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Midterm Review

Midterm Exam Review

- No more than 50 questions – maybe less
- Problems questions – not multiple guess
- Open book / open notes
- Know how to read NEC tables
- Review all the lectures and handouts
  - Electrical Safety
  - Ampacity Calculation
  - Derating factors
  - Voltage Drop Calculation
  - Site Analysis (including work we did for our project)
  - 3 phase power
  - Transformers
- Sample problems online

- Conductor sizes typically used in PV systems range from 20 AWG to 2/0 AWG. Conductors may be solid or stranded.

Conductor Sizes

AWG	DIAMETER*	AREA	AWG	DIAMETER*	AREA
20	0.0320		6	0.1620	
18	0.0403		4	0.2043	
16	0.0508		3	0.2294	
14	0.0641		2	0.2576	
12	0.0808		1	0.2893	
10	0.1019		0 (1/0)	0.3249	
8	0.1285		00 (2/0)	0.3648	

* in in.

Recommended Insulation Types for PV Systems

APPLICATION	REQUIRED RESISTANCES: Moisture	Sunlight	≥90°C	Fire	NUMBER OF CABLE CONDUCTORS: One	Multiple	INSTALLATION: Exposed	Conduit	RECOMMENDED INSULATION TYPE
Source-circuit wiring	✓	✓	✓		✓		✓	✓*	USE, USE-2, UF, SE
Output-circuit wiring	✓		✓		✓			✓	USE-2, XHHW-2, RHW-2, THWN-2
	✓	✓	✓			✓	✓		UF, TC
Interior wiring				✓	✓			✓	THHN, THW, RHW, XHHW, RH
				✓		✓	✓†		NM, NMB, UF
Battery wiring	✓				✓		✓		USE, RHW, THW

* only flexible conduit
† may not be permitted in local jurisdiction

Type	
T	Thermoplastic insulation
H	High temp 75C
HH	High temp 90C
N	Nylon Jacket
W	Moisture resistant
R	Rubber insulated
U	Underground use
USE	Underground service entrance
UF	Underground Feeder
SE	Service Entrance
-2	90C and wet

- Conductors in different parts of a PV system have different requirements.

NEC Article 310.16 and 310.17

Table 310.16 Allowable Ampacities of Insulated Conductors Rated 0 Through 2000 Volts, 60°C Through 90°C (140°F Through 194°F), Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)

	Temperature Rating of Conductor						
	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, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
or kcmil	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			or kcmil
18	–	–	14	–	–	–	–
16	–	–	18	–	–	–	–
14*	20	20	25	–	–	–	–
12*	25	25	30	20	20	25	12*
10*	30	35	40	25	30	35	10*
8	40	50	55	30	40	45	8
6	55	65	75	40	50	60	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	150	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	190	230	255	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	355	420	475	285	340	385	600
700	385	460	520	310	375	420	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	450	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	520	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	560	665	750	470	560	630	2000

CORRECTION FACTORS

Ambient Temp. (°C)	For ambient temperatures other than 30°C (86°F), multiply the allowable ampacities shown above by the appropriate factor shown below.						Ambient Temp. (°F)
21-25	1.08	1.05	1.04	1.08	1.05	1.04	70-77
26-30	1.00	1.00	1.00	1.00	1.00	1.00	78-86
31-35	0.91	0.94	0.96	0.91	0.94	0.96	87-95
36-40	0.82	0.88	0.91	0.82	0.88	0.91	96-104
41-45	0.71	0.82	0.87	0.71	0.82	0.87	105-113
46-50	0.58	0.75	0.82	0.58	0.75	0.82	114-122
51-55	0.41	0.67	0.76	0.41	0.67	0.76	123-131
56-60	—	0.58	0.71	—	0.58	0.71	132-140
61-70	—	0.33	0.58	—	0.33	0.58	141-158
71-80	—	—	0.41	—	—	0.41	159-176

* **Small Condutors.** Unless specifically permitted in 240.4(E) through (G), the overcurrent protection shall not exceed 15 amperes for 14 AWG, 20 amperes for 12 AWG, and 30 amperes for 10 AWG copper; or 15 amperes for 12 AWG and 25 amperes for 10 AWG aluminum and copper-clad aluminum after any correction factors for ambient temperature and number of conductors have been applied.

