Table 5A. Compact Aluminum Building Wire Nominal Dimensions * and Areas

Size (AWG or kcmil)	Bare Conductor			Types THW and THHW				Type THHN				Type XHHW				Size (AWG or kcmil)
	Number of Strands	Diameter		Approximate Diameter		Approximate Area		Approximate Diameter		Approximate Area		Approximate Diameter		Approximate Area		
		mm	(in.)	mm	(in.)	mm^2	($in.^2$)	mm	(in.)	mm^2	($in.^2$)	mm	(in.)	mm^2	($in.^2$)	
8	7	3.404	0.134	6.477	0.255	32.90	0.0510	—	—	—	—	5.690	0.224	25.42	0.0394	8
6	7	4.293	0.169	7.366	0.290	42.58	0.0660	6.096	0.240	29.16	0.0452	6.604	0.260	34.19	0.0530	6
4	7	5.410	0.213	8.509	0.335	56.84	0.0881	7.747	0.305	47.10	0.0730	7.747	0.305	47.10	0.0730	4
2	7	6.807	0.268	9.906	0.390	77.03	0.1194	9.144	0.360	65.61	0.1017	9.144	0.360	65.61	0.1017	2
1	19	7.595	0.299	11.81	0.465	109.5	0.1698	10.54	0.415	87.23	0.1352	10.54	0.415	87.23	0.1352	1
1/0	19	8.534	0.336	12.70	0.500	126.6	0.1963	11.43	0.450	102.6	0.1590	11.43	0.450	102.6	0.1590	1/0
2/0	19	9.550	0.376	13.84	0.545	150.5	0.2332	12.57	0.495	124.1	0.1924	12.45	0.490	121.6	0.1885	2/0
3/0	19	10.74	0.423	14.99	0.590	176.3	0.2733	13.72	0.540	147.7	0.2290	13.72	0.540	147.7	0.2290	3/0
4/0	19	12.07	0.475	16.38	0.645	210.8	0.3267	15.11	0.595	179.4	0.2780	14.99	0.590	176.3	0.2733	4/0
250	37	13.21	0.520	18.42	0.725	266.3	0.4128	17.02	0.670	227.4	0.3525	16.76	0.660	220.7	0.3421	250
300	37	14.48	0.570	19.69	0.775	304.3	0.4717	18.29	0.720	262.6	0.4071	18.16	0.715	259.0	0.4015	300
350	37	15.65	0.616	20.83	0.820	340.7	0.5281	19.56	0.770	300.4	0.4656	19.30	0.760	292.6	0.4536	350
400	37	16.74	0.659	21.97	0.865	379.1	0.5876	20.70	0.815	336.5	0.5216	20.32	0.800	324.3	0.5026	400
500	37	18.69	0.736	23.88	0.940	447.7	0.6939	22.48	0.885	396.8	0.6151	22.35	0.880	392.4	0.6082	500
600	61	20.65	0.813	26.67	1.050	558.6	0.8659	25.02	0.985	491.6	0.7620	24.89	0.980	486.6	0.7542	600
700	61	22.28	0.877	28.19	1.110	624.3	0.9676	26.67	1.050	558.6	0.8659	26.67	1.050	558.6	0.8659	700
750	61	23.06	0.908	29.21	1.150	670.1	1.0386	27.31	1.075	585.5	0.9076	27.69	1.090	602.0	0.9331	750
1000	61	26.92	1.060	32.64	1.285	836.6	1.2968	31.88	1.255	798.1	1.2370	31.24	1.230	766.6	1.1882	1000

*** Dimensions are from industry sources.**

(Log #1301)

6- 217 - (Chapter 9, Table 5A): Accept in Principle
SUBMITTER: Technical Correlating Committee National Electrical Code
RECOMMENDATION: Revise Table 5A as follows.
SUBSTANTIATION: The proposed revision is intended to comply with the NFPA 1M Manual of Style Section 4.1 with respect to the placement of units, i.e., to show the SI units as the preferred unit and the (inch-pound units) immediately following in parenthesis.

In accordance with NFPA 1M Manual of Style Section 4.1, a hard conversion is proposed wherever safety would not be compromised. In accordance with NFPA 1M Manual of Style Section 4.1, a soft conversion is proposed wherever safety could be compromised by using a hard conversion.
PANEL ACTION: Accept in Principle.
PANEL STATEMENT: See panel action on Proposal 6-216.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

SEE tables on the following **(2 pages)**

Table 5A. Compact Aluminum Building Wire Nominal Dimensions* and Areas

	Bare Conductor			Types THW and THHW				
Size AWG or kcmil	Number of Strands	Approximate Diameter (mm)	Approximate Diameter In.	Approximate Diameter (mm)	Approximate Diameter In.	Approximate Area (mm^2)	Approximate Area Sq. In	Size AWG or kcmil
8	7	3.4	0.134	6.5	0.255	33	0.0510	8
6	7	4.3	0.169	7.4	0.290	43	0.0660	6
4	7	5.4	0.213	8.5	0.335	57	0.0881	4
2	7	6.8	0.268	9.9	0.390	77	0.1194	2
1	19	7.6	0.299	11.8	0.465	110	0.1698	1
1/0	19	8.5	0.336	12.7	0.500	127	0.1963	1/0
2/0	19	9.6	0.376	13.8	0.545	150	0.2332	2/0
3/0	19	10.7	0.423	15.0	0.590	176	0.2733	3/0
4/0	19	12.1	0.475	16.4	0.645	211	0.3267	4/0
250	37	13.2	0.520	18.4	0.725	266	0.4128	250
300	37	14.5	0.570	19.7	0.775	304	0.4717	300
350	37	15.7	0.616	20.8	0.820	341	0.5281	350
400	37	16.7	0.659	22.0	0.865	379	0.5876	400
500	37	18.7	0.736	23.9	0.940	448	0.6939	500
600	61	20.7	0.813	26.7	1.050	559	0.8659	600
700	61	22.3	0.877	28.2	1.110	624	0.9676	700
750	61	23.1	0.908	29.2	1.150	670	1.0386	750
1000	61	26.9	1.060	32.6	1.285	837	1.2968	1000

*Dimensions are from industry sources.

Table 5A. Compact Aluminum Building Wire Nominal Dimensions* and Areas (continued)

	Bare Conductor			Type THHN				Type XHHW				
Size AWG or kcmil	Number of Strands	Approximate Diameter (mm)	Approximate Diameter In.	Approximate Diameter (mm)	Approximate Diameter In.	Approximate Area (mm^2)	Approximate Area ($in.^2$)	Approximate Diameter (mm)	Approximate. Diameter In.	Approximate Area (mm^2)	Approximate. Area ($in.^2$)	Size AWG or kcmil
8	7	3.4	0.134	—	—	—	—	5.7	0.224	25	0.0394	8
6	7	4.3	0.169	6.1	0.240	29	0.0452	6.6	0.260	34	0.0530	6
4	7	5.4	0.213	7.7	0.305	47	0.0730	7.7	0.305	47	0.0730	4
2	7	6.8	0.268	9.1	0.360	66	0.1017	9.1	0.360	66	0.1017	2
1	19	7.6	0.299	10.5	0.415	87	0.1352	10.5	0.415	87	0.1352	1
1/0	19	8.5	0.336	11.4	0.450	103	0.1590	11.4	0.450	103	0.1590	1/0
2/0	19	9.6	0.376	12.6	0.495	124	0.1924	12.4	0.490	122	0.1885	2/0
3/0	19	10.7	0.423	13.7	0.540	148	0.2290	13.7	0.540	148	0.2290	3/0
4/0	19	12.1	0.475	15.1	0.595	179	0.2780	15.0	0.590	176	0.2733	4/0
250	37	13.2	0.520	17.0	0.670	227	0.3525	16.8	0.660	221	0.3421	250
300	37	14.5	0.570	18.3	0.720	263	0.4071	18.2	0.715	259	0.4015	300
350	37	15.6	0.616	19.6	0.770	301	0.4656	19.3	0.760	293	0.4536	350
400	37	16.7	0.659	20.7	0.815	337	0.5216	20.3	0.800	324	0.5026	400
500	37	18.7	0.736	22.5	0.885	397	0.6151	22.4	0.880	392	0.6082	500
600	61	20.7	0.813	25.0	0.985	492	0.7620	24.9	0.980	487	0.7542	600
700	61	22.3	0.877	26.7	1.050	558	0.8659	26.7	1.050	559	0.8659	700
750	61	23.1	0.908	27.3	1.075	586	0.9076	27.7	1.090	602	0.9331	750
1000	61	26.9	1.060	31.9	1.255	798	1.2370	31.2	1.230	767	1.1882	1000

*Dimensions are from industry sources.

(Log #1256)

6- 218 - (Chapter 9, Table 8): Accept in Principle
SUBMITTER: Technical Correlating Committee National Electrical Code
RECOMMENDATION: Revise Table 8 of Chapter 9 as shown:

See **TABLE 8** on the following **(2 pages)**

Table 8. Conductor Properties

Size AWG / kcmil	Area		Conductors							DC Resistance at 75°C (167°F)					
			Stranding			Overall				Copper				Aluminum	
				Diameter		Diameter		Area		Uncoated		Coated			
	mm^2	Cir. Mills	Quantity	mm	in.	mm	in.	mm^2	in^2	ohm/km	ohm/kFT	ohm/km	ohm/kFT	ohm/km	ohm/kFT
18	0.823	1620	1	-	-	1.02	0.040	0.823	0.001	25.5	7.77	26.5	8.08	42.0	12.8
18	0.823	1620	7	0.39	0.015	1.16	0.046	1.06	0.002	26.1	7.95	27.7	8.45	42.8	13.1
16	1.31	2580	1	-	-	1.29	0.051	1.31	0.002	16.0	4.89	16.7	5.08	26.4	8.05
16	1.31	2580	7	0.49	0.019	1.46	0.058	1.68	0.003	16.4	4.99	17.3	5.29	26.9	8.21
14	2.08	4110	1	-	-	1.63	0.064	2.08	0.003	10.1	3.07	10.4	3.19	16.6	5.06
14	2.08	4110	7	0.62	0.024	1.85	0.073	2.68	0.004	10.3	3.14	10.7	3.26	16.9	5.17
12	3.31	6530	1	-	-	2.05	0.081	3.31	0.005	6.34	1.93	6.57	2.01	10.45	3.18
12	3.31	6530	7	0.78	0.030	2.32	0.092	4.25	0.006	6.50	1.98	6.73	2.05	10.69	3.25
10	5.261	10380	1	-	-	2.588	0.102	5.26	0.008	3.984	1.21	4.148	1.26	6.561	2.00
10	5.261	10380	7	0.98	0.038	2.95	0.116	6.76	0.011	4.070	1.24	4.226	1.29	6.679	2.04
8	8.367	16510	1	-	-	3.264	0.128	8.37	0.013	2.506	0.764	2.579	0.786	4.125	1.26
8	8.367	16510	7	1.23	0.049	3.71	0.146	10.76	0.017	2.551	0.778	2.653	0.809	4.204	1.28
6	13.30	26240	7	1.56	0.061	4.67	0.184	17.09	0.027	1.608	0.491	1.671	0.510	2.652	0.808
4	21.15	41740	7	1.96	0.077	5.89	0.232	27.19	0.042	1.010	0.308	1.053	0.321	1.666	0.508
3	26.67	52620	7	2.20	0.087	6.60	0.260	34.28	0.053	0.802	0.245	0.833	0.254	1.320	0.403
2	33.62	66360	7	2.47	0.097	7.42	0.292	43.23	0.067	0.634	0.194	0.661	0.201	1.045	0.319
1	42.41	83690	19	1.69	0.066	8.43	0.332	55.80	0.087	0.505	0.154	0.524	0.160	0.829	0.253
1/0	53.49	105600	19	1.89	0.074	9.45	0.372	70.41	0.109	0.399	0.122	0.415	0.127	0.660	0.201
2/0	67.43	133100	19	2.13	0.084	10.62	0.418	88.74	0.137	0.3170	0.0967	0.329	0.101	0.523	0.159
3/0	85.01	167800	19	2.39	0.094	11.94	0.470	111.9	0.173	0.2512	0.0766	0.2610	0.0797	0.413	0.126
4/0	107.2	211600	19	2.68	0.106	13.41	0.528	141.1	0.219	0.1996	0.0608	0.2050	0.0626	0.328	0.100

Table 8. Conductor Properties (continued)

Size AWG / kcmil	Area		Conductors						DC Resistance at 75°C (167°F)					
			Stranding			Overall			Copper				Aluminum	
	mm^2	Cir. Mills	Quantity	Diameter		Diameter		Area	Uncoated		Coated			
				mm	in.	mm	in.	mm^2 / in^2	ohm/km	ohm/kFT	ohm/km	ohm/kFT	ohm/km	ohm/kFT
250	-	127	37	2.09	0.082	14.61	0.575	168 / 0.260	0.1687	0.0515	0.1753	0.0535	0.2778	0.0847
300	-	152	37	2.29	0.090	16.00	0.630	201 / 0.312	0.1409	0.0429	0.1463	0.0446	0.2318	0.0707
350	-	177	37	2.47	0.097	17.30	0.681	235 / 0.364	0.1205	0.0367	0.1252	0.0382	0.1984	0.0605
400	-	203	37	2.64	0.104	18.49	0.728	268 / 0.416	0.1053	0.0321	0.1084	0.0331	0.1737	0.0529
500	-	253	37	2.95	0.116	20.65	0.813	336 / 0.519	0.0845	0.0258	0.0869	0.0265	0.1391	0.0424
600	-	304	61	2.52	0.099	22.68	0.893	404 / 0.626	0.0704	0.0214	0.0732	0.0223	0.1159	0.0353
700	-	355	61	2.72	0.107	24.49	0.964	471 / 0.730	0.0603	0.0184	0.0622	0.0189	0.0994	0.0303
750	-	380	61	2.82	0.111	25.35	0.998	505 / 0.782	0.0563	0.0171	0.0579	0.0176	0.0927	0.0282
800	-	405	61	2.91	0.114	26.16	1.030	538 / 0.834	0.0528	0.0161	0.0544	0.0166	0.0868	0.0265
900	-	456	61	3.09	0.122	27.79	1.094	606 / 0.940	0.0470	0.0143	0.0481	0.0147	0.0770	0.0235
1000	-	507	61	3.25	0.128	29.26	1.152	673 / 1.042	0.0423	0.0129	0.0434	0.0132	0.0695	0.0212
1250	-	633	91	2.98	0.117	32.74	1.289	842 / 1.305	0.0338	0.0103	0.0347	0.0106	0.0554	0.0169
1500	-	760	91	3.26	0.128	35.86	1.412	1011 / 1.566	0.02814	0.00858	0.02814	0.00883	0.0464	0.0141
1750	-	887	127	2.98	0.117	38.76	1.526	1180 / 1.829	0.02410	0.00735	0.02410	0.00756	0.0397	0.0121
2000	-	1010	127	3.19	0.126	41.45	1.632	1349 / 2.092	0.02109	0.00643	0.02109	0.00662	0.0348	0.0106

These resistance values are valid ONLY for the parameters as given. Using conductors having coated strands, different stranding type, and, especially, other temperatures changes the resistance.

