10 & 13 - 22)

Circuit	from	to	power (W)	Voltage (Vmp)	Current (Imp)	DCB Fuse (A)	Cable Size (AWG)	Cable Length (Ft)
1	ER - 1	DCB	28,674	972	29.5	30	12	193.75
2	ER - 2	DCB	28,674	972	29.5	30	12	131.35
3	ER - 3	DCB	28,674	972	29.5	30	12	68.95
4	ER - 4	DCB	28,674	972	29.5	30	12	6.55
5	ER - 5	DCB	28,674	972	29.5	30	12	6.55
6	ER - 6	DCB	28,674	972	29.5	30	12	68.95
7	ER - 7	DCB	28,674	972	29.5	30	12	131.35
8	ER - 8	DCB	28,674	972	29.5	30	12	193.75
Total:			229,392		236			

7 Input Disconnect Combiner Box (CB 11)

| Circuit	from	to	power (W)	Voltage (Vmp)	Current (Imp)	DCB Fuse (A)	Cable Size (AWG)	Cable Length (Ft)
1	ER - 1	DCB	28,674	972	29.5	30	12	198.842
2	ER - 2	DCB	28,674	972	29.5	30	12	136.442
3	ER - 3	DCB	28,674	972	29.5	30	12	6.55
4	ER - 4	DCB	28,674	972	29.5	30	12	6.55
5	ER - 5	DCB	28,674	972	29.5	30	12	68.95
6	ER - 6	DCB	28,674	972	29.5	30	12	131.35
7	ER - 7	DCB	28,674	972	29.5	30	12	193.75
Total:			200,718		206.5			

7 Input Disconnect Combiner Box (CB 12)

Circuit	from	to	power (W)	Voltage (Vmp)	Current (Imp)	DCB Fuse (A)	Cable Size (AWG)	Cable Length (Ft)
1	ER - 1	DCB	28,674	972	29.5	30	12	203.934
2	ER - 2	DCB	28,674	972	29.5	30	12	141.534
3	ER - 3	DCB	28,674	972	29.5	30	12	6.55
4	ER - 4	DCB	28,674	972	29.5	30	12	6.55
5	ER - 5	DCB	28,674	972	29.5	30	12	131.35
6	ER - 6	DCB	28,674	972	29.5	30	12	131.35
7	ER - 7	DCB	28,674	972	29.5	30	12	193.75
Total:			200,718		206.5			