Table 310.17 Allowable Ampacities of Single-Insulated Conductors Rated 0 Through 2000 Volts in Free Air, Based on Ambient Air Temperature of 30°C (86°F)

	Temperature Rating of Conductor						
	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, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
or kcmil	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM			or kcmil
18	—	—	18	—	—	—	—
16	—	—	24	—	—	—	—
14*	25	30	35	—	—	—	—
12*	30	35	40	25	30	35	12*
10*	40	50	55	35	40	40	10*
8	60	70	80	45	55	60	8
6	80	95	105	60	75	80	6
4	105	125	140	80	100	110	4
3	120	145	165	95	115	130	3
2	140	170	190	110	135	150	2
1	165	195	220	130	155	175	1
1/0	195	230	260	150	180	205	1/0
2/0	225	265	300	175	210	235	2/0
3/0	260	310	350	200	240	275	3/0
4/0	300	360	405	235	280	315	4/0
250	340	405	455	265	315	355	250
300	375	445	505	290	350	395	300
350	420	505	570	330	395	445	350
400	455	545	615	355	425	480	400
500	515	620	700	405	485	545	500
600	575	690	780	455	540	615	600
700	630	755	855	500	595	675	700
750	655	785	885	515	620	700	750
800	680	815	920	535	645	725	800
900	730	870	985	580	700	785	900
1000	780	935	1055	625	750	845	1000
1250	890	1065	1200	710	855	960	1250
1500	980	1175	1325	795	950	1075	1500
1750	1070	1280	1445	875	1050	1185	1750
2000	1155	1385	1560	960	1150	1335	2000

CORRECTION FACTORS

Ambient Temp. (°C)	For ambient temperatures other than 30°C (86°F), multiply the allowable ampacities shown above by the appropriate factor shown below.						Ambient Temp. (°F)
21-25	1.081	.051	.041	.081	.051	0.04	70-77
26-30	1.00	1.00	1.00	1.00	1.00	1.00	78-86
31-35	0.91	0.94	0.96	0.91	0.94	0.96	87-95
36-40	0.82	0.88	0.91	0.82	0.88	0.91	96-104
41-45	0.71	0.82	0.87	0.71	0.82	0.87	105-113
46-50	0.58	0.75	0.82	0.58	0.75	0.82	114-122
51-55	0.41	0.67	0.76	0.41	0.67	0.76	123-131
56-60	—	0.58	0.71	—	0.58	0.71	132-140
61-70	—	0.33	0.58	—	0.33	0.58	141-158
71-80	—	—	0.41	—	—	0.41	159-176

* **Small Condutors.** Unless specifically permitted in 240.4(E) through (G), the overcurrent protection shall not exceed 15 amperes for 14 AWG, 20 amperes for 12 AWG, and 30 amperes for 10 AWG copper; or 15 amperes for 12 AWG and 25 amperes for 10 AWG aluminum and copper-clad aluminum after any correction factors for ambient temperature and number of conductors have been applied.

NEC Article 310.15(B)(2)

Ampacity Correction Factors for Number of Conductors

NUMBER OF CURRENT-CARRYING CONDUCTORS	CORRECTION FACTOR
4 to 6	0.80
7 to 9	0.70
10 to 20	0.50
21 to 30	0.45
31 to 40	0.40
Over 40	0.35

- Conductor ampacity must be derated for more than three current-carrying conductors together in a conduit or cable.

Cable sizing and over current protection

1. Circuit current. For circuits carrying DC current from PV modules, multiply the short circuit current by 125% and use this value for all further calculations. This is called the CONTINUOUS CURRENT calculation.
2. Over current device rating. The over current device must be rated at 125% of the current determined in step 1. This calculation is often referred to as the 80% OPERATION current.
3. Cable sizing. Conductors shall have a 30C ampacity of 125% of the continuous current to ensure proper operation of the connected over current devices.
4. Cable derating. Based on the location of the conductor, conductor size, and temperature rating it may need to be de-rated. The resulting de-rated ampacity must be greater than value in step 1.