Formula for temperature change: $R2 = R1 [1 + \alpha(T2 - 75)]$ where: $\alpha_{cu} = 0.00323$, $\alpha_{AL} = 0.00330$ at 75° C.

Conductors with compact and compressed stranding have about 9 percent and 3 percent, respectively, smaller bare conductor diameters than those shown. See Table 5A for actual compact cable dimensions.

The IACS conductivities used: bare copper = 100%, aluminum = 61%.

Class B stranding is listed as well as solid for some sizes. Its overall diameter and area is that of its circumscribing circle.

(FPN): The construction information is per NEMA WC8-1988 or ANSI/UL 1581-1998. The resistance is calculated per National Bureau of Standards Handbook 100, dated 1966, and Handbook 109, dated 1972.

These resistance values are valid ONLY for the parameters as given. Using conductors having coated strands, different stranding type, and, especially, other temperatures changes the resistance.

Formula for temperature change: R2 = R1 [1 + α(T2 - 75)] where: α_{cu} = 0.00323, α_{AL} = 0.00330 at 75° C.

Conductors with compact and compressed stranding have about 9 percent and 3 percent, respectively, smaller bare conductor diameters than those shown. See Table 5A for actual compact cable dimensions.

The IACS conductivities used: bare copper = 100%, aluminum = 61%.

Class B stranding is listed as well as solid for some sizes. Its overall diameter and area is that of its circumscribing circle.

(FPN): The construction information is per NEMA WC8-1988 or ANSI/UL 1581-1998. The resistance is calculated per National Bureau of Standards Handbook 100, dated 1966, and Handbook 109, dated 1972.

SUBSTANTIATION: The proposed revision complies with the NFPA 1M Manual of Style Section 4-1 with respect to the placement of units, i.e., to show the SI units as the preferred unit and the inch-pound units immediately following in parenthesis.

A "soft" conversion is necessary to conform to U.S. Industry practice and applicable product standards.

PANEL ACTION: Accept in Principle.

PANEL STATEMENT: The notes to the table must be numbered as in the existing code. In note 2 add "at 75 degree C" at the end of the sentence. In FPN add "or ANSI/UL 1581-1998" after "NEMA WC8-1988". The NEMA reference should be the 1992 edition not the 1988 edition.

In column title area change "Cir. Mills" to "Cir. Mils".

In the second page of the table, the numbers shown under "Cir. Mills" should be moved to be shown under "mm2".

NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12

VOTE ON PANEL ACTION:

AFFIRMATIVE: 11

(Log #1257)

6- 219 - (Chapter 9, Table 9): Accept

SUBMITTER: Technical Correlating Committee National Electrical Code

RECOMMENDATION: Revise Table 9 of Chapter 9 as shown to add SI units.

(Table shown on following pages)

SUBSTANTIATION: The proposed revision complies with the NFPA 1M Manual of Style Section 4-1 with respect to the placement of units, i.e., to show the SI units as the preferred unit and the inch-pound units immediately following in parenthesis.

A "soft" conversion is necessary to conform to U.S. Industry practice and applicable product standards.

PANEL ACTION: Accept.

NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12

VOTE ON PANEL ACTION:

AFFIRMATIVE: 11

(Log #3207)

16- 371 - (Chapter 9, Tables 11(a) and (b)): Reject

SUBMITTER: S. E. Egesdal, Honeywell Inc.

RECOMMENDATION: Delete the "Over 30 and through 150" columns in Tables 11(a) and Table 11(b).

SUBSTANTIATION: Chapter 9, Tables 11(a) and (b) each have a column which permits Class 2 power supplies to have an output of 150 VDC, .005 Amps, max. This requirement was put in the NEC in 1968, based on a proposal from GT&E Corporation, NY, NY. The 1968 edition of the NEC provided the voltage, current, and VA requirements, but did not require the Class 2 source to be listed. The present edition of the NEC requires Class 2 sources to be listed. UL has not listed power supplies to meet the voltage and current range permitted by the "Over 30 and through 150" column in Chapter 9, Tables 11(a) and 11(b).

PANEL ACTION: Reject.

PANEL STATEMENT: No substantiation was submitted to show that these voltages pose either shock or fire hazards. These columns should remain to provide guidance for the listing of these supplies.

NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 22

VOTE ON PANEL ACTION:

AFFIRMATIVE: 22

(Log #3212)

16- 372 - (Chapter 9, Table 12(b)): Reject

SUBMITTER: S. E. Egesdal, Honeywell Inc.

RECOMMENDATION: Delete the "Over 100 and through 250" column in Chapter 9, Table 12(b).

SUBSTANTIATION: This voltage range and low current requirement was put in the NEC to accommodate a smoke detector that required a supply voltage of over 200 volts. These smoke detectors have not been sold for over 20 years. There is no reason to retain this special exception to the voltage ranges permitted by Table 12.

PANEL ACTION: Reject.

PANEL STATEMENT: The products using these voltages are still in use and the information should be retained.

NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 21

VOTE ON PANEL ACTION:

AFFIRMATIVE: 20

NEGATIVE: 1

EXPLANATION OF NEGATIVE:

MOORE: The provisions of the NEC are not retroactive. The panel statement that "The products using these voltages are still in use and the information should be retained", is not correct. Nothing in the NEC would prevent the continued use of products already in service. However since there are no products currently manufactured that need this Exception, retention of the Exception serves no useful purpose.

Table 9. Alternating-Current Resistance and Reactance for 600-Volt Cables, 3-Phase, 60 Hz, 75°C (167°F) — Three Single Conductors in Conduit

Size (AWG or kcmil)	Ohms to Neutral per kilometer Ohms to Neutral per 1000 feet														Size (AWG or kcmil)
	XL (Reactance) for All Wires		Alternating-Current Resistance for Uncoated Copper Wires			Alternating-Current Resistance for Aluminum Wires			Effective Z at 0.85 PF for Uncoated Copper Wires			Effective Z at 0.85 PF for Aluminum Wires			
	PVC, Aluminum Conduits	Steel Conduit	PVC Conduit	Aluminum Conduit	Steel Conduit	PVC Conduit	Aluminum Conduit	Steel Conduit	PVC Conduit	Aluminum Conduit	Steel Conduit	PVC Conduit	Aluminum Conduit	Steel Conduit	
14	0.190	0.240	10.2	10.2	10.2	—	—	—	8.9	8.9	8.9	—	—	—	14
	0.058	0.073	3.1	3.1	3.1	—	—	—	2.7	2.7	2.7	—	—	—	
12	0.177	0.223	6.6	6.6	6.6	10.5	10.5	10.5	5.6	5.6	5.6	9.2	9.2	9.2	12
	0.054	0.068	2.0	2.0	2.0	3.2	3.2	3.2	1.7	1.7	1.7	2.8	2.8	2.8	
10	0.164	0.207	3.9	3.9	3.9	6.6	6.6	6.6	3.6	3.6	3.6	5.9	5.9	5.9	10
	0.050	0.063	1.2	1.2	1.2	2.0	2.0	2.0	1.1	1.1	1.1	1.8	1.8	1.8	
8	0.171	0.213	2.56	2.56	2.56	4.3	4.3	4.3	2.26	2.26	2.30	3.6	3.6	3.6	8
	0.052	0.065	0.78	0.78	0.78	1.3	1.3	1.3	0.69	0.69	0.70	1.1	1.1	1.1	
6	0.167	0.210	1.61	1.61	1.61	2.66	2.66	2.66	1.44	1.48	1.48	2.33	2.36	2.36	6
	0.051	0.064	0.49	0.49	0.49	0.81	0.81	0.81	0.44	0.45	0.45	0.71	0.72	0.72	
4	0.157	0.197	1.02	1.02	1.02	1.67	1.67	1.67	0.95	0.95	0.98	1.51	1.51	1.51	4
	0.048	0.060	0.31	0.31	0.31	0.51	0.51	0.51	0.29	0.29	0.30	0.46	0.46	0.46	
3	0.154	0.194	0.82	0.82	0.82	1.31	1.35	1.31	0.75	0.79	0.79	1.21	1.21	1.21	3
	0.047	0.059	0.25	0.25	0.25	0.40	0.41	0.40	0.23	0.24	0.24	0.37	0.37	0.37	
2	0.148	0.187	0.62	0.66	0.66	1.05	1.05	1.05	0.62	0.62	0.66	0.98	0.98	0.98	2
	0.045	0.057	0.19	0.20	0.20	0.32	0.32	0.32	0.19	0.19	0.20	0.30	0.30	0.30	
1	0.151	0.187	0.49	0.52	0.52	0.82	0.85	0.82	0.52	0.52	0.52	0.79	0.79	0.82	1
	0.046	0.057	0.15	0.16	0.16	0.25	0.26	0.25	0.16	0.16	0.16	0.24	0.24	0.25	
1/0	0.144	0.180	0.39	0.43	0.39	0.66	0.69	0.66	0.43	0.43	0.43	0.62	0.66	0.66	1/0
	0.044	0.055	0.12	0.13	0.12	0.20	0.21	0.20	0.13	0.13	0.13	0.19	0.20	0.20	
2/0	0.141	0.177	0.33	0.33	0.33	0.52	0.52	0.52	0.36	0.36	0.36	0.52	0.52	0.52	2/0
	0.043	0.054	0.10	0.10	0.10	0.16	0.16	0.16	0.11	0.11	0.11	0.16	0.16	0.16	
3/0	0.138	0.171	0.253	0.269	0.259	0.43	0.43	0.43	0.289	0.302	0.308	0.43	0.43	0.46	3/0
	0.042	0.052	0.077	0.082	0.079	0.13	0.13	0.13	0.088	0.092	0.094	0.13	0.13	0.14	
4/0	0.135	0.167	0.203	0.220	0.207	0.33	0.36	0.33	0.243	0.256	0.262	0.36	0.36	0.36	4/0
	0.041	0.051	0.062	0.067	0.063	0.10	0.11	0.10	0.074	0.078	0.080	0.11	0.11	0.11	
250	0.135	0.171	0.171	0.187	0.177	0.279	0.295	0.282	0.217	0.230	0.240	0.308	0.322	0.33	250
	0.041	0.052	0.052	0.057	0.054	0.085	0.090	0.086	0.066	0.070	0.073	0.094	0.098	0.10	
300	0.135	0.167	0.144	0.161	0.148	0.233	0.249	0.236	0.194	0.207	0.213	0.269	0.282	0.289	300
	0.041	0.051	0.044	0.049	0.045	0.071	0.076	0.072	0.059	0.063	0.065	0.082	0.086	0.088	
350	0.131	0.164	0.125	0.141	0.128	0.200	0.217	0.207	0.174	0.190	0.197	0.240	0.253	0.262	350
	0.040	0.050	0.038	0.043	0.039	0.061	0.066	0.063	0.053	0.058	0.060	0.073	0.077	0.080	
400	0.131	0.161	0.108	0.125	0.115	0.177	0.194	0.180	0.161	0.174	0.184	0.217	0.233	0.240	400
	0.040	0.049	0.033	0.038	0.035	0.054	0.059	0.055	0.049	0.053	0.056	0.066	0.071	0.073	

Table 9. (Continued)

Size (AWG or kcmil)	Ohms to Neutral per kilometer Ohms to Neutral per 1000 feet														Size (AWG or kcmil)
	XL (Reactance) for All Wires		Alternating-Current Resistance for Uncoated Copper Wires			Alternating-Current Resistance for Aluminum Wires			Effective Z at 0.85 PF for Uncoated Copper Wires			Effective Z at 0.85 PF for Aluminum Wires			
	PVC, Aluminum Conduits	Steel Conduit	PVC Conduit	Aluminum Conduit	Steel Conduit	PVC Conduit	Aluminum Conduit	Steel Conduit	PVC Conduit	Aluminum Conduit	Steel Conduit	PVC Conduit	Aluminum Conduit	Steel Conduit	
500	0.128	0.157	0.089	0.105	0.095	0.141	0.157	0.148	0.141	0.157	0.164	0.187	0.200	0.210	500
	0.039	0.048	0.027	0.032	0.029	0.043	0.048	0.045	0.043	0.048	0.050	0.057	0.061	0.064	
600	0.128	0.157	0.075	0.092	0.082	0.118	0.135	0.125	0.131	0.144	0.154	0.167	0.180	0.190	600
	0.039	0.048	0.023	0.028	0.025	0.036	0.041	0.038	0.040	0.044	0.047	0.051	0.055	0.058	
750	0.125	0.157	0.062	0.079	0.069	0.095	0.112	0.102	0.118	0.131	0.141	0.148	0.161	0.171	750
	0.038	0.048	0.019	0.024	0.021	0.029	0.034	0.031	0.036	0.040	0.043	0.045	0.049	0.052	
1000	0.121	0.151	0.049	0.062	0.059	0.075	0.089	0.082	0.105	0.118	0.131	0.128	0.138	0.151	1000
	0.037	0.046	0.015	0.019	0.018	0.023	0.027	0.025	0.032	0.036	0.040	0.039	0.042	0.046	

Notes:

1. These values are based on the following constants: UL-type RHH wires with Class B stranding, in cradled configuration. Wire conductivities are 100 percent IACS copper and 61 percent IACS aluminum, and aluminum conduit is 45 percent IACS. Capacitive reactance is ignored, since it is negligible at these voltages.
These resistance values are valid only at 75°C (167°F) and for the parameters as given, but are representative for 600-volt wire types operating at 60 Hz.

