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Useful NEC Tables

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NEC 500 Special Occupancies

Here is a table with details from Article 500 to be uses as a reference for a quick search of code content.

NEC 500 Special Occupancies	Division 1	Division 2
Class I - NEC 501 - Gases Group A - Acetylene Group B - liquid MESG less than .45 (MIC .40 or less) Group C - liquid MESG .45 to .75 (MIC greater than .40 to .80) Group D - liquid greater than MESG .75 (MIC greater than .80)	gases or vapors - normal operating conditions intrinsic safe explosion proof	gases or vapors - confined hermetically sealed oil immersion nonincendive intrinsic safe explosionproof
Class II - NEC 502 - dust Group E - metal dusts Group F - Carbonaceous dusts Group G - flour, grain, wood, plastic dusts	dust - normal operation intrinsic safe dust ignition proof	dust - abnormal hermetically sealed nonincendive intrinsic safe dusttight dust ignitionproof
Class III - NEC 503	fibers - normal operation hermetically sealed nonincendive E & C intrinsic safe dusttight	fibers - stored hermetically sealed nonincendive E intrinsic safe dusttight
Class I -Zone 0 - NEC 505 ignitible flammable gases or vapors present continuously or for long periods of time.	Class I - Zone 1 - NEC 505 ignitible flammable gases or vapors in normal operation, frequently due to repair, or breakdown could cause release.	Class I - Zone 2 - NEC 505 ignitible flammable gases, not in normal operation, short period, confined when handled, positive ventilation, positive pressure.
Zone 20 - NEC 506 ignitible dust fibers, flyings, continuously present, long periods of time.	Zone 21 - NEC 506 ignitible dust, fiber, flyings ocassionaly under normal conditions, due to repair or maintenance, result of breakdown.	Zone 22 - NEC 506 ignitible dust, fibers, flyings not likely to occur in normal operation, or for short period, or normally confined.

Motor Aspects References

Motor Type	NEC Reference	Description
Direct Current DC	430.247	motor table flc
Design B, C, D	430.251B	motor table flc 430.251B
General, Standard Single Phase	430.248 430.32A1	motor table flc: disconnect 430.110A 115% branch circuit conductors 430.22 125% overcurrent protection 430.52 175% 250% 300% overloads from nameplate 430.32 115% 125% 130% 140%
Intermittent Duty	430.22E	% of nameplate flc from table 430.22E
Multi-speed	430.22B	nameplate flc
Part Winding	430.22D	nameplate flc
Periodic Duty	430.22E	% of nameplate flc from table 430.22E
Short Time Duty	430.22E	% of nameplate flc from table 430.22E
Synchronous Three Phase	430.250	motor table flc for all overloads from nameplate flc *Correct for 80% 90% power factor
General Three Phase	430.250	motor table flc for all overloads from nameplate flc
Torque	430.6B	nameplate flc
Varying Duty	430.22E	% of name plate flc from table 430.22E
Wound Rotor Secondary	430.23	nameplate flc
Wye-Start Delta Run	430.22C	nameplate flc

Single Phase Motor flc Table

HP	120v flc	fuse	dual element	breaker	THW	208v flc	fuse	dual element	breaker	THW	240v flc	fuse	dual element	breaker	THW	HP
.5	9.8	30	20	25	14	5.4	20	15	15	14	4.9	15	15	15	14	.5
1	16	50	30	40	14	8.8	30	20	25	14	8	25	15	20	14	1
1.5	20	60	35	50	12	11	35	20	30	14	10	30	20	25	14	1.5
2	24	80	45	60	10	13.2	40	25	35	14	12	40	25	30	14	2
2.5	29	90	60	80	8	15.95	50	30	40	14	14.5	45	30	40	14	2.5
3	34	110	60	90	8	18.7	60	35	50	12	17	60	30	45	12	3
3.5	39.5	125	70	100	8	21.72	70	40	60	10	19.75	60	35	50	12	3.5
4	45	150	80	125	4	24.75	80	45	70	10	22.5	70	40	60	10	4
4.5	50.5	175	90	150	4	27.27	90	50	70	10	25.25	80	45	70	10	4.5
5	56	175	100	150	4	30.8	100	60	80	8	28	90	50	70	10	5
5.5	60.8	200	110	175	4	33.44	110	60	90	8	30.4	100	60	80	8	5.5
6	65.6	200	125	175	4	36.08	110	70	100	8	32.8	100	60	90	8	6
6.5	70.4	225	125	200	3	38.72	125	70	100	8	35.2	110	70	90	8	6.5
7	75.2	250	150	200	3	41.36	125	80	110	6	37.6	125	70	100	8	7
7.5	80	300	150	200	3	44	150	80	110	6	40	125	70	100	8	7.5
8	84	300	150	225	2	46.2	150	90	125	6	42	150	80	110	6	8
8.5	88	300	175	225	2	48.4	150	90	125	6	44	150	80	110	6	8.5
9	92	300	175	250	2	50.6	175	90	150	6	46	150	90	125	6	9
9.5	96	300	175	250	1	52.8	175	100	150	4	48	150	90	125	6	9.5
10	100	300	175	250	1	55	175	100	150	4	50	150	90	125	6	10