5. Ampacity vs over current device. The de-rated ampacity of step 4 must be equal to or greater than the over current device rating calculated in step 2. If the de-rated ampacity of the cable is less then the over current device rating that a larger cable must be selected.
6. Device terminal compatibility. Most over current devices have terminal ratings of 75C so compatibility must be verified if 90C insulated cable was selected. The 30C current of the same size conductor with the 75C insulation must be greater than the current found in step 2.
7. If the over current device is mounted in a location that has an ambient temperature higher than 40C then the rating of the device must be adjusted per manufacturer's specifications.

Cable sizing and over current protection

Example 1:

- 2 PV circuits in conduit (4 conductors)
- Isc = 40amps
- Ambient temperature of conductors= 45C
- Over current device terminal rating = 75C
- Ambient temperature of over current device = 40C

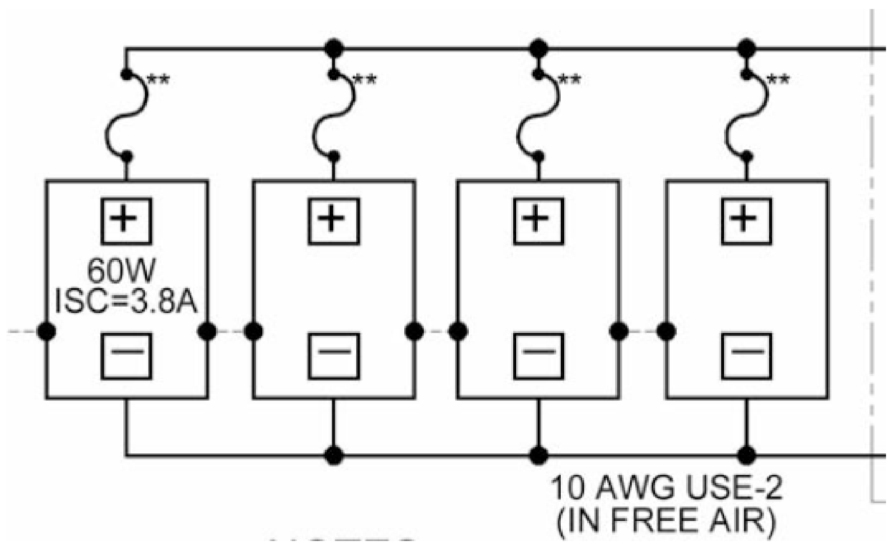
Cable sizing and over current protection

1. Continuous current = 40A * 1.25 = 50A
2. Over current device rating = 50A * 1.25 = 62.5A
   Fuse = 70A
3. Cable ampacity = 50A * 1.25 = 62.5A
   THWN-2, 6AWG
4. Derated ampacity = 75A * .80 * .87 = 52.2A
   52.2A > 50.0 so this cable OK
5. Ampacity vs over current rating? No, 52.2A < 70A
   Acceptable size, 4AWG
6. Over current device compatibility? Yes at 75C rating, 85A > 62.5A
7. Over current device adjustment required? No

Cable sizing and over current protection

Example 2:

- Array size: 4 12-volt, 60Watt modules
- Isc = 3.8A, Voc = 21.1
- Ambient temperature of conductors= 150F
- Over current device terminal rating = 140F
- Ambient temperature of over current device = 96F



Cable sizing and over current protection

1. Continuous current = 3.8A * 4 * 1.25 = 19A
2. Over current device rating = 19A * 1.25 = 23.75A
   Fuse = 30A
3. Cable ampacity = 19A * 1.25 = 23.75A
   USE-2, 10AWG
4. Derated ampacity = 55A * .58 = 32A
   32A > 19 so OK
5. Ampacity vs over current rating? 32A > 30A
   Acceptable size, 10AWG
6. Over current device compatibility? 10AWG USE-2 at 140F = 40A
7. Over current device adjustment required? No