2. Effective Z is defined as R cos(q) + X sin(q), where q is the power factor angle of the circuit. Multiplying current by effective impedance gives a good approximation for line-to-neutral voltage drop. Effective impedance values shown in this table are valid only at 0.85 power factor.
For another circuit power factor (PF), effective impedance (Ze) can be calculated from R and XL values given in this table as follows:
Ze = R x PF + XL sin[arccos(PF)].

APPENDIX A

(Log #3290)

1- 315 - (Annex A): Accept
SUBMITTER: James T. Pauley, Square D Co.
RECOMMENDATION: Add a new Annex A to read as follows:
Annex A (informative) - Product Safety Standards
This informative annex is intended to provide a list of product safety standards that are utilized for product listing where that listing is required by this Code. It is recognized that this list is current at the time of development, but new standards or modifications to existing standards can occur at any time while this Code is adopted.
This list does not form a mandatory part of the requirements of this Code, but is intended to only provide Code users some informational guidance on the product characteristics on which Code requirements have been based.

Product Standard Name	Product Standard Number
Antenna-Discharge Units	UL 452
Armored Cable	UL 4
Attachment Plugs and Receptacles	UL 498
Audio / Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use	UL 6500
Audio-Video Products and Accessories	UL 1492
Busways and Associated Fittings	UL 857
Cables - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables	UL 493
Cables - Thermoplastic-Insulated Wires and Cables	UL 83
Cables - Thermoset-Insulated Wires and Cables	UL 44
Cables for Non-Power-Limited Fire-Alarm Circui ts	UL 1425
Cables for Power-Limited Fire-Alarm Circuits	UL 1424
Cellular Metal Floor Raceways and Fittings	UL 209
Class 2 Power Units	UL 1310
Commercial Audio Equipment	UL 813
Communication Circuit Accessories	UL 1863
Communications Cables	UL 444
Community-Antenna Television Cables	UL 1655
Conduit - Type EB and A Rigid PVC Conduit and HDPE Conduit	UL 651A
Continuous Length High Density Polyethylene Conduit	UL 651B
Control Centers for Changing Message Type Electric Signs	UL 1433
Cord Sets and Power-Supply Cords	UL 817
Data-Processing Cable	UL 1690
Dead-Front Switchboards	UL 891
Electric Signs	UL 48
Electric Spas, Equipment Assemblies, and Associated Equipment	UL 1563
Electric Water Heaters for Pools and Tubs	UL 1261
Electrical Equipment for Use in Class I, Zone 0, 1, and 2 Hazardous (Classified) Locations	UL 2279
Electrical Metallic Tubing	UL 797
Electrical Nonmetallic Tubing	UL 1653
Electric-Battery-Powered Industrial Trucks	UL 583
Electrode Receptacles for Gas-Tube Signs	UL 879
Enclosed and Dead-Front Switches	UL 98
Enclosures for Electrical Equipment	UL 50
Energy Management Equipment	UL 916
Fire Pump Controllers	UL 218
Fittings for Cable and Conduit	UL 514B
Flexible Cord and Fixture Wire	UL 62
Flexible Metal Conduit	UL 1
Fluorescent Lighting Fixtures	UL 1570
Fluorescent-Lamp Ballasts	UL 935
Gas-Tube-Sign and Ignition Cable	UL 814
General-Use Snap Switches	UL 20
Ground-Fault Circuit-Interrupters	UL 943
Ground-Fault Sensing and Relaying Equipment	UL 1053
Grounding and Bonding Equipment	UL 467
High Intensity Discharge Lighting Fixtures	UL 1572
High-Intensity-Discharge Lamp Ballasts	UL 1029
Incandescent Lighting Fixtures	UL 1571
Industrial Battery Chargers	UL 1564
Industrial Control Equipment	UL 508
Instrumentation Tray Cable	UL 2250
Insulated Wire Connector Systems for Underground Use or in Damp or Wet Locations	UL 486D
Intermediate Metal Conduit	UL 1242
Isolated Power Systems Equipment	UL 1047
Junction Boxes for Swimming Pool Lighting Fixtures	UL 1241
Liquid-Tight Flexible Nonmetallic Conduit	UL 1660
Liquid-Tight Flexible Steel Conduit	UL 360
Low Voltage Landscape Lighting Systems	UL 1838
Low-Voltage Fuses - Part 1: General Requirements	UL 248-1
Low-Voltage Fuses - Part 10: Class L Fuses	UL 249-10
Low-Voltage Fuses - Part 11: Plug Fuses	UL 248-11
Low-Voltage Fuses - Part 12: Class R Fuses	UL 248-12
Low-Voltage Fuses - Part 15: Class T Fuses	UL 248-15
Low-Voltage Fuses - Part 2: Class C Fuses	UL 248-2
Low-Voltage Fuses - Part 3: Class CA and CB Fuses	UL 248-3
Low-Voltage Fuses - Part 4: Class CC Fuses	UL 248-4
Low-Voltage Fuses - Part 5: Class G Fuses	UL 248-5
Low-Voltage Fuses - Part 6: Class H Non-Renewable Fuses	UL 248-6
Low-Voltage Fuses - Part 7: Class H Renewable Fuses	UL 248-7
Low-Voltage Fuses - Part 8: Class J Fuses	UL 248-8
Low-Voltage Fuses - Part 9: Class K Fuses	UL 248-9
Machine-Tool Wires and Cables	UL 1063
Manufactured Wiring Systems	UL 183
Medical and Dental Equipment	UL 544
Medium-Voltage Power Cables	UL 1072
Metal-Clad Cables	UL 1569
Metal-Clad Cables and Cable-Sealing Fittings for Use in Hazardous (Classified) Locations	UL 2225
Metallic Outlet Boxes	UL 514A
Mobile Home Pipe Heating Cable	UL 1462

Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures	UL 489
Molded-Case Switches	UL 1087
Neon Transformers and Power Supplies	UL 2161
Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers	UL 514C
Nonmetallic Surface Raceways and Fittings	UL 5A
Nonmetallic Underground Conduit with Conductors	UL 1990
Office Furnishings	UL 1286
Optical Fiber Cable	UL 1651
Optical Fiber Cable Raceway	UL 2024
Panelboards	UL 67
Personal Protection Systems for Electric Vehicle Supply Circuits: General Requirements	UL 2231-1
Personal Protection Systems for Electric Vehicle Supply Circuits: Particular Requirements for Protection Devices for Use in Charging Systems	UL 2231-2
Portable Electric Lamps	UL 153
Potting Compounds for Swimming Pool, Fountain, and Spa Equipment	UL 676A
Power Outlets	UL 231
Power Units Other Than Class 2	UL 1012
Power-Limited Circuit Cables	UL 13
Professional Video and Audio Equipment	UL 1419
Protectors for Coaxial Communications Circuits	UL 497C
Protectors for Data Communication and Fire Alarm Circuits	UL 497B
Protectors for Paired Conductor Communications Circuits	UL 497
Radio Receivers, Audio Systems, and Accessories	UL 1270
Reference Standard for Electrical Wires, Cables, and Flexible Cords	UL 1581
Reinforced Thermosetting Resin Conduit (RTRC) and Fittings	UL 1684
Residential Pipe Heating Cable	UL 2049
Rigid Metal Conduit	UL 6
Roof and Gutter De-Icing Cable Units	UL 1588
Safety of Information Technology Equipment, Including Electrical Business Equipment	UL 1950
Schedule 40 and 80 Rigid PVC Conduit	UL 651
Secondary Protectors for Communications Circuits	UL 497A
Service-Entrance Cables	UL 854
Smoke Detectors for Fire Protective Signaling Systems	UL 268
Specialty Transformers	UL 506
Splicing Wire Connectors	UL 486C
Static Inverters and Charge Controllers for use in Photovoltaic Power Systems	UL 1741
Strut-Type Channel Raceways and Fittings	UL 5B
Surface Metal Raceways and Fittings	UL 5
Surface Raceways and Fittings for Use with Data, Signal and Control Circuits	UL 5C
Surge Arresters - Gapped Silicon-Carbide Surge Arresters for AC Power Circuits	IEEE C62.1
Surge Arresters - Metal-Oxide Surge Arresters for AC Power Circuits	IEEE C62.11
Swimming Pool Pumps, Filters, and Chlorinators	UL 1081
Telephone Equipment	UL 1459
Transfer Switch Equipment	UL 1008
Underfloor Raceways and Fittings	UL 884
Underwater Lighting Fixtures	UL 676
Vacuum Cleaners, Blower Cleaners, and Household Floor Finishing Machines	UL 1017
Wire Connectors and Soldering Lugs for Use with Copper Conductors	UL 486A
Wire Connectors for Use with Aluminum Conductors	UL 486B
Wireways, Auxiliary Gutters, and Associated Fittings	UL 870

SUBSTANTIATION: The relationship between the Code and the product standards is well known to the participants of the code process. Requirements in product standards are continually used as justification for specific code requirements and the code-making panels rely, in many cases, on the fact that products will be designed and manufactured to those standards in order to allow application of a specific code rule.

However, in a global environment, we can no longer afford to assume that everyone is aware of the importance of the connection of the standards to the code. This proposal serves to more directly indicate that interdependence through an informative annex.

The proposed list for the Annex was developed by reviewing all of the present requirements for product listing in the NEC. In each of these cases, the appropriate product standard was identified and added to the list. It is not the objective to indicate the specific standards reference by Section of the Code, but to simply have a list of standards that indeed include the appropriate standard for that particular section. The proposed list is in alphabetical order by product.

It is recognized that there are products covered by a standard that is not on the list. It is intentional to limit the list at this time to only those products that are affected by a listing requirement in the NEC. The list could indeed expand in future NEC editions to include products covered by a standard where listing is not explicitly indicated.

This proposal is critical to maintaining the consistency in our US Electrical Safety System. Everyone involved in the process realizes that the code cannot be properly applied without having products that are designed to standards compatible with those code requirements. See the attached paper on the US Electrical Safety System which discusses this interrelationship.

Note: Supporting Material is available for review at NFPA headquarters.

PANEL ACTION: Accept.

NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 13

VOTE ON PANEL ACTION:

AFFIRMATIVE: 11

NEGATIVE: 1

NOT RETURNED: 1 Macias

EXPLANATION OF NEGATIVE:

PRICHARD: The proposal to include Annex A was originally submitted to Panel 6 whose panel action was to reject the inclusion of the Annex. Panel 1 did not have the opportunity to discuss or review the contents of the Annex. It is not a complete list of product standards.

COMMENT ON AFFIRMATIVE:

FISKE: We are voting affirmatively on the subject proposal, and wish to register the following comments.

Proposed Informative Annex A is extensive, and clearly required considerable effort on the submitter's part; however, it is incomplete. There are many electrical product safety standards to which the NEC refers, in Fine Print Notes, that are not included in the proposal. If the NEC is to include such an informative annex - as we believe it should - it should include the expressed standards as well as the implied ones. We have taken the liberty of compiling the electrical product safety standards named in the 1999 NEC Fine Print Notes. The list follows.