Voltage Drop Calculations From Racks to CB

DCB	Strings per Harness	IMP for circuit	Rack Harness Length	Rack Harness wire size	Rack Harness resistance	Rack Harness resistance	Voltage Drop of Harness	Jumper Length	Jumper wire size	Jumper resistance	Jumper resistance	Voltage Drop of Jumper	DCB Whip length	DCB Whip wire size	DCB Whip resistance	DCB Whip resistance	Voltage Drop of DCB Whip	Total resistance	Total voltage drop	Voltage drop for branch
DCB#-##	per rack	Amp	feet	AWG	Ohm/kft	Ohm	Volts	feet	AWG	Ohm/kft	Ohm	Volts	feet	AWG	Ohm/kft	Ohm	Volts	Ohm	Volts	percent
DCB1-01	2	29.5	62.4	14	3.1900	0.398	11.744304	193.75	12	2.0100	0.779	22.9768125	1.23705666	7	0.4982	0.001	0.036	1.177	34.757	3.58%
DCB1-02	2	29.5	62.4	14	3.1900	0.398	11.744304	131.35	12	2.0100	0.528	15.5767965	1.23705666	7	0.4982	0.001	0.036	0.926	27.367	2.81%
DCB1-03	2	29.5	62.4	14	3.1900	0.398	11.744304	68.95	12	2.0100	0.277	8.1767805	1.23705666	7	0.4982	0.001	0.036	0.675	19.957	2.05%
DCB1-04	2	29.5	62.4	14	3.1900	0.398	11.744304	6.55	12	2.0100	0.026	0.7767645	1.23705666	7	0.4982	0.001	0.036	0.424	12.557	1.29%
DCB1-05	2	29.5	62.4	14	3.1900	0.398	11.744304	6.55	12	2.0100	0.026	0.7767645	1.23705666	7	0.4982	0.001	0.036	0.424	12.557	1.29%
DCB1-06	2	29.5	62.4	14	3.1900	0.398	11.744304	68.95	12	2.0100	0.277	8.1767805	1.23705666	7	0.4982	0.001	0.036	0.675	19.957	2.05%
DCB1-07	2	29.5	62.4	14	3.1900	0.398	11.744304	131.35	12	2.0100	0.528	15.5767965	1.23705666	7	0.4982	0.001	0.036	0.926	27.367	2.81%
DCB1-08	2	29.5	62.4	14	3.1900	0.398	11.744304	193.75	12	2.0100	0.779	22.9768125	1.23705666	7	0.4982	0.001	0.036	1.177	34.757	3.58%
DCB11-01	2	29.5	62.4	14	3.1900	0.398	11.744304	198.842	12	2.0100	0.799	23.58067278	1.23705666	7	0.4982	0.001	0.036	1.197	35.361	3.64%
DCB11-02	2	29.5	62.4	14	3.1900	0.398	11.744304	136.442	12	2.0100	0.548	16.18065678	1.23705666	7	0.4982	0.001	0.036	0.946	27.961	2.88%
DCB11-00																				
DCB11-03	2	29.5	62.4	14	3.1900	0.398	11.744304	6.55	12	2.0100	0.026	0.7767645	1.23705666	7	0.4982	0.001	0.036	0.424	12.557	1.29%
DCB11-04	2	29.5	62.4	14	3.1900	0.398	11.744304	6.55	12	2.0100	0.026	0.7767645	1.23705666	7	0.4982	0.001	0.036	0.424	12.557	1.29%
DCB11-05	2	29.5	62.4	14	3.1900	0.398	11.744304	68.95	12	2.0100	0.277	8.1767805	1.23705666	7	0.4982	0.001	0.036	0.675	19.957	2.05%
DCB11-06	2	29.5	62.4	14	3.1900	0.398	11.744304	131.35	12	2.0100	0.528	15.5767965	1.23705666	7	0.4982	0.001	0.036	0.926	27.367	2.81%
DCB11-07	2	29.5	62.4	14	3.1900	0.398	11.744304	193.75	12	2.0100	0.779	22.9768125	1.23705666	7	0.4982	0.001	0.036	1.177	34.757	3.58%
DCB12-01	2	29.5	62.4	14	3.1900	0.398	11.744304	203.934	12	2.0100	0.82	24.18453306	1.23705666	7	0.4982	0.001	0.036	1.218	35.965	3.70%
DCB12-02	2	29.5	62.4	14	3.1900	0.398	11.744304	141.534	12	2.0100	0.569	16.78451706	1.23705666	7	0.4982	0.001	0.036	0.967	28.565	2.94%
DCB12-00																				
DCB12-03	2	29.5	62.4	14	3.1900	0.398	11.744304	6.55	12	2.0100	0.026	0.7767645	1.23705666	7	0.4982	0.001	0.036	0.424	12.557	1.29%
DCB12-04	2	29.5	62.4	14	3.1900	0.398	11.744304	6.55	12	2.0100	0.026	0.7767645	1.23705666	7	0.4982	0.001	0.036	0.424	12.557	1.29%
DCB12-05	2	29.5	62.4	14	3.1900	0.398	11.744304	131.35	12	2.0100	0.528	15.5767965	1.23705666	7	0.4982	0.001	0.036	0.926	27.367	2.81%
DCB12-06	2	29.5	62.4	14	3.1900	0.398	11.744304	193.75	12	2.0100	0.779	22.9768125	1.23705666	7	0.4982	0.001	0.036	1.177	34.757	3.58%
DCB12-07	2	29.5	62.4	14	3.1900	0.398	11.744304	131.35	12	2.0100	0.528	15.5767965	1.23705666	7	0.4982	0.001	0.036	0.926	27.367	2.81%

Collector AutoCAD and Parameters Calculation
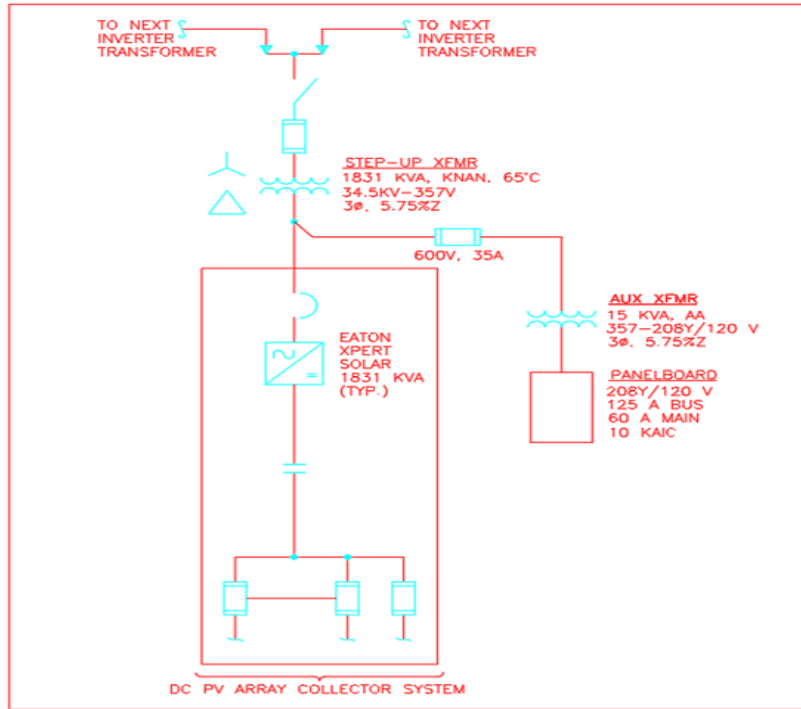
1831 KVA INVERTER TRANSFORMER DETAIL