Electrical Calculations Notes - Here are notes which provide instruction on how to proceed with electrical calculations. To effectively use this material, a copy of Reference Formulas Appendix (Larson) and the National Electrical Code 2008 are needed.

Ampacity Derate for Temperature 310.16 bottom factor times table value = corrected ampacity
Ampacity Derate for Conduit Fill 310.15B2a factor times table value = corrected ampacity
Ampacity Derate for Continuous Load 80%
Box Fill NEC 314.16B
Bus Bar Ampacity copper 1000 amps/sq. inch aluminum 700 amps/sq. inch
Combination Circuits RFA page 6
Commercial Cooking Load 220.56 factor times nameplate total
Conductor Ampacity Table NEC310.16
Conduit Fill NEC Appendix C All Same - NEC Appendix C
Conduit Fill Different NEC Ch9 T5 then NEC Ch9 T4 40%
Dryer Demand 220.54 RFA Table
Dryer Load 5000 or nameplate which ever is larger
Fixed Appliance Load 4 or more 75% of nameplate
General Lighting Load 3va residential
Gutter Sizing 20% 366.22 and 75% at splice points 366.56A
Junction Box RFA 314.28
Laundry Load 1500 va per circuit
Motor Branch Circuit Conductor 125% of table flc
Motor Disconnect at least 115% of table flc
Motor Feeder Conductor flc of largest plus flc's of others
Motor Branch Circuit Overcurrent flc times % at 430.52 non 300% dual element 175% breaker 250%
Motor Feeder Overcurrent largest overcurrent protection for any motor plus other flc's
Motor Interpolation RFA
Motor Overloads 430.32 % times nameplate flc
Net General Lighting Small Appliance 3va/sq ft + 3000 small appliance + 1500 laundry -3000 times 35% + 3000 = net
Neutral Load 70% If larger at least 12 1/2% NEC 250.28D
Nipple Fill NEC Ch9 T5 then NEC Ch9 T4 60%
Ohms Watts DC AC Resistive RFA page 6
Ohms Watts AC RFA page 7 and 8
Parallel Circuits RFA page 6
Pull Box Sizing RFA
Series Circuits RFA page 6
Service Calculations - General Lighting 3 va/sq. ft
Service Calculations - Small Appliance Branch Circuit 1500 va each
Service Calculations - Laundry Load 1500 va each
Service Calculations - Heating or AC 65% heat 100% ac
Service Calculations - Fixed Appliance Load 75% of 4 or more of nameplate
Service Calculations - RFA page 23
Small Appliance Circuit Load 1500 each must have at least 2
Transformers - Single Phase RFA page 10
Transformers - Three Phase RFA page 11
Unbalanced Load Maximum load on either leg if other is off

NEC Table Index - These tables can be used for look-up's to NEC questions with numerical answers.