ANSI A17.5	Elevator and Escalator Electrical Equipment
ANSI B30	Overhead and Gantry Cranes
ANSI/IEEE C37.23	Guide for Metal-Enclosed Bus and Calculating Losses inIsolated-Phase Bus
ANSI/IEEE C57.12.00	Liquid-Immersed Distribution, Power, and Regulating Transformers
ANSI/ISA S12.12	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations
ANSI/ISA S12.23.01	Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations Type of Protection - Encapsulation “m”
ANSI/ISA S12.24.01	Recommended Practice for Classification of Locations for Electrical Installations Classified as Class I, Zone 0, Zone 1, or Zone 2
ANSI/NEMA 250	Enclosures for Electrical Equipment (100 Volts Maximum)
ANSI/NFPA 79	Electrical Standard for Industrial Machinery
ANSI/NFPA 496	Purged and Pressurized Enclosures for Electrical Equipment
ANSI/SAE J1284	Blade Type Electric Fuses
ANSI/SAE J554	Electric Fuses (Cartridge Type)
ANSI/UL 1581	Electrical Wires, Cables, and Flexible Cords
ANSI/UL 1666	Flame Propagation Height of Electrical and Optical-Fiber CableInstalled Vertically in Shafts
ANSI/UL 275	Automotive Glass-Tube Fuses
IEC 60079-1	Electrical Apparatus for Explosive Gas Atmospheres Part 1: Construction and Verification Test of Flameproof Enclosures of Electrical Apparatus
IEC 60079-6	Electrical Apparatus for Explosive Gas Atmospheres - Part 6: Oil-Immersion “o”
IEC 60079-7	Electrical Apparatus for Explosive Gas Atmospheres - Part 7: Increased Safety “E”
IEC 60079-11	Electrical Apparatus for Explosive Gas Atmospheres Part 11: Intrinsic Safety “i”
IEC 60079-15	Electrical Apparatus for Explosive Gas Atmospheres Part 15: Electrical Apparatus with Type of Protection “N”
IEC 60079-18	Electrical Apparatus for Explosive Gas Atmospheres Part 18: Encapsulation “m”
IEEE C57.12.01	Dry-Type Distribution and Power Transformers Including Those With Solid-Cast and/or Resin-Encapsulated Windings
ISA 12.0.01	Electrical Apparatus for Use in Class I, Zones 0 & 1 Hazardous (Classified) Locations: General Requirements
ISA S12.16.01	Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations Type of Protection - Increased Safety “e”
ISA S12.22.01	Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations Type of Protection - Flameproof “d”
ISA S12.25.01	Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations: Type of Protection - Powder Filling “q”
ISA S12.26.01	Electrical Apparatus for Use in Class I, Zone 1 Hazardous (Classified) Locations Type of Protection - Oil-Immersion “O”
NFPA 262	Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
SAE J1127	Battery Cable
SAE J1128	Low Tension Primary Cable
UL 2043	Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces
UL 2200	Stationary Engine Generator Assemblies

Standards that are identified in Fine Print Notes should be identified as American National Standards, where applicable. This would indicate that it is intended for standards' references to include ANSI designations, as indicated in 2-6.2 of NFPA Manual of Style. According to the information available to us, the following standards from proposed annex A are American National Standards.

UL 452	Antenna-Discharge Units
UL 4	Armored Cable
UL 498	Attachment Plugs and Receptacles
UL 6500	Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use
UL 857	Busways and Associated Fittings
UL 493	Cables - Thermoplastic-Insulated Wires and Cable
UL 1425	Cables for Non-Power-Limited Fire-Alarm Circuits
UL 1310	Class 2 Power Units
UL 651A	Conduit - Type EB and A Rigid PVC Conduit and HDPE Conduit
UL 817	Cord Sets and Power-Supply Cords
UL 1690	Data-Processing Cable
UL 891	Dead-Front Switchboards
UL 1563	Electric Spas, Equipment Assemblies, and Associated Equipment
UL 2279	Electrical Equipment for Use in Class I, Zone 0, 1, and 2 Hazardous (Classified) Locations
UL 797	Electrical Metallic Tubing
UL 583	Electric-Battery-Powered Industrial Trucks
UL 98	Enclosed and Dead-Front Switches
UL 50	Enclosures for Electrical Equipment
UL 62	Flexible Cord and Fixture Wire
UL 20	General-Use Snap Switches
UL 943	Ground-Fault Circuit-Interrupters
UL 1053	Ground-Fault Sensing and Relaying Equipment
UL 467	Grounding and Bonding Equipment
UL 1029	High-Intensity-Discharge Lamp Ballasts
UL 1564	Industrial Battery Chargers
UL 1047	Isolated Power Systems Equipment
UL 248-1	Low-Voltage Fuses - Part 1: General Requirements
UL 248-10	Low-Voltage Fuses - Part 10: Class L Fuses
UL 248-11	Low-Voltage Fuses - Part 11: Plug Fuses
UL 248-12	Low-Voltage Fuses - Part 12: Class R Fuses
UL 248-15	Low-Voltage Fuses - Part 15: Class T Fuses
UL 248-2	Low-Voltage Fuses - Part 2: Class C Fuses
UL 248-3	Low-Voltage Fuses - Part 3: Class CA and CB Fuses
UL 248-4	Low-Voltage Fuses - Part 4: Class CC Fuses
UL 248-5	Low-Voltage Fuses - Part 5: Class G Fuses
UL 248-6	Low-Voltage Fuses - Part 6: Class H Non-Renewable Fuses
UL 248-7	Low-Voltage Fuses - Part 7: Class H Renewable Fuses
UL 248-8	Low-Voltage Fuses - Part 8: Class J Fuses

UL 248-9	Low-Voltage Fuses - Part 9: Class K Fuses
UL 1063	Machine-Tool Wires and Cable
UL 183	Manufactured Wiring Systems
UL 1072	Medium-Voltage Power Cables
UL 489	Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures
UL 1087	Molded-Case Switches
UL 1286	Office Furnishings
UL 1651	Optical Fiber Cable
UL 67	Panelboards
UL 153	Portable Electric Lamps
UL 231	Power Outlets
UL 1012	Power Units Other Than Class 2
UL 497	Protectors for Paired Conductor Communications Circuits
UL 1581	Reference Standard for Electrical Wires, Cables, and Flexible Cords
UL 1950	Safety of Information Technology Equipment, Including Electrical Business Equipment
UL 651	Schedule 40 and 80 Rigid PVC Conduit
UL 497A	Secondary Protectors for Communications Circuits
UL 854	Service-Entrance Cables
UL 506	Specialty Transformers
UL 486C	Splicing Wire Connectors
UL 5B	Strut-Type Channel Raceways and Fittings
UL 1459	Telephone Equipment
UL 1008	Transfer Switch Equipment
UL 486A	Wire Connectors and Soldering Lugs for Use with Copper Conductors
UL 870	Wireways, Auxiliary Gutters, and Associated Fittings

MINICK: Editorially revise the proposed language to read as suggested by CMP-1 member Brooke Stauffer.

I understand the revised language by Mr. Stauffer to read as follows:

Annex A (~~informative~~ informational) – Product Safety Standards

This ~~informative~~ informational annex ~~is intended to provide~~ provides a list of product safety standards ~~that are utilized~~ used for product listing where that listing is required by this Code. It is recognized that this list is current at the time of ~~development~~ publication, but that new standards or modifications to existing standards can occur at any time while this edition of the Code is ~~adopted~~ in effect.

This ~~list~~ Annex does not form a mandatory part of the requirements of this Code, but is intended ~~to only~~ only to provide Code users ~~some~~ with informational guidance ~~on~~ about the product characteristics on which Code requirements have been based.

STAUFFER: Editorially revise the proposed language to read as follows. ~~Strikeout~~ and underline format is used for the convenience of CMP-1 members reviewing these suggested changes:

Annex A (~~informative~~ informational) – Product Safety Standards

This ~~informative~~ informational annex ~~is intended to provide~~ provides a list of product safety standards ~~that are utilized~~ used for product listing where that listing is required by this Code. It is recognized that this list is current at the time of ~~development~~ publication, but that new standards or modifications to existing standards can occur at any time while this edition of the Code is ~~adopted~~ in effect.

This ~~list~~ Annex does not form a mandatory part of the requirements of this Code, but is intended ~~to only~~ only to provide Code users ~~some~~ with informational guidance ~~on~~ about the product characteristics on which Code requirements have been based.

APPENDIX B

(Log #1170)

6- 221 - (Appendix B): Reject
SUBMITTER: Harvey L. Williams, Pensacola, FL
RECOMMENDATION: Delete Appendix B.
SUBSTANTIATION: Removal of information that cannot be considered mandatory, should be included in the NECH commentary.
PANEL ACTION: Reject.
PANEL STATEMENT: The information in Appendix B is useful. Not all users of the Code have a copy of the NEC Handbook available.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #3836)

6- 222 - (Appendix B): Accept
SUBMITTER: Rik Oldefest, Riviera Electric
RECOMMENDATION: In Appendix B, I recommend moving Table B-310-11 behind Table B-310-10. Follow this with Figures B-310-1 through B-310-5.
SUBSTANTIATION: I feel this change would improve the flow and make the tables and figures more user friendly.
PANEL ACTION: Accept.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #3109)

6- 5 - (Table B-310-1): Accept in Principle

NOTE: It was the action of the Technical Correlating Committee that this Proposal be referred to Code-Making Panels 8 and 12 for correlation. This action will be considered by Panels 8 and 12 as a Public Comment.

SUBMITTER: Larry F. Miller, Nat'l Electrical Mfrs Assn. (NEMA)
RECOMMENDATION: Delete Type RH from the third and sixth columns of the table heading.
SUBSTANTIATION: Underwriters Laboratories canvassed subscribers of Thermoset-Insulated Wires and Cables, UL 44. It was determined that Type RH insulated conductor is no longer being produced.
PANEL ACTION: Accept in Principle.
Delete "RH" throughout the code.
PANEL STATEMENT: The submitter's reference to Table 310-1 is incorrect. Type RH insulated conductor is no longer produced. This action will also correlate with Proposals 6-16, 6-45, 6-101, 6-107, 6-111, and 6-215.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 11
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #3143)

6- 6 - (Table B-310-1): Accept in Principle

NOTE: It was the action of the Technical Correlating Committee that this Proposal be reconsidered and correlated with the action on Proposal 6-5. The Technical Correlating Committee directs the Panel to correct the text in 310-15(b) to include the table. The Technical Correlating Committe directs that the Panel clarify the Panel Action of this Proposal relative to Table 310-16. This action will be considered by the Panel as a Public Comment.

SUBMITTER: Brandon Bender, Sand Beach Electric
RECOMMENDATION: Move Table B-310-1 to Section 15 of Article 310 as Table 310-22.
SUBSTANTIATION: Electrical cables consisting of insulated conductors with an overall outer covering are frequently installed in raceways for lengths greater than 10 ft where the conductors required physical protection. Electricians are not permitted to use Appendix B so they are generally not aware that conductor ampacity under these conditions cannot be determined using Table 310-16. There needs to be a table available to electricians and inspectors to determine the allowable ampacity of multiconductor cables when installed in raceways for distances greater than 10 ft to reduce the chances of overheating and fires.
PANEL ACTION: Accept in Principle.
Change existing Table 310-21 to Table 310-23. Replace the existing note below the existing Table B-310-1 with "See 240-3(d)". Relocate and renumber Table B-310-1 to Table 310-21. Delete all of the existing asterisks. Delete wire size 14 from column 8. Add asterisks to columns number 1 and 8 for wire sizes 14,12, and 10.
PANEL STATEMENT: To correlate and maintain consistency of placing insulated conductor ampacity tables ahead of the bare covered ampacity tables. These tables should be formatted to be consistent with Tables 310-16 and 310-17.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 11
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #2009)

6- 223 - (B-310-15(b)(1)): Reject
SUBMITTER: John E. Conley, Stratford, CT
RECOMMENDATION: Insert "scientific" before "ampacities" on the second line.
SUBSTANTIATION: See the substantiation for proposal on "Ampacity" definitions.
PANEL ACTION: Reject.
PANEL STATEMENT: Ampacity values provided in the tables (which utilize ampacities versus allowable ampacities) are no less or no more scientific than the calculated ampacity in accordance with 310-15(c). Substantiation, provided with the proposed definition in Proposal 1-101, does not provide any evidence of the problem with the use of ampacity values provided in various tables (which utilize ampacities versus allowable ampacities) or calculated in accordance with 310-15(c).
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #24)

6- 224 - (Tables B-310-1, B-310-3, B-310-5 and through B-310-10): Accept in Principle
NOTE: The following proposal consists of Comment 6-90 on Proposal 6-58 in the 1998 Annual Meeting National Electrical Code Committee Report on Proposals. This comment was held for further study during the processing of the 1999 NATIONAL ELECTRICAL CODE. The recommendation in Proposal 6-58 was:
Change the line directly above the columns to refer users to Table 310-13 for insulation temperature ratings and use of conductors: For Temperature Rating and Use of Conductor See Table 310-13.
Replace the right-hand column of AWG/kcmil information with two columns listing nominal metric wire sizes and Standard metric wire gages.
Eliminate the alphabet soup letters at the head of each column.
(Table shown below)
SUBMITTER: Bob Macfarlane, McLean, VA
RECOMMENDATION: Add the following title at the top of the second table in the above referenced tables: "Ambient Temperature Adjustment Factors".
SUBSTANTIATION: This addition will make the format for the presentation of the referenced tables consistent with ROP 6-58. Presently, the two tables contained in each of the referenced tables are run together, and the second tables have no title, as do the tables in Section 310-16 and beyond. Another suggestion submitted with this group of suggestions recommends that the present title in the tables at 310-16 and beyond be changed from the present "Correction Factors" to "Adjustments for Ambient Temperature", which is the term I propose to use in the referenced tables.
PANEL ACTION: Accept in Principle.
In the recommendation, replace "Ambient Temperature Adjustment Factors" with "Correction Factors".
PANEL STATEMENT: The portion of the heading addressed in the recommendation for Table 310-20 should match the similar portion of the heading for Tables 310-16 through 310-19.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12

Table 310-16 Allowable Ampacities of Insulated Conductors Rated 0 through 2000 Volts, 60°to 90°C (140° to 194°F) Not More Than Three Current-Carrying Conductors in Raceway or Cable or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)