3 Phase Transformer

Max current = 3000 A
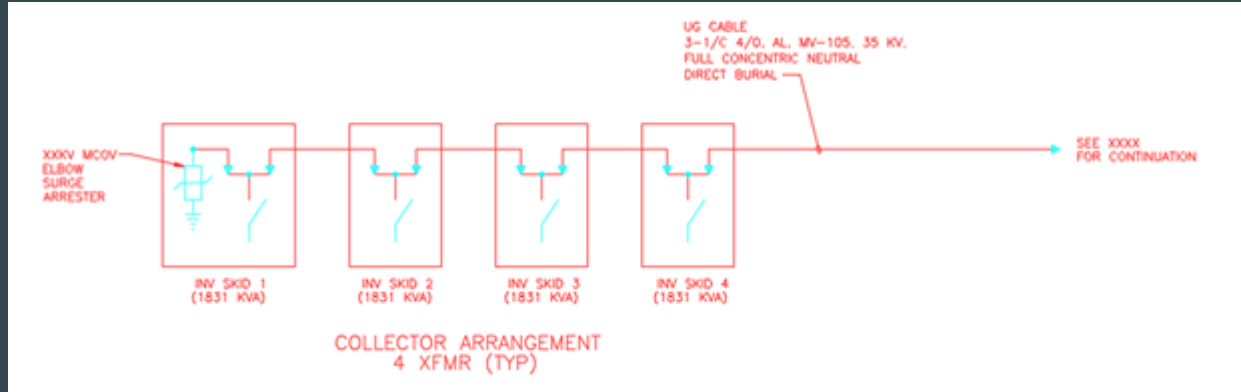
Rated Voltage = 357

Transformer rating = (3000*357*1.732) = 1854 KVA

The max current output of 1 skid (inverter and transformer)
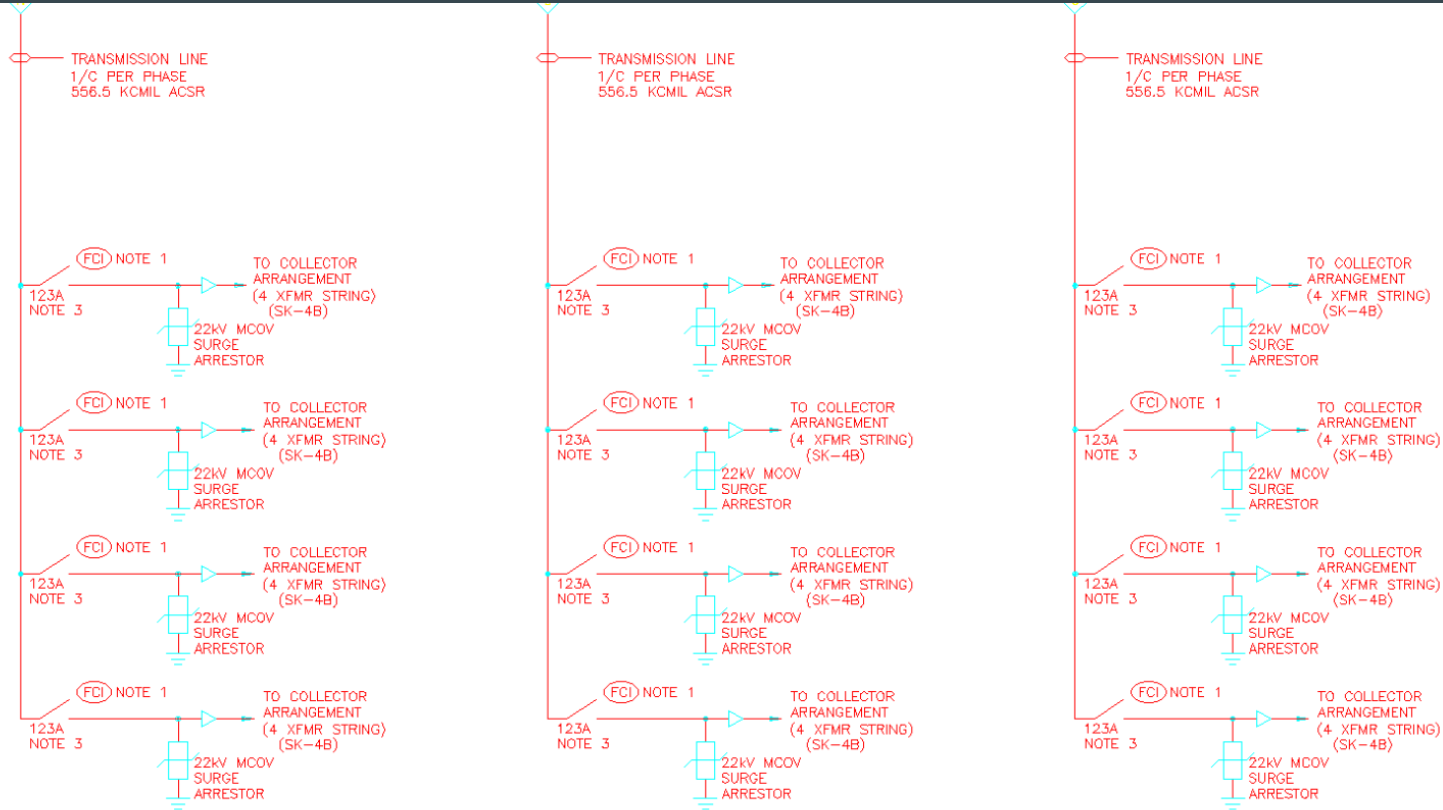
Using the AUX XFNR 15 KVA