Example Problem 3

Consider an array of 33 Sharp NT175U1 modules, three parallel strings of 11. Use the NEC tables to answer the following questions. (Isc = 5.40A)

1. What is the Continuous Current for each string of the array?

   5.4A * 1.25 = 6.75A

2. Each string is connected through an fused combiner box. What is the over current device rating for each string?

   5.4A * 1.25 * 1.25 = 8.44A , go to next higher fuse value – 10Amp

3. What is the required ampacity at 30C for each string?

   5.4A * 1.25 * 1.25 = 8.44A

4. We want to use USE02 conductors in these circuits. What is the temperature derating factor if the expected temperature is 135F? What is the conduit fill derating factor?

   Temperature Derate = 0.71 **Conduit Derate = 1.0 (USE02 NOT in Conduit)**

5. Using NEC tables, select a conductor size. **I chose 14AWG USE-2**

6. Derate the conductor you selected based on the derating factors above. What is the derated amapacity? **35A * 0.71 * 1 = 24.8A**

7. Is the derated ampacity greater than the Continous Current ? If yes, move ahead, if no, repeat steps 5,6,7 **Yes**

8. Is the derated ampacity greater than the over current protection device rating? If yes, move ahead, if no, repeat steps 5,6,7,8. **Yes**

Example Problem 3

9. The combiner box terminals are rated at 75C not 90C. What is the ampacity at 30C of the combiner box terminals?

   The 14AWG USE-2 conductor ampacity at 75C = 30A

10. Are the combiner box terminals acceptable for this application?

    Yes

11. The combiner box is outside but not in direct sunlight. The expected temperature is 40C. Is this acceptable?

    Yes, but if temperature is greater than 40C then we need to refer to the manufacture's specifications to determine if we can use.

Example Problem 4

Consider the same array of 33 Sharp NT175U1 modules (Isc = 5.40A) and the circuit between the combiner box and the inverter disconnect switch

1.What is the Continuous Current for the circuit out of the combiner box?

5.4A * 3 * 1.25 = 20.25A

2.What is the over current device rating for the circuit?

5.4A * 3 * 1.25 * 1.25 = 25.3A , go to next higher fuse value – 30Amp

3.What is the required ampacity at 30C for each string?

5.4A * 3 * 1.25 * 1.25 = 25.3A

4.We want to use THWN-2 conductors in conduit. What is the temperature derating factor if the expected temperature is 125F? What is the conduit fill derating factor if there are 4 current carrying conductors in the conduit?

Temperature Derate = 0.76 **Conduit Derate = 0.8**

5. Using NEC tables, select a conductor size. **I chose 10AWG THWN-2**

6.Derate the conductor you selected based on the derating factors above. What is the derated amapacity? **40A * 0.76 * 0.8 = 24.32A**

7.Is the derated ampacity greater than the Continous Current ? If yes, move ahead, if no, repeat steps 5,6,7 **Yes**

8. Is the derated ampacity greater than the over current protection device rating? If yes, move ahead, if no, repeat steps 5,6,7,8. **No, pick next larger conductor – 8AWG**

Example Problem 4

9. The disconnect switch terminals are rated at 75C not 90C. What is the ampacity at 30C of the inverter terminals?

   The 8AWG THWN-2 conductor ampacity at 75C = 50A

10. Are the terminals acceptable for this application?

    Yes

11. The disconnect switch in direct sunlight. The expected temperature is 45C. Is this acceptable?

    No, the temperature is greater than 40C so we need to refer to the manufacture’s specifications to determine if we can use.

Cable sizing and over current protection

- <u>AC circuits.</u> What do we do to calculate the ampacity of conductors in the AC circuits of our PV system?

  Use the rated AC continuous current out of the inverter multiply by 125% to get the over current device rating and the conductor ampacity at 30C (steps 2 and 3). Remaining steps are the same.