Size	For Temperature Rating and Use of Conductor See Table 310-13						Size	
	60C (140F)	75C (167F)	90C (194F)	60C (140F)	75C (167F)	90C (194F)	Nominal mm^2	Standard mm^2
AWG kcmil	COPPER			ALUMINUM OR COPPER-CLAD				
18	....	....	14	....	....	....	0.82	1.0
16	....	....	18	....	....	....	1.31	1.5
14	20*	20*	25*	....	....	....	2.08	2.5
12	25*	25*	30*	20*	20*	25*	3.31	4
10	30	35*	40*	25	30*	35*	5.26	6
8	40	50	55	30	40	45	8.37	10
6	55	65	70	40	50	60	13.3	16
4	70	85	95	55	65	75	21.2	25
3	85	100	110	65	75	85	26.7	35
2	95	115	130	75	90	100	33.6	35
1	110	130	150	85	100	115	42.4	50
1/0	125	150	170	100	120	135	53.5	70
2/0	145	175	195	115	135	150	67.4	70
3/0	165	200	225	130	155	175	85.0	95
4/0	195	230	260	150	180	205	107	120
250	215	255	290	170	205	230	127	150
300	240	285	320	190	230	255	152	185
350	260	310	350	210	250	280	177	185
400	280	335	380	225	270	305	203	240
500	320	380	430	260	310	350	253	300
600	355	420	475	285	340	385	304	400
700	400	475	535	310	375	420	355	400
750	400	475	535	320	385	435	380	400
800	410	490	555	330	395	450	405	500
900	435	520	585	355	425	480	456	500
1000	455	545	615	375	445	500	507	630
1250	495	590	665	405	485	545	633	800
1500	528	625	705	435	520	585	760	800
1750	545	650	735	455	545	615	887	1000
2000	560	665	750	470	560	630	1010	.....
	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.°C
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	.91	.94	.96	.91	.94	.96		87-95
36-40	.82	.88	.91	.82	.88	.91		96-104
41-45	.71	.82	.87	.71	.82	.87		105-113
45-50	.58	.75	.82	.58	.75	.82		114-122
51-55	.41	.67	.76	.41	.67	.76		123-131
56-60	....	.58	.71	....	.58	.71		132-140
61-70	....	.33	.58	....	.33	.58		141-158
71-80	....	....	.41	....	....	.41		159-176

* Unless otherwise specifically permitted elsewhere in this *Code*, the overcurrent protection for conductor types marked with an asterisk (*) shall not exceed 15 amperes for No. 14, 20 amperes for No. 12 and 30 amperes for No. 10 copper; or 15 amperes for No. 12 and 25 amperes for No. 10 aluminum and copper-clad aluminum after any correction factors for ambient temperatures and number of conductors have been applied.

VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #1123)

6- 225 - (Table B-310-1): Accept
SUBMITTER: James M. Daly, BICC General
RECOMMENDATION: Revise footnote as follows:
*Unless otherwise specifically permitted elsewhere in this Code, the overcurrent protection for these conductor types shall not exceed 15 amperes for ~~No. 14~~ 14 AWG, 20 amperes for ~~No. 12~~ 12 AWG, and 30 amperes for ~~No. 10~~ 10 AWG copper; or 15 amperes for ~~No. 12~~ 12 AWG and 25 amperes for ~~No. 10~~ 10 AWG aluminum and copper-clad aluminum.
SUBSTANTIATION: To provide consistency throughout the Code. The term "No." is not used in any of the Tables in Chapter 3.
AWG and kcmil are trade size designators specifically authorized for use with the SI system of units in North America. Also, industry practice is to use AWG or kcmil only.
This is one of a series of proposals to make this change throughout the Code.
PANEL ACTION: Accept.
PANEL STATEMENT: See panel statement on Proposal 6-7.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #2011)

6- 226 - (Table B-310-1): Reject
SUBMITTER: John E. Conley, Stratford, CT
RECOMMENDATION: Insert "Scientific" before "Ampacities" in the heading.
SUBSTANTIATION: See the substantiation for proposal on "Ampacity" definitions.
PANEL ACTION: Reject.
PANEL STATEMENT: Ampacity values provided in the tables (which utilize ampacities versus allowable ampacities) are no less or no more scientific than the calculated ampacity in accordance with 310-15(c). Substantiation, provided with the proposed definition in Proposal 1-101, does not provide any evidence of the problem with the use of ampacity values provided in various tables (which utilize ampacities versus allowable ampacities) or calculated in accordance with 310-15(c).
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #1297)

6- 227 - (B-310-15(b)(2)): Accept
SUBMITTER: Technical Correlating Committee National Electrical Code
RECOMMENDATION: Revise as follows:
Appendix B
B310-15 (b) (2)
B-310-15(b)(2). Typical Applications Covered by Tables.
Typical ampacities for conductors rated 0 through 2000 volts are shown in Tables B-310-1 through B-310-10. Underground electrical duct bank configurations, as detailed in Figures B-310-3, B-310-4, and B-310-5, are utilized for conductors rated 0 through 5000 volts. In Figures B-310-2 through B-310-5, where adjacent duct banks are used, a separation of 1.5 m (5 ft) ~~(1.52 m)~~ between the centerlines of the closest ducts in each bank or 1.2 m (4 ft) ~~(1.22 m)~~ between the extremities of the concrete envelopes is sufficient to prevent derating of the conductors due to mutual heating. These ampacities were calculated as detailed in the basic ampacity paper, The Calculation of the Temperature Rise and Load Capability of Cable Systems, by J. H. Neher and M. H. McGrath, AIEE Paper 57-660. For additional information concerning the application of these ampacities, see Power Cable Ampacities, IEEE/ICEA Standard S-135/P-46-426 and IEEE Standard 835-1994, Standard Power Cable Ampacity Tables.
B310-15 (b) (3)
B-310-15(b)(3). Criteria Modifications.
Where values of load factor and Rho are known for a particular electrical duct bank installation and they are different from those shown in a specific table or figure, the ampacities shown in the table or figure can be modified by the application of factors derived from the use of Figure B-310-1.
Where two different ampacities apply to adjacent portions of a circuit, the higher ampacity can be used beyond the point of transition, a distance equal to 3 m (10 ft) ~~(3.05 m)~~ or 10 percent of the circuit length figured at the higher ampacity, whichever is less.
Where the burial depth of direct burial or electrical duct bank circuits are modified from the values shown in a figure or table, ampacities can be modified as shown in (1) and (2) as follows.
1. Where burial depths are increased in part(s) of an electrical duct run to avoid underground obstructions, no decrease in ampacity of the conductors is needed, provided the total length of parts of the duct run increased in depth to avoid obstructions is less than 25 percent of the total run length.
2. Where burial depths are deeper than shown in a specific underground ampacity table or figure, an ampacity derating factor of 6 percent per increased 300 mm (foot) ~~(305 mm)~~ of depth for all values of Rho can be utilized. No rating change is needed where the burial depth is decreased.
B310-15 (b) (5) (1)
B-310-15(b)(5). Tables B-310-6 and B-310-7.
1. To obtain the ampacity of cables installed in two electrical ducts in one horizontal row with 191 mm (7.5-in.) ~~(191 mm)~~ center-to-center spacing between electrical ducts, similar to Figure B-310-2, Detail 1, multiply the ampacity shown for one duct in Tables B-310-6 and B-310-7 by 0.88.
2. To obtain the ampacity of cables installed in four electrical ducts in one horizontal row with 191 mm (7.5-in.) ~~(191 mm)~~ center-to-center spacing between electrical ducts, similar to Figure B-310-2, Detail 2, multiply the ampacity shown for three electrical ducts in Tables B-310-6 and B-310-7 by 0.94.
SUBSTANTIATION: The proposed revision is intended to comply with the NFPA 1M Manual of Style Section 4.1 with respect to the placement of units, i.e., to show the SI units as the preferred unit and the (inch-pound units) immediately following in parenthesis. In accordance with NFPA 1M Manual of Style Section 4.1, a hard conversion is proposed wherever safety would not be compromised. In accordance with NFPA 1M Manual of Style Section 4.1, a soft conversion is proposed wherever safety could be compromised by using a hard conversion.
PANEL ACTION: Accept.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #2010)

6- 228 - (B-310-15(b)(2)): Reject
SUBMITTER: John E. Conley, Stratford, CT
RECOMMENDATION: Insert "scientific" before "ampacities" on the second line.
SUBSTANTIATION: See the substantiation for proposal on "Ampacity" definitions.
PANEL ACTION: Reject.
PANEL STATEMENT: Ampacity values provided in the tables (which utilize ampacities versus allowable ampacities) are no less or no more scientific than the calculated ampacity in accordance with 310-15(c). Substantiation, provided with the proposed definition in Proposal 1-101, does not provide any evidence of the problem with the use of ampacity values provided in various tables (which utilize ampacities versus allowable ampacities) or calculated in accordance with 310-15(c).
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #1252)

6- 229 - (Figures B-310-2; B-310-3; B-310-4 and B-310-5): Accept
SUBMITTER: Technical Correlating Committee National Electrical Code
RECOMMENDATION: Change dimensions in Figures B-310-2, B-310-3, B-310-4, and B-310-5 to read as follows:
In Figure B-310-2:
~~7.5 in~~ 190 mm (7.5 in)
~~11.5 in. x 11.5 in.~~290 x 290 mm (11.5 in. x 11.5 in.)
~~19 in. x 19 in.~~ 475 x 475 mm (19 in. x 19 in.)
~~19 in. x 27 in.~~ 475 x 675 mm (19 in. x 27 in.)
~~27 in. x 27 in.~~ 675 x 675 mm (27 in. x 27 in.)
~~27 in. x 11.5 in.~~ 675 x 290 mm (27 in. x 11.5 in.)
~~27 in. x 19 in.~~ 675 x 475 mm (27 in. x 19 in.)
~~24 in.~~ 600 mm (24 in.)
Change dimensions in Note 1 in Figure B-310-2 to read as follows:
~~30 in.~~ 750 mm (30 in.)
~~36 in.~~ 900 mm (36 in.)
Delete Note 3 in Figure B-310-2.
Figure B-310-3:

~~6 in.~~ 150 mm (6 in.)
~~7.5 in.~~ 190 mm (7.5 in.)
~~24 in.~~ 600 mm (24 in.)
~~27 in.~~ 675 mm (27 in.)
~~30 in.~~ 750 mm (30 in.)

Under design criteria in Figure B-310-3:

Change "6 in." to "150 mm (6 in.)", change "3 to 5 in." to "75 to 125 mm (3 to 5 in.)", and delete "For SI Units: 1 in. = 25.4 mm".

In Figure B-310-4:

~~6 in.~~ 150 mm (6 in.)
~~10 in.~~ 250 mm (10 in.)
~~24 in.~~ 600 mm (24 in.)
~~38 in.~~ 950 mm (38 in.)
~~44 in.~~ 1.1 m (44 in.)

Under design criteria in Figure B-310-4: Change "6 in." to "150 mm (6 in.)", change "3 in." to "75 mm (3 in.)".

Under Notes to Figure B-310-4: Delete Note 1.

In Figure B-310-5:

~~6 in.~~ 150 mm (6 in.)
~~10 in.~~ 250 mm (10 in.)
~~24 in.~~ 600 mm (24 in.)
~~38 in.~~ 950 mm (38 in.)
~~54 in.~~ 1.4 m (44 in.)

Under design criteria in Figure B-310-5: Change "6 in." to "150 mm (6 in.)", change "3 in." to "75 mm (3 in.)".

Under Notes to Figure B-310-5: Delete Note 1.

SUBSTANTIATION: The proposed revision complies with the NFPA 1M Manual of Style Section 4-1 with respect to the placement of units, i.e., to show the SI units as the preferred unit and the inch-pound units immediately following in parenthesis.
PANEL ACTION: Accept.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #1124)

6- 230 - (Table B-310-3): Accept
SUBMITTER: James M. Daly, BICC General
RECOMMENDATION: Revise footnote as follows:

*Unless otherwise specifically permitted elsewhere in this Code, the overcurrent protection for these conductor types shall not exceed 15 amperes for ~~No. 14~~ 14 AWG, 20 amperes for ~~No. 12~~ 12 AWG, and 30 amperes for ~~No. 10~~ 10 AWG copper; or 15 amperes for ~~No. 12~~ 12 AWG and 25 amperes for ~~No. 10~~ 10 AWG aluminum and copper-clad aluminum.

SUBSTANTIATION: To provide consistency throughout the Code. The term "No." is not used in any of the Tables in Chapter 3.

AWG and kcmil are trade size designators specifically authorized for use with the SI system of units in North America. Also, industry practice is to use AWG or kcmil only.