I = 15000 VA / (208*1.732) = 41 A

Each collector is attached to 3 inverter skid the total Amp is 123 A

Collector Arrangement AutoCAD

- Each inverter skid output 41 A
- There will be 3 inverter skid pre collector
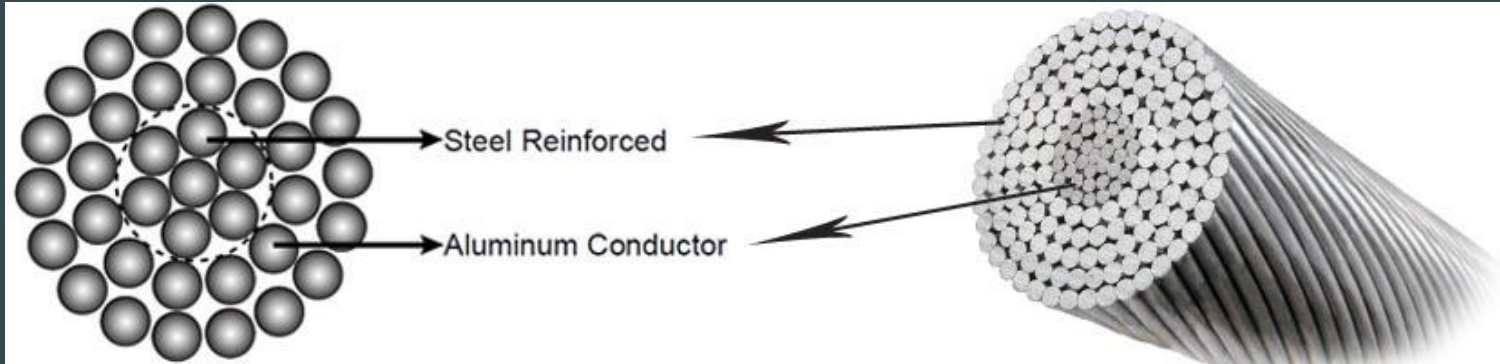- 123A output of each collector will serve as an input to the Feeder

Feeder Drawing

Conductor for Feeder Line

Aluminum Conductor Steel Reinforced (ACSR)

- High-purity aluminum for good conductivity, low weight, and cost
- Zinc coated steel core wire is for strength to support the weight of the conductor (lower elasticity from deformity)

About ACSR

- Given from the AutoCAD, the size that we are choosing for ACSR is 556.5KCM.
- Which one of these should we choose?
- Current per feeder = 4 x 123 A

    = 492 A

Code Word	Size (AWG or kcmil)	Strand- ing (Al/Stl)	Rated Strength (lbs.)	Resistance OHMS/1000 ft.		Allowable Ampacity+ (Amps)
				DC @ 20°C	AC @ 75°C	
Osprey	556.5	18/1	13700	.0308	.0379	711
Parakeet	556.5	24/7	19800	.0307	.0376	721
Dove	556.5	26/7	22600	.0306	.0375	726
Eagle	556.5	30/7	27800	.0303	.0372	734
Ostrich	300	26/7	12700	.0567	.0693	492
Merlin	336.4	18/1	8680	.0510	.0625	519
Linnet	336.4	26/7	14100	.0505	.0618	529
Oriole	336.4	30/7	17300	.0502	.0613	535

Questions

- In the voltage drop calc template, what is "one way distance not to exceed" referring to?

- Are we not suppose to exceed the specification on the PANELBOARD?