- <u>Battery output circuits</u>. What do we do to calculate the ampacity of conductors in the DC circuits between the batteries and the inverter?

  Work backwards from the inverter. Rated AC continuous current out of the inverter multiply by 125%, divide by inverter efficiency, divide by the DC voltage to get the over current device rating and conductor ampacity at 30C (steps 2 and 3). Remaining steps are the same.

- <u>Battery input circuits</u>. What do we do to calculate the ampacity of conductors in the DC circuits between the charge controller and the batteries?

  Use the rated DC continuous current out of the charge controller multiply by 125% to get the over current device rating and the conductor ampacity at 30C (steps 2 and 3).
  Remaining steps are the same.

Example Problem 5

Consider the same system of 33 Sharp NT175U1 modules (Isc = 5.40A). The modules are connected to a SMA Sunny Boy 6000US with an output continuous current rating of 29A.AC.

1.What is the Continuous Current for the circuit between the inverter and AC disconnect?

29A

2.What is the over current device rating for the circuit?

29A* 1.25 = 36.25A , go to next higher circuit reaker value – 40Amp

3.What is the required ampacity at 30C for each string?

29A * 1.25 = 36.25A

4.We want to use THWN conductors in conduit. What is the temperature derating factor if the expected temperature is 110F? What is the conduit fill derating factor if there are 3 current carrying conductors in the conduit?

Temperature Derate = 0.82 **Conduit Derate = 1.0**

5. Using NEC tables, select a conductor size. **I chose 8AWG THWN**

6.Derate the conductor you selected based on the derating factors above. What is the derated amapacity? **50A * 0.82 * 1.0 = 41A**

7.Is the derated ampacity greater than the Continuous Current ? If yes, move ahead, if no, repeat steps 5,6,7 **Yes**

8. Is the derated ampacity greater than the over current protection device rating? If yes, move ahead, if no, repeat steps 5,6,7,8. **Yes**

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Example Problem 5

9. The disconnect switch terminals are rated at 75C not 90C. What is the ampacity at 30C of the inverter terminals?

   The 8AWG THWN conductor ampacity = 50A (same temp rating as conductor)

10. Are the terminals acceptable for this application?

    Yes

11. The disconnect switch in direct sunlight. The expected temperature is 45C. Is this acceptable?

    Yes

Example Problem 6

Let's assume we have a stand alone system with four 12VDC batteries rated at 90AHr that are connected in a 2X2 configuration (2 batteries in series in parallel with 2 batteries in series) and the inverter continuous rating is 3.5kW. The inverter efficiency is 90% and its minimum operating input voltage is 21.5V

1.What is the Continuous Current for the circuit between the batteries and inverter?

3500W / 0.90 / 21.5V = 180.9A

2.What is the over current device rating for the circuit?

180.9 * 1.25 = 226.1A , next higher circuit breaker size = 250A

3.What is the required ampacity at 30C for the circuit?

180.9A* 1.25 = 226.1A

4.We want to use THWN conductors in free air. What is the temperature derating factor if the expected temperature is 104F? What is the conduit fill derating factor?

Temperature Derate = 0.88 **Conduit Derate = 1.0**

5. Using NEC tables, select a conductor size. **I chose 3/0AWG THWN**

6.Derate the conductor you selected based on the derating factors above. What is the derated amapacity? **273A**

Example Problem 6

7. Is the derated ampacity greater than the Continuous Current ? If yes, move ahead, if no, repeat steps 5,6,7

   Yes

8. Is the derated ampacity greater than the over current protection device rating? If yes, move ahead, if no, repeat steps 5,6,7,8.