This is one of a series of proposals to make this change throughout the Code.
PANEL ACTION: Accept.
PANEL STATEMENT: See panel statement on Proposal 6-7.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #2012)

6- 231 - (Table B-310-3): Reject
SUBMITTER: John E. Conley, Stratford, CT
RECOMMENDATION: Insert "Scientific" before "Ampacities" in the heading.
SUBSTANTIATION: See the substantiation for proposal on "Ampacity" definitions.
PANEL ACTION: Reject.
PANEL STATEMENT: Ampacity values provided in the tables (which utilize ampacities versus allowable ampacities) are no less or no more scientific than the calculated ampacity in accordance with 310-15(c). Substantiation, provided with the proposed definition in Proposal 1-101, does not provide any evidence of the problem with the use of ampacity values provided in various tables (which utilize ampacities versus allowable ampacities) or calculated in accordance with 310-15(c).
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #2013)

6- 232 - (Table B-310-5): Reject
SUBMITTER: John E. Conley, Stratford, CT
RECOMMENDATION: Insert "Scientific" before "Ampacities" in the heading.
SUBSTANTIATION: See the substantiation for proposal on "Ampacity" definitions.
PANEL ACTION: Reject.
PANEL STATEMENT: Ampacity values provided in the tables (which utilize ampacities versus allowable ampacities) are no less or no more scientific than the calculated ampacity in accordance with 310-15(c). Substantiation, provided with the proposed definition in Proposal 1-101, does not provide any evidence of the problem with the use of ampacity values provided in various tables (which utilize ampacities versus allowable ampacities) or calculated in accordance with 310-15(c).
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #2014)

6- 233 - (Table B-310-6): Reject
SUBMITTER: John E. Conley, Stratford, CT
RECOMMENDATION: Insert "Scientific" before "Ampacities" in the heading.
SUBSTANTIATION: See the substantiation for proposal on "Ampacity" definitions.
PANEL ACTION: Reject.
PANEL STATEMENT: Ampacity values provided in the tables (which utilize ampacities versus allowable ampacities) are no less or no more scientific than the calculated ampacity in accordance with 310-15(c). Substantiation, provided with the proposed definition in Proposal 1-101, does not provide any evidence of the problem with the use of ampacity values provided in various tables (which utilize ampacities versus allowable ampacities) or calculated in accordance with 310-15(c).
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #2015)

6- 234 - (Table B-310-7): Reject
SUBMITTER: John E. Conley, Stratford, CT
RECOMMENDATION: Insert "Scientific" before "Ampacities" in the heading.
SUBSTANTIATION: See the substantiation for proposal on "Ampacity" definitions.
PANEL ACTION: Reject.
PANEL STATEMENT: Ampacity values provided in the tables (which utilize ampacities versus allowable ampacities) are no less or no more scientific than the calculated ampacity in accordance with 310-15(c). Substantiation, provided with the proposed definition in Proposal 1-101, does not provide any evidence of the problem with the use of ampacity values provided in various tables (which utilize ampacities versus allowable ampacities) or calculated in accordance with 310-15(c).
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #2016)

6- 235 - (Table B-310-8): Reject
SUBMITTER: John E. Conley, Stratford, CT
RECOMMENDATION: Insert "Scientific" before "Ampacities" in the heading.
SUBSTANTIATION: See the substantiation for proposal on "Ampacity" definitions.
PANEL ACTION: Reject.
PANEL STATEMENT: Ampacity values provided in the tables (which utilize ampacities versus allowable ampacities) are no less or no more scientific than the calculated ampacity in accordance with 310-15(c). Substantiation, provided with the proposed definition in Proposal 1-101, does not provide any evidence of the problem with the use of ampacity values provided in various tables (which utilize ampacities versus allowable ampacities) or calculated in accordance with 310-15(c).
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #2017)

6- 236 - (Table B-310-9): Reject
SUBMITTER: John E. Conley, Stratford, CT
RECOMMENDATION: Insert "Scientific" before "Ampacities" in the heading.
SUBSTANTIATION: See the substantiation for proposal on "Ampacity" definitions.
PANEL ACTION: Reject.
PANEL STATEMENT: Ampacity values provided in the tables (which utilize ampacities versus allowable ampacities) are no less or no more scientific than the calculated ampacity in accordance with 310-15(c). Substantiation, provided with the proposed definition in Proposal 1-101, does not provide any evidence of the problem with the use of ampacity values provided in various tables (which utilize ampacities versus allowable ampacities) or calculated in accordance with 310-15(c).
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #2018)

6- 237 - (Table B-310-10): Reject
SUBMITTER: John E. Conley, Stratford, CT
RECOMMENDATION: Insert "Scientific" before "Ampacities" in the heading.
SUBSTANTIATION: See the substantiation for proposal on "Ampacity" definitions.
PANEL ACTION: Reject.
PANEL STATEMENT: Ampacity values provided in the tables (which utilize ampacities versus allowable ampacities) are no less or no more scientific than the calculated ampacity in accordance with 310-15(c). Substantiation, provided with the proposed definition in Proposal 1-101, does not provide any evidence of the problem with the use of ampacity values provided in various tables (which utilize ampacities versus allowable ampacities) or calculated in accordance with 310-15(c).
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #1125)

6- 238 - (Table B-310-11): Accept
SUBMITTER: James M. Daly, BICC General
RECOMMENDATION: Example No. 1 - change "No. 14" to "14 AWG"
Example No. 2 - change "No. 14" to "14 AWG".
SUBSTANTIATION: To provide consistency throughout the Code. The term "No." is not used in any of the Tables in Chapter 3.
AWG and kcmil are trade size designators specifically authorized for use with the SI system of units in North America. Also, industry practice is to use AWG or kcmil only.
This is one of a series of proposals to make this change throughout the Code.
PANEL ACTION: Accept.
PANEL STATEMENT: See panel statement on Proposal 6-7.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11

(Log #4423)

6- 239 - (B-310-15(b)(2)): Reject
SUBMITTER: Craig M. Wellman, Newark, DE
RECOMMENDATION: Revise paragraph as marked:
B310-15(b)(2) Typical...
Typical ampacities for conductors rated 0-2000 volts are shown in Tables B...
Underground...B-310-5, are utilized for conductors rated 0-5000 volts. Refer to Table B-310-15(b)(2) to select the appropriate table.
Shift remaining material in this section to a new paragraph. No new number is needed.
SUBSTANTIATION: Finding the correct table consistently is difficult. The proposed change will reduce code application errors by improving usability of the code.
PANEL ACTION: Reject.
PANEL STATEMENT: The proposed recommendation does not add to the usability of the various ampacity tables.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 10
NEGATIVE: 1
EXPLANATION OF NEGATIVE:
PETTIGREW: See my Explanation of Negative Vote on Proposal 6-48.

APPENDIX C

(Log #1172)

8- 459 - (Appendix C): Reject
SUBMITTER: Gary L. Jones, Alberta, AL
RECOMMENDATION: Convert Appendix C into a mandatory rule and relocate into Chapter 3 as a separate Article 344.
SUBSTANTIATION: This information presently not part of the Code and should be deleted now or revised to become a mandatory rule.
PANEL ACTION: Reject.
PANEL STATEMENT: See panel action and statement on Proposal 8-463 that addressed not relocating Appendix C. The mandatory rules for raceway fill are contained in Table 1, Chapter 9.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

Table B-310-15(b)(2) Selection of Ampacity Tables

0-2000 Volts Above Ground	Reference
Multiconductor cable with 2 or 3 conductors in raceway in free air	Table B-310-1
Multiconductor cables with not more than 3 insulated conductors in free air	Table B-310-3
0-35,000 Volts Above Ground	
Bare or covered conductors	Table B-310-4
0-2000 Volts Directly Buried or in Electrical Ducts	
Single insulated conductors in nonmagnetic ducts (one conductor per duct)	Table B-310-5
Three insulated conductors within an overall covering (3/C cable) in ducts (1 cable per duct)	Table B-310-6
Three single insulated conductors in electrical ducts (3 conductors per duct)	Table B-310-7
Two or three insulated conductors cabled within an overall covering directly buried in earth	Table B-310-8
Three triplexed single insulated conductors directly buried in earth	Table B-310-9
Three single insulated conductors directly buried in earth	Table B-310-10
Interpolation chart for cables in a duct bank based on load factor and rho	Figure B-310-1
Cable installation dimensions for use with Tables B-5 through B-10	Figure B-310-2
0-5000 Volts Single Insulated Conductors in Underground Electrical Ducts	
Three conductors per duct, 9 single-conductor cables per phase	Figure B-310-3
Nonmagnetic ducts, 1 conductor per duct, 4 single-conductor cables per phase	Figure B-310-4
Nonmagnetic ducts, 1 conductor per duct, 5 single-conductor cables per phase	Figure B-310-5

See also Section 310-15(b) and Appendix B-310-15(b)(1) to (7)
For adjustment factors — more than 3 current carrying conductors in a raceway or cable — see Table 310 Note 8
For adjustment factors — more than 3 current-carrying conductors in a raceway or cable with load diversity — see Table B-310-11

(Log #1689)

8- 460 - (Appendix C): Accept
SUBMITTER: Technical Correlating Committee National Electrical Code
RECOMMENDATION: Appendix C Conduit and tubing fill table - All tables.
Add two new rows at the top as follows:

Metric Designator
16, 21, 27, 35, 41, 53, 63, 78, 91, 103

After Trade size, delete (in.)
SUBSTANTIATION: The proposed revision complies with the NFPA 1M Manual of Style Section 4 with respect to the placement of units and values of measurements.
PANEL ACTION: Accept.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11
NEGATIVE: 2
NOT RETURNED: 1 Corry
EXPLANATION OF NEGATIVE:
LINDSAY: See my Explanation of Negative Vote on Proposal 8-11.
LOYD: See my Explanation of Negative Vote on Propoosal 8-11.

(Log #3017)

8- 461 - (Appendix C): Accept
SUBMITTER: Robert H. Keis, Dover, DE
RECOMMENDATION: In Tables C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, and C11 change the following wording:
Maximum Number of Conductors ~~and~~ or Fixture Wires in... (conduit/raceway types–remain the same as present).
SUBSTANTIATION: It seems that the correct word would be "or" not "and." Since Section 402-11 prohibits using fixture wires as branch-circuit conductors, it seems that there would be one or the other in a raceway, but usually not both together so it should be "or" not "and."
PANEL ACTION: Accept.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3018)

8- 462 - (Appendix C): Reject
SUBMITTER: Robert H. Keis, Dover, DE
RECOMMENDATION: In Tables C1(A), C2(A), C3(A), C4(A), C5(A), C6(A), C7(A), C8(A), C9(A), C10(A), C11(A), and C12(A), add the word "Aluminum" between Compact Conductors. Table title would then read:
Maximum Number of Compact Aluminum Conductors in... (conduit/raceway types–remain the same as present).
SUBSTANTIATION: I submitted this same type proposal for the 1993 Code (and the panel accepted) to clarify that "compact conductors" were "compact aluminum conductors" and no others. The Codes before 1993 used the term compact conductors and it is confusing to those who are just beginning to use the Code. The words were changed in the 1993 Code and then for some reason reverted back to the old wording in the 1999 Code. Please help clarify what the Code means when it says "compact conductors." If this book is to be the least bit "user friendly," this will help. For example, Table 5A, Chapter 9, has the correct wording.
PANEL ACTION: Reject.
PANEL STATEMENT: Not all compact conductors are aluminum. Compact copper conductors are manufactured.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3189)

8- 463 - (Appendix C): Reject
SUBMITTER: Tim Andrassy, Steel Tube Inst.
RECOMMENDATION: Delete Appendix C.
SUBSTANTIATION: At the time these tables were placed in the NEC it appeared they would be helpful to the user. Many users prefer not to take up all the space required in the NEC. With the advent of more metrication of the NEC it appears another 25 pages would be needed to convert to metric. This is unrealistic. In addition, it has become apparent that there are instances where the computed number of conductors will not actually fit into the conduit due to configuration and only conductors of the same size are computed. This detracts from their usefulness. Table 4 of Chapter 9 will still be available and it is more complete than in the past.
PANEL ACTION: Reject.
PANEL STATEMENT: Appendix C is provided for the information and application of the user. It is not mandatory Code.
The two FPN's for Table 1 of Chapter 9 alert the user of situations that may result in difficulty when installing conductors in raceways. Eliminating Appendix C will not affect the problems associated with installing the conductors as the number of conductors will still be computed per Tables 1 and 4 of Chapter 9.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3950)

8- 464 - (Appendix C): Accept in Principle
SUBMITTER: Daniel J. Thomas, Jr., City of Durham, NC
RECOMMENDATION: Add a "Table of Contents" for Appendix C, listing the type raceway for each table and the page number for each. This "Table of Contents" should be the first page of Appendix C.
Appendix C
Table of Contents
(A) Where this is used in conjunction with Tables C1 through C12, the conductors installed, must be of the compact type.

SUBSTANTIATION: It is very difficult to find a specific type raceway being used, without going through each table until you find the particular table needed for your raceway.
PANEL ACTION: Accept in Principle.
Add the correct acronyms from the proposed article revisions after each table title.
PANEL STATEMENT: Panel action is editorial.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #4310)

8- 465 - (Appendix C): Accept in Principle
SUBMITTER: J. Kevin Vogel, Crescent Electrical Supply
RECOMMENDATION: Provide a table of contents for Appendix C immediately before Table C1, following Appendix B.
SUBSTANTIATION: Appendix C is cumbersome to use. A table of contents would make this section of the Code more "user friendly."
PANEL ACTION: Accept in Principle.
PANEL STATEMENT: The submitter's concerns are addressed by the panel's action on Proposal 8-464.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #4464)

8- 466 - (Tables C1 through C12): Accept in Principle
SUBMITTER: Charles M. Williams, Stealth Electric
RECOMMENDATION: The table headings in these tables should have the raceway types more easily identified. This could be done with bold face type or larger print, as is done in the tables in Chapter 9.
SUBSTANTIATION: One of the driving forces in the last Code change was to enhance the "usability" of the NEC. Making these tables more easily identified would seem to compliment this effort.
PANEL ACTION: Accept in Principle.
PANEL STATEMENT: The submitter's concerns are addressed by the panel's action on Proposal 8-457.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3110)

8- 467 - (Appendix C Table C1): Accept
Note: It was the action of the Technical Correlating Committee that this Proposal be referred to Code-Making Panel 6 for information.
SUBMITTER: Larry F. Miller, Nat'l Electrical Mfrs Assn. (NEMA)
RECOMMENDATION: Delete Type RH from the first column of the table in two places.
SUBSTANTIATION: Underwriters Laboratories canvassed subscribers of Thermoset-Insulated Wires and Cables, UL 44. It was determined that Type RH insulated conductor is no longer being produced.
PANEL ACTION: Accept.
PANEL STATEMENT: The panel refers this action to CMP 6 for information.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #4309)

8- 468 - (Appendix C, Table C1(a)): Reject
SUBMITTER: J. Kevin Vogel, Crescent Electrical Supply
RECOMMENDATION: For 350 kcmil XHHW, XHHW-2 compact conductors in 3-inch EMT: ~~8~~ 7.
SUBSTANTIATION: Eight conductors exceeds the 40 percent fill maximum allowed by Chapter 9, Table 1.
PANEL ACTION: Reject.
PANEL STATEMENT: Chapter 9, Table 4 lists the 40% fill square inch area of 3-inch EMT as 3.538. Chapter 9, Table 5A lists the approximate square inch area of 350 Type XHHW insulated conductor as .4536. (3.538 / .4536 = 7.7998236)
Utilizing a standard round-up method the result is a total of 7.8. Note (7) of Chapter 9, Notes to Tables states "(7) When calculating the maximum number of conductors permitted in a conduit or tubing, all of the same size (total cross-sectional area including insulation), the next higher whole number shall be used to determine the maximum number of conductors permitted when the calculation results in a decimal of 0.8 or larger." Because the number achieved by the above calculation is 7.8 the number can be increased to 8.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3114)

8- 469 - (Appendix C Table C2): Accept
NOTE: It was the action of the Technical Correlating Committee that this Proposal be referred to Code-Making Panel 6 for information.
SUBMITTER: Larry F. Miller, Nat'l Electrical Mfrs Assn. (NEMA)
RECOMMENDATION: Delete Type RH from the first column of the table in two places.
SUBSTANTIATION: Underwriters Laboratories canvassed subscribers of Thermoset-Insulated Wires and Cables, UL 44. It was determined that Type RH insulated conductor is no longer being produced.
PANEL ACTION: Accept.
PANEL STATEMENT: The panel refers this action to CMP 6 for information.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3115)

8- 470 - (Appendix C Table C3): Accept
NOTE: It was the action of the Technical Correlating Committee that this Proposal be referred to Code-Making Panel 6 for information.
SUBMITTER: Larry F. Miller, Nat'l Electrical Mfrs Assn. (NEMA)
RECOMMENDATION: Delete Type RH from the first column of the table in two places.
SUBSTANTIATION: Underwriters Laboratories canvassed subscribers of Thermoset-Insulated Wires and Cables, UL 44. It was determined that Type RH insulated conductor is no longer being produced.
PANEL ACTION: Accept.
PANEL STATEMENT: The panel refers this action to CMP 6 for information.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3116)

8- 471 - (Appendix C Table C4): Accept
NOTE: It was the action of the Technical Correlating Committee that this Proposal be referred to Code-Making Panel 6 for information.
SUBMITTER: Larry F. Miller, Nat'l Electrical Mfrs Assn. (NEMA)
RECOMMENDATION: Delete Type RH from the first column of the table in two places.
SUBSTANTIATION: Underwriters Laboratories canvassed subscribers of Thermoset-Insulated Wires and Cables, UL 44. It was determined that Type RH insulated conductor is no longer being produced.
PANEL ACTION: Accept.
PANEL STATEMENT: The panel refers this action to CMP 6 for information.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #437)

8- 472 - (Appendix C Table C5): Accept in Principle
SUBMITTER: Mike Theisen, St. Cloud, MN
RECOMMENDATION: Revise as follows:
Table C5. Maximum Number of Conductors and Fixture Wires in Liquidtight Flexible Nonmetallic Conduit (Type ~~FNMC~~LFNC-B* (Based on Table 1, Chapter 9)
SUBSTANTIATION: In Sections 351-22(2), the Liquidtight Flexible Nonmetallic Conduit is designated as Type LFNC-B. This change will make for consistent use of LFNC-B as the correct terminology for this particular type of conduit.
PANEL ACTION: Accept in Principle.

The panel directs staff to make the same correction to Tables C5A, C6 and C6A.
PANEL STATEMENT: The panel's action provides the necessary corrections to all applicable tables.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3117)

8- 473 - (Appendix C Table C5): Accept
NOTE: It was the action of the Technical Correlating Committee that this Proposal be referred to Code-Making Panel 6 for information.
SUBMITTER: Larry F. Miller, Nat'l Electrical Mfrs Assn. (NEMA)
RECOMMENDATION: Delete Type RH from the first column of the table in two places.
SUBSTANTIATION: Underwriters Laboratories canvassed subscribers of Thermoset-Insulated Wires and Cables, UL 44. It was determined that Type RH insulated conductor is no longer being produced.
PANEL ACTION: Accept.
PANEL STATEMENT: The panel refers this action to CMP-6 for information.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #438)

8- 474 - (Appendix C Table C6): Accept in Principle
SUBMITTER: Mike Theisen, St. Cloud, MN
RECOMMENDATION: Revise as follows:
Table C6. Maximum Number of Conductors and Fixture Wires in Liquidtight Flexible Nonmetallic Conduit (Type ~~FNMC~~LFNC-A*) (Based on Table 1, Chapter 9)
SUBSTANTIATION: In Section 351-22(1), the Liquidtight Flexible Nonmetallic Conduit is designated as Type LFNC-A. This change will make for consistent use of LFNC-A as the correct terminology for this particular type of conduit.
PANEL ACTION: Accept in Principle.
PANEL STATEMENT: The panel's action on Proposal 8-472 addresses the submitter's concern.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3118)

8- 475 - (Appendix C Table C6): Accept
NOTE: It was the action of the Technical Correlating Committee that this Proposal be referred to Code-Making Panel 6 for information.
SUBMITTER: Larry F. Miller, Nat'l Electrical Mfrs Assn. (NEMA)
RECOMMENDATION: Delete Type RH from the first column of the table in two places.
SUBSTANTIATION: Underwriters Laboratories canvassed subscribers of Thermoset-Insulated Wires and Cables, UL 44. It was determined that Type RH insulated conductor is no longer being produced.
PANEL ACTION: Accept.
PANEL STATEMENT: The panel refers this action to CMP-6 for information.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3119)

8- 476 - (Appendix C Table C7): Accept
NOTE: It was the action of the Technical Correlating Committee that this Proposal be referred to Code-Making Panel 6 for information.
SUBMITTER: Larry F. Miller, Nat'l Electrical Mfrs Assn. (NEMA)
RECOMMENDATION: Delete Type RH from the first column of the table in two places.
SUBSTANTIATION: Underwriters Laboratories canvassed subscribers of Thermoset-Insulated Wires and Cables, UL 44. It was determined that Type RH insulated conductor is no longer being produced.
PANEL ACTION: Accept.
PANEL STATEMENT: The panel refers this action to CMP-6 for information.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3390)

8- 477 - (Appendix C, Tables C7 and C7(A)): Reject
SUBMITTER: Will Dockham, Gilmanton Iron Works, NH
RECOMMENDATION: Add a 3/8 in. column to Tables C7 and C7(A). The conductor fill for the new 3/8 in. column of Tables C7 and C7(A) should be the same as the 3/8 in. column of Tables C4 and C4(A) because the internal diameter of 3/8 in. liquidtight flexible metal conduit is the same as the internal diameter of 3/8 in. liquidtight flexible nonmetallic conduit.
SUBSTANTIATION: Confusion is caused when applying Table 350-12, to 3/8 in. liquidtight flexible metal conduit because it is unclear as to which column - "Fitting Inside Conduit" or "Fitting Outside Conduit", should be used. Liquidtight flexible metal conduit fittings typically have a component that installs inside the liquidtight flexible metal conduit, however, I doubt that it is intended that the "Fitting Inside Conduit" column is the appropriate column to use. Also, 3/8 in. liquidtight flexible nonmetallic conduit, Type-B, has the same internal diameter per Chapter 9, Table 4, as 3/8 in. liquidtight flexible metal conduit, therefore the sizing criteria for both raceways should be the same.
PANEL ACTION: Reject.
PANEL STATEMENT: The panel does not agree that it is necessary to add new columns to these tables based on the action taken on Proposal 8-334.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3120)

8- 478 - (Appendix C Table C8): Accept
NOTE: It was the action of the Technical Correlating Committee that this Proposal be referred to Code-Making Panel 6 for information.
SUBMITTER: Larry F. Miller, Nat'l Electrical Mfrs Assn. (NEMA)
RECOMMENDATION: Delete Type RH from the first column of the table in two places.
SUBSTANTIATION: Underwriters Laboratories canvassed subscribers of Thermoset-Insulated Wires and Cables, UL 44. It was determined that Type RH insulated conductor is no longer being produced.
PANEL ACTION: Accept.
PANEL STATEMENT: The panel refers this action to CMP-6 for information.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3111)

8- 479 - (Appendix C Table C10): Accept
NOTE: It was the action of the Technical Correlating Committee that this Proposal be referred to Code-Making Panel 6 for information.
SUBMITTER: Larry F. Miller, Nat'l Electrical Mfrs Assn. (NEMA)
RECOMMENDATION: Delete Type RH from the first column of the table in two places.
SUBSTANTIATION: Underwriters Laboratories canvassed subscribers of Thermoset-Insulated Wires and Cables, UL 44. It was determined that Type RH insulated conductor is no longer being produced.
PANEL ACTION: Accept.
PANEL STATEMENT: The panel refers this action to CMP 6 for information.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3112)

8- 480 - (Appendix C Table C11): Accept
NOTE: It was the action of the Technical Correlating Committee that this Proposal be referred to Code-Making Panel 6 for information.
SUBMITTER: Larry F. Miller, Nat'l Electrical Mfrs Assn. (NEMA)
RECOMMENDATION: Delete Type RH from the first column of the table in two places.
SUBSTANTIATION: Underwriters Laboratories canvassed subscribers of Thermoset-Insulated Wires and Cables, UL 44. It was determined that Type RH insulated conductor is no longer being produced.
PANEL ACTION: Accept.
PANEL STATEMENT: The panel refers this action to CMP 6 for information.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

(Log #3113)

8- 481 - (Appendix C Table C12): Accept
NOTE: It was the action of the Technical Correlating Committee that this Proposal be referred to Code-Making Panel 6 for information.
SUBMITTER: Larry F. Miller, Nat'l Electrical Mfrs Assn. (NEMA)
RECOMMENDATION: Delete Type RH from the first column of the table in two places.
SUBSTANTIATION: Underwriters Laboratories canvassed subscribers of Thermoset-Insulated Wires and Cables, UL 44. It was determined that Type RH insulated conductor is no longer being produced.
PANEL ACTION: Accept.
PANEL STATEMENT: The panel refers this action to CMP 6 for information.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 14
VOTE ON PANEL ACTION:
AFFIRMATIVE: 13
NOT RETURNED: 1 Corry

APPENDIX D

(Log #CP1209)

12- 122a - (Annex D): Accept
SUBMITTER: CMP 12
RECOMMENDATION: Add title to Figure D9: "Generator Field Control."
Add title to Figure D10: "Adjustable Speed Drive Control."
SUBSTANTIATION: The proposal addresses NEC Style Manual issues.
PANEL ACTION: Accept.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 19
VOTE ON PANEL ACTION:
AFFIRMATIVE: 17
NOT RETURNED: 2 Kelly, Laney

(Log #3832)

2- 310 - (Appendix D): Accept in Principle
SUBMITTER: Kevin Starkie, Riviera Electric
RECOMMENDATION: Revise text to read as follows:
"Laundry facilities on premises are available to all tenants. Add no circuit to individual dwelling unit. Add 1500 VA for each laundry circuit to have load and an example as a "house load" (code reference)."
SUBSTANTIATION: No where in the code book is there a reference for this modification to computing laundry circuits for laundry facilities. Add this example to code not just in the example.
PANEL ACTION: Accept in Principle.
In Examle D4(a), delete the last sentence of the existing text beginning with "Add 1500 VA for laundry circuit...".
PANEL STATEMENT: This revision corrects the problem as presented by the submitter.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 12

(Log #1196)