   Yes

9. The inverter terminals are rated at 75C not 90C. What is the ampacity at 30C of the inverter terminals?

   310A

10. Are the terminals acceptable for this application?

    Yes

11. The inverter is in a shaded area. The expected temperature is 35C. Is this acceptable?

    Yes

Voltage Drop Calculation

- Voltage drop is NOT an NEC code issue
  - It is not a safety issue
  - Still important design consideration ($$$$)
  - Power = I * V, as V drops, P drops
- Ohms Law
  - $V = I * R$
  - $\Delta V = I * R$ where I = amperage in conductor,
    R = property of the conductor
- Conductor resistance
  - Decreases as conductor size increases
  - Increases as conductor temperature increases

Voltage Drop Calculation

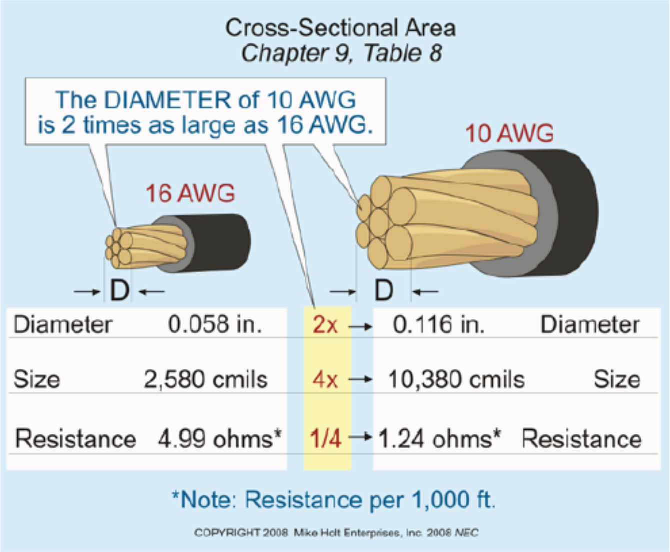
- NEC Chapter 9, Table 8 – Conductor properties
  - Direct Current Resistance at 75C
  - Stranded versus solid conductors
  - Copper versus Aluminum
  - Size 18 to 4/0
  - Area, diameter, and Ohm/kFT / Ohm/km

Table 8–1. Conductor Properties, *NEC* Chapter 9, Table 8

Conductor Size American Wire Gage	Conductor Resistance Per 1,000 Feet at 75°C	Conductor Diameter Inches	Conductor Area Circular Mils
14 AWG	3.140 ohms (stranded)	0.073	4,110
12 AWG	1.980 ohms (stranded)	0.092	6,530
10 AWG	1.240 ohms (stranded)	0.116	10,380
8 AWG	0.778 ohms (stranded)	0.146	16,510
6 AWG	0.491 ohms (stranded)	0.184	26,240

Voltage Drop Calculation

- Resistance as a function of diameter
  - How does resistance change if diameter is doubled?



- Resistance as a function of temperature
  - How does resistance change if temp = 150C?

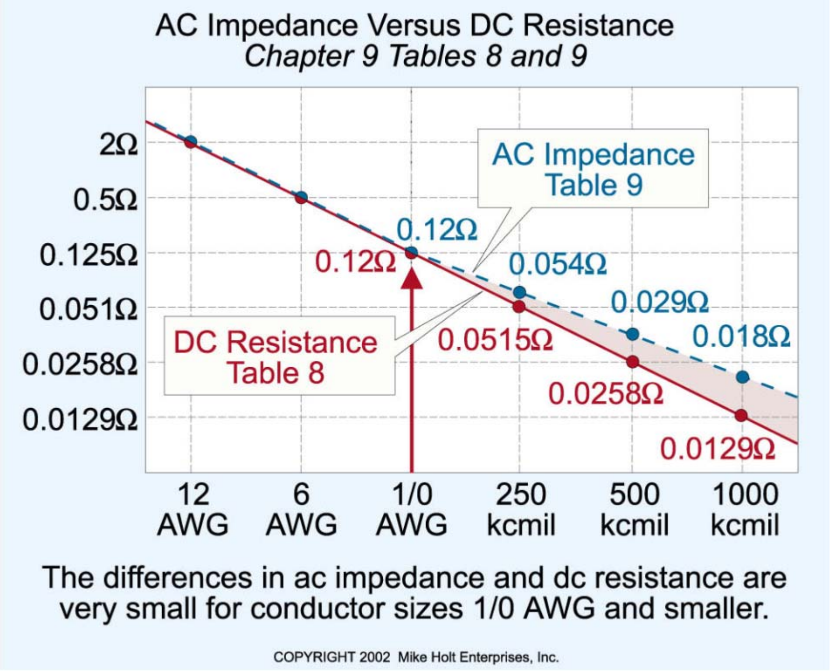
Temperature Adjustment, Table 8, Note 2:

$$R \text{ for CU} = \text{Table } R \times [1 + (0.00323 \times (\text{Temp}°C - 75°))]$$

$$R \text{ for AL} = \text{Table } R \times [1 + (0.00333 \times (\text{Temp}°C - 75°))]$$

Voltage Drop Calculation

- What about Alternating Current Resistance?
  - NEC Chapter 9, Table 9
  - More complex considerations
  - Power factor, and effective impedance
  - DC table is fairly accurate for conductors smaller than 2AWG



Voltage Drop Calculation

- Calculate resistance in conductors
  - What is the resistance in 200ft of 12AWG copper stranded at 30C?

    1.98 Ohm/kFT * 200/1000 = 0.396 Ohm

  - What is the resistance of 400ft of 10AWG copper stranded at 100C?

1.24 Ohm/kFT * 400/1000 * (1+ 0.00323 * (Temp – 75C)) = 0.536 Ohm

  - What is resistance in circuit between junction box and inverter if distance between them is 300ft and we are using 10AWG copper stranded at 50C?

    1.24 Ohm/kFT * 600/1000 = 0.744 Ohm

Voltage Drop Calculation

- What is an acceptable voltage drop?
  - No code requirements
  - Typically measured as a percentage of the nominal voltage
  - 5% or greater bad
  - 2% - 3% is considered “good: design practice
  - What is the voltage drop in 200ft of 12AWG copper stranded at 30C if amperage is 5A?

    5A * 0.396 Ohm = 1.98V

  - If circuit voltage is 12V, what is the percent voltage drop?

    1.98V / 12V = 16.5%

  - If circuit voltage is 48V, what is the percentage drop?

    1.98V / 48V = 4.125%

Voltage Drop Calculation

- What amperage do we use in PV voltage drop calcs?
  - The higher the amperage, the greater the calculated drop
  - Rule of thumb:
    - Use Peak Power amperage (IMP) for grid-tied PV currents
    - Use ISC for battery charging circuits PV circuits
    - Use max steady state current of the load
    - Use max steady state current for battery to inverter circuits
- What voltage do we use in PV voltage drop calcs?
  - Doesn't matter if we are trying to measure the actual voltage loss
    - Example calculating voltage drop to make sure on/off set point is not reached
  - Use nominal percentage if you are looking for percentage

Voltage Drop Calculation

Example 7, 8:

- Determine voltage drop in grid-tied PV source circuit (12AWG stranded, 200FT, ISC = 5.2A IMP = 4.95, Temp = 40C)

  1.98 Ohm/kFT * 200/1000 * 4.95A = 1.96V

- Determine voltage drop in battery charging circuit (2AWG, 50FT, ISC = 41.6A IMP = 39.6A, Temp = 120C)

0.194 Ohm/kFT * 50/1000 * 41.6A*(1 + 0.00323*(120C-75C)) = 0.46V

- Is this acceptable for a 12V system with 2%-3% voltage drop?

  No, it is 3.8% drop

Voltage Drop Calculation

Example 9,10:

- Determine voltage drop in grid-tied PV source circuit (10AWG stranded, 375FT, ISC = 5.4A IMP = 4.99, Temp = 40C)

  1.24 Ohm/kFT * 375/1000 * 4.99A = 2.32V

- Determine voltage drop in battery charging circuit (2/0AWG, 75FT, I = 180A, Temp = 132C)

0.0967 Ohm/kFT * 75/1000 * 180A*(1 + 0.00323*(132C-75C)) = 1.54V

- Is this acceptable for a 12V system with 2%-3% voltage drop?

  No, it is 12.8% drop