2- 311 - (Appendix D, Examples No. D1 through D4): Reject
SUBMITTER: Technical Correlating Committee National Electrical Code
RECOMMENDATION: 1. In Example D1(a), first paragraph, replace "1500 ft^2" with "139.5 m^2 (1500 ft^2)"
2. In Example D1(a), Computed Load, replace "1500 ft^2 at 3 VA per ft^2 with 139.5 m^2 at 33 VA per m^2 (1500 ft^2 at 3 VA per ft^2)"
3. In Example No. D2(a), first paragraph, replace "1500 ft^2" with "139.5 m^2 (1500 ft^2)"
4. In Example No. D2(a), Feeder Neutral Load per Section 220-22, replace "1500 ft^2 at 3VA per ft^2 with "139.5 m^2 at 33 VA per m^2 (1500 ft^2 at 3 VA per ft^2)"
5. In Example No. D2(b), first paragraph, replace "1500 ft^2" with "139.5 m^2 (1500 ft^2)"
6. In Example No. D2(b), General Load, replace "1500 ft^2 at 3 VA per ft^2" with "139.5 m^2 at 33 VA per m^2 (1500 ft^2 at 3 VA per ft^2)"
7. In Example No. D2(b), Feeder Neutral Load per Section 220-22, replace "1500 ft^2 at 3 VA per ft^2" with "139.5 m^2 at 33 VA per m^2 (1500 ft^2 at 3VA per ft^2)"
8. In Example No. D2(c), first paragraph, replace "2000 ft^2" with "186 m^2 (2000 ft^2)"
9. In Example No. D2(c), General Load, replace "2000 ft^2 at 3 VA" with "186 m^2 at 33 VA (2000 ft^2 at 3 VA)"
10. Example No. D3, first paragraph, replace "...50 by 60 ft, or 3000 ft^2, has 30 ft ..." with "...15 m (50 ft) by 18 m (60 ft), or 270 m^2 (3000 ft^2), has 9.0 m (30 ft)..."
11. In Example No. D3, Continuous Loads, replace "3000 ft^2 at 3 VA per ft^2 with "270 m^2 at 33 VA per m^2 (3000 ft^2 at 3 VA per ft^2)"
12. In Example No. D3, Continuous Loads, replace "30 ft at 200 VA per ft" with "9.0 m at 656 VA per m (30 ft at 200 VA per ft)"
13. In Example No. D4(a), 4th paragraph, replace "840 ft^2" with "78.12 m^2 (840 ft^2)"
14. In Example No. D4(a), Computed Load for Each Dwelling Unit, replace "...840 ft^2 at 3VA per ft^2" with "(78.12 m^2 at 33 VA per m^2 (840 ft^2 at 3 VA per ft^2)..."
15. In Example No. D4(b), 5th paragraph, replace "840 ft^2" with "78.12 m^2 (840 ft^2)"
16. In Example No. D4(b), Computed Load for Each Dwelling Unit, replace "840 ft^2 at 3 VA per ft^2" with "78.12 m^2 at 33 VA per m^2 (840 ft^2 at 3 VA per ft^2)"
SUBSTANTIATION: The proposed revision is intended to comply with the NFPA No. 1M Manual of Style Section 4.1 with respect to the placement of units and values of measurement, i.e., show SI units as the preferred and inch-pound units immediately following in parenthesis. A soft conversion was generally used for area numbers to maintain consistency with the existing examples although the Panel may elect to use a hard conversion.
PANEL ACTION: Reject.
PANEL STATEMENT: The panel recommends that the examples remain in inch-pound units for clarity. Using the conversions supplied by the Metrication Task Group, will result in two different electrical load calculations for the exact same example.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12

VOTE ON PANEL ACTION:
AFFIRMATIVE: 12

(Log #1019)

2- 312 - (Appendix D Example No.s D1(a) and D2(a)): Accept
SUBMITTER: Dan Leaf, Palmdale, CA
RECOMMENDATION: Revise Example D1(a) to read as follows:
~~Net computed load exceeds 10 kVA Section 230-42(b)(2) would require service conductors to be 100 amperes.~~ Sections 230-42(b) and 230-79 require service conductors and disconnecting means rated not less than 100-amperes.
D2(a) Therefore, the minimum service rating ~~size~~ would be 100-amperes in accordance with Sections 230-42 and 230-79.
SUBSTANTIATION: Editorial. There is no Section 230-42(b)(2). Sections 230-42 and 230-79 are sections requiring a 100 ampere "rating" which is more appropriate than "size".
PANEL ACTION: Accept.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 12

(Log #3831)

2- 313 - (Appendix D Example No. D1(a)): Accept in Principle
SUBMITTER: Clint Bonham, Riviera Electric
RECOMMENDATION: Change Section 230.42(b) reference to Section 230.79(e).
SUBSTANTIATION: In example No. D1(a) net computed load for 120/240 volt, 3-wire, single-phase service or feeder, Section 230.42(b) is referenced. This reference is not accurate, it does not give the information required.
PANEL ACTION: Accept in Principle.
PANEL STATEMENT: See panel action on Proposal 2-312.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 12

(Log #4338)

2- 314 - (Appendix D, Example No. D1(a)): Accept in Principle
SUBMITTER: Leo F. Martin, Martin Electrical & Technical Training Services
RECOMMENDATION: Delete: "Net computed load exceeds 10 kVA. Section 230-42(b) would require service conductors to be 100 A."
Replace with see Section 230-42(b).
SUBSTANTIATION: Statement mandates that 100 ampere rated service conductors are required only if the net computed load exceeds 10 kVA. Section 230-42(b) makes reference to 230-79 which requires a minimum of 100 amperes for all one-family dwellings, regardless of load calculation.
PANEL ACTION: Accept in Principle.
PANEL STATEMENT: See panel action on Proposal 2-312.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 12

(Log #4072)

2- 315 - (Appendix D, Example No. D2(c)): Reject
SUBMITTER: David P. Brown, Baltimore Gas and Electric Co./Rep. Edison Electric Inst./Electric Light & Power Group
RECOMMENDATION: This is a companion proposal to change Section 220.30(c).
Revise parts of Appendix D, Example No. D2(c) as follows:
20.76 kVA x ~~100%~~ 65% = ~~20.76 kVA~~ 13.49 kVA
Totals
Net general load 19,280 VA
Heat pump and supplementary heat 13,490 VA ~~20,760 VA~~
Total 32,770 VA ~~40,040 VA~~
Calculated Load for Service
~~40.04 kVA~~ 32.77 kVA x 1000) 240 V = ~~166.8 A~~ 136.5 A
This dwelling unit would be permitted to be served by a ~~175 A~~ 150 A Service.
SUBSTANTIATION: This example was changed in conjunction with a text change in Section 220.30 for the 1999 NEC method of counting central electric space heat at 100 percent back to 65 percent as it has been since 1971.
In the 1999 NEC a major change was made in calculations without adequate technical substantiation. This change impacts load calculations for single family dwellings with heat pumps when the compressor and supplemental heating is operating at the same time (normal installation) by counting the central space heat at 100 percent rather than at 65 percent as had been done by the Optional Method since the 1971 NEC. This change was made with no historical load data to justify the change. It significantly increases the main panel size and service entrance conductors on many homes and apartments thus increasing the cost with no improvements in safety. Also, the 1999 calculations are very erratic depending on whether or not the heat pump can be on at the same time as the supplementary heat. Based on the NFPA 70 A98 ROP Proposal 2-319 was rejected because it did not further clarify the present wording. See the NFPA 70 A98 ROC for Comments 2-164 and 2-165 that were accepted in principle as editorial revision to enhance clarity. In Proposal 2-319, the submitter stated that "These changes have no impact on the result of the calculation, only on the format of this section". In reality the example for the Optional Calculation using 220-30 in the 1996 and 1999 NEC is identical except for counting the central electric space heating at 100 percent in the 1999 NEC!
Numerous load surveys have been submitted by various utility companies throughout the years to verify the diversified demand of electric heat. Going back to the 1971 NEC and following codes as well, the key statement was, "Use the larger of the air conditioning load or the diversified demand of the heating load." Using 100 percent for the air conditioning and cooling, including heat pump compressors (from 1971 to 1996) meant that a heat pump could be used for cooling with or without supplemental electric heat and that the summer load could thus be greater than the winter load. Central Electric Space Heating, which was calculated at 65 percent, could include a heat pump compressor as well as integral supplemental heat, i.e., "strip" or electric resistance heat. All of the authors writing books on calculations have included resistance heat at 65 percent. A heat pump is more efficient (lower demand, higher heat output) than straight resistance heat. Also, heat pump systems are designed to turn off the heat pump if the outdoor temperature drops too low preventing continuous operation of the heat pump and the full backup resistance heat. Therefore the diversified demand for a residence would be less if the heat pump and strip heat were on at the same time. This is exactly opposite to the 1999 changes!! Appendix D Example No. 2(c) of the 1996 NEC added the heat pump load of 5.76 kVA and the 15 kVA and multiplied the total by 65 percent for a total of 13.49 kVA. However, example D2(c) of the 1999 NEC uses a total of 20.76 kVA. The statement that "If supplementary heat is not on at the same time as heat pump, heat pump kVA need not be added to total." would mean that one would use 65 percent of 15 kVA which would be 9.75 kVA. It is reasonable to assume that the winter heat diversified demand is based on the heat loss of the home with a particular thermostat setting. If more electric heat is installed than needed (or it is not divided into two or more stages) then it will just cycle more often, but essentially have the same electrical demand. However, look at the differences in calculations for the 1999 NEC when using a 5 kW heat pump and various amounts of supplemental heat.

Assume:	Heat Pump plus Supplemental Heat	Supplemental Heat Only	Diversified Demand 1971-96 NEC	1999 NEC
	5 + 15 = 20 kVA		13.0 kVA	20.0 kVA
		15 kVA	9.75 kVA	9.75 kVA
		20 kVA	13.0 kVA	13.0 kVA
	5 + 20 = 25 kVA		16.25 kVA	25 kVA
		20 kVA	13.0 kVA	13 kVA
		25 kVA	16.25 kVA	16.25 kVA

Thus, based on the 1999 NEC if one uses a 25 kVA central electric heating system with a heat pump, the load is 25 kVA, but if one uses 5 kVA of supplemental heat to replace the heat pump, then the diversified demand drops to 16.25 kVA. If one has 20 kVA of supplemental heat the demand is 13 kVA, but if a 5 kW heat pump is added, the demand jumps to 25 kVA. If one has a 15 kVA system calculated at 9.75 kVA, the demand more than doubles to 20 kVA if a 5 kVA heat pump is added. The 25 kVA heat pump system could actually have a lower demand than the 25 kVA supplemental heat only system that is calculated at 16.25 kVA!!

Note: Supporting material is available for review at NFPA Headquarters.

PANEL ACTION: Reject.
PANEL STATEMENT: See panel action and statement on Proposal 2-289.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 11
NEGATIVE: 1
EXPLANATION OF NEGATIVE:
MOORE: See my Explanation of Negative Vote on Proposal 2-289.

(Log #1126)

2- 316 - (Appendix D, Example No.s D4(a), D4(b), D5(a), and D5(b)): Accept
SUBMITTER: James M. Daly, BICC General
RECOMMENDATION: Revise Appendix D as follows:
Example No. D4(a)
Minimum Number of Branch Circuits Required for Each Dwelling Unit
Small Appliance Load - change "No. 12" to "12 AWG"
Range Circuit - change "No. 8" to "8 AWG" and "No. 10" to "10 AWG"
Example No. D4(b)
Minimum Number of Branch Circuits Required for Each Dwelling Unit
Small Appliance Load - change "No. 12" to "12 AWG"
Range Circuit - change "No. 10" to "10 AWG"
Example No. D5(a)
Minimum Number of Branch Circuits Required for Each Dwelling Unit
Change "No. 8" to "8 AWG" and "No. 10" to "10 AWG"
Example No. D5(b)
Minimum Number of Branch Circuits Required for Each Dwelling Unit
Change "No. 8" to "8 AWG", "No. 10" to "10 AWG", and "No. 12" to "12 AWG".
SUBSTANTIATION: To provide consistency throughout the Code. The term "No." is not used in any of the Tables in Chapter 3.

AWG and kcmil are trade size designators specifically authorized for use with the SI system of units in North America. Also, industry practice is to use AWG or kcmil only.

This is one of a series of proposals to make this change throughout the Code.

PANEL ACTION: Accept.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 12

(Log #4362)

2- 317 - (Appendix D, Example No. D4(b)): Reject
SUBMITTER: J. Kevin Vogel, Crescent Electrical Supply
RECOMMENDATION: One page 612, in the second column, following the calculation for the "size of each feeder" at 78A, add:
(Note: NEC Section 220-30(a) requires the use of conductors to each dwelling unit to have an allowable ampacity of not less than 100.)
SUBSTANTIATION: The proposed note will clarify the intent of Section 220-30(a) that the optional calculations of Part C of Article 220 may only be used where the conductors to each dwelling unit have an ampacity of not less than 100.
PANEL ACTION: Reject.
PANEL STATEMENT: Example D4(b) does not use the optional calculation from Section 220-30 for the individual dwelling units.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 12

(Log #4308)

2- 318 - (Appendix D, Example No. D5(a)): Accept
SUBMITTER: J. Kevin Vogel, Crescent Electrical Supply
RECOMMENDATION: Revise formula to read:
64,740 VA ÷ (208 V) (1.732) = ~~179.6 A~~ 179.7A
SUBSTANTIATION: None.
PANEL ACTION: Accept.
PANEL STATEMENT:
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 12
VOTE ON PANEL ACTION:
AFFIRMATIVE: 12

APPENDIX E

(Log #1838)

5- 317 - (Appendix E): Reject
SUBMITTER: Willard Homes, City of Orlando, FL
RECOMMENDATION: Keep Appendix E in the next NEC for another cycle.
SUBSTANTIATION: This information is very helpful. Thank you CMP 5 for this cross-reference.
PANEL ACTION: Reject.
PANEL STATEMENT: The panel concludes the cross reference is no longer necessary.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 16
VOTE ON PANEL ACTION:
AFFIRMATIVE: 16

(Log #4346)

5- 318 - (Appendix E): Accept
SUBMITTER: Larry Miller, Nat'l Electrical Mfrs Assn. (NEMA)
RECOMMENDATION: Delete Appendix E.
SUBSTANTIATION: This cross-reference to the 1996 Code is no longer needed.
PANEL ACTION: Accept.
NUMBER OF PANEL MEMBERS ELIGIBLE TO VOTE: 16
VOTE ON PANEL ACTION:
AFFIRMATIVE: 16