Ambient temperature correction conduit 310.16 Free air 310.17
Box Sizing all Conductors Same Size 314.16A
Box Sizing all Conductors Different 314.16B
Branch Circuit Requirements 210.24
Clearance Overhead conductors not over 600v 224.18
Conductor Ampacity in Raceways 310.16
Conductor Ampacity in Free Air 310.17
Conductor Circular Mils Ch9 T8
Conductor Cubic Inches 314.16B
Conductor Insulation 310.13
Conductor Resistance Ch9 T8
Conductor Specifications 310.13 Ch9 T8
Conductor square inches Ch9 T5
Conduit Fill All the Same Conductor Annex C
Conductor tap 210.24
Conduit fill correction factors 310.15B2a
Conduit Fill Different Conductors Ch9 T5 then Ch9 T4
Conduit Fill Percentages Ch9 T1
Conduit metric designator 300.1C
Cord and plug connected load 210.21B2
Cover Requirements 300.5 under 600v 300.50 over 600v
Dryer Demand 220.54
Equipment Grounding Conductors 250.122
Fixture Wire Ampacity 402.5
Fixture wire conduit fill Annex C
Fixture Wire Specifications 402.3
Flexible Cord Ampacities 400.5A + B
Flexible Cord Specifications 400.4
FMC fitting inside or outside 3/4" 348.22
General Lighting Loads 220.12
Grounding Electrode Conductor 250.66
Household Cooking Load Demand 220.55
Insulation thickness 310.13
Lighting demand % 220.42
Lighting load 220.12
Locked rotor 430.7B
Motor FLC 1 phase 430.248 3 phase 430.250
Motor Overcurrent Protection 430.52
Multi Family demand 220.84
Nipple fill Ch9T5 then T4
Overhead span length outside 224.6
Pull box sizing back of the box 314.16A
Receptacle demand non dwelling 210.44
Receptacle rating 210.21B2
Residential Service Conductors 310.15B6
Restaurant cooking load 220.56
Rigid metal conduit supports 344.30B2
Rigid nonmetallic supports 352.30B
Separation see RFA
Spacing see RFA
Spacing for conductor supports vertical raceways 300.19A
Span Length outside 225.6
Standard Rating of Overcurrent Devices 240.6
Taps 210.24
Vertical raceway supports 300.19A
Wire Bending Space 312.6A adjacent wall 312.6B opposite wall
Working Clearance 110.26A1 under 600v 110.34A over 600v

Voltage Drop k Constants

From Reference Formulas Appendix.

CONSTANTS FOR VOLTAGE DROP CALCULATIONS

(FPN): Stranded and solid conductors have different constant values. This table shows sol for solid. All others are stranded. Copper and Aluminum as indicated.

Formula for determining k is: k = R Cm / 1000. Cm is given in NEC® Chapter 9 Table 8.
R is given in NEC® Chapter 9 Table 8. Use uncoated unless instructed otherwise.

UNCOATED VALUES USED FOR THESE k FACTORS.

	AWG	Cu	Al	AWG	Cu	Al
sol	18	12.58	20.73	1/0	12.88	21.22
	18	12.87	21.22	2/0	12.87	21.16
sol	16	12.61	20.76	3/0	12.85	21.14
	16	12.87	21.18	4/0	12.86	21.16
sol	14	12.61	20.79	250kcmil	12.87	21.175
	14	12.90	21.24	300kcmil	12.8	21.21
sol	12	12.60	20.76	350kcmil	12.84	21.175
	12	12.92	21.22	400kcmil	12.84	21.16
sol	10	12.55	20.76	500kcmil	12.9	21.2
	10	12.87	21.17	600kcmil	12.88	21.18
sol	8	12.61	20.80	700kcmil	12.88	21.21
	8	12.84	21.13	750kcmil	12.825	21.15
				800kcmil	12.88	21.2
	6	12.88	21.20	900kcmil	12.87	21.15
	4	12.85	21.20	1000kcmil	12.9	21.2
	3	12.89	21.20	1250kcmil	12.87	21.125
	2	12.87	21.16	1500kcmil	12.87	21.15
	1	12.88	21.17	1750kcmil	12.86	21.175
				2000kcmil	12.86	21.2

Synchronous Three Phase Motor flc Table

230 volt HP	pf 1.0 100%	pf .9 110%	pf .8 125%	460 volt HP	pf 1.0 100%	pf .9 110%	pf .8 125%	575 volt HP	pf 1.0 100%	pf .9 110%	pf .8 125%
25	53	58.3	66.25	25	26	28.6	32.5	25	21	23.1	26.25
30	63	69.3	78.75	30	32	35.2	40	30	26	28.6	32.5
40	83	91.3	103.75	40	41	45.1	51.25	40	33	36.3	41.25
50	104	114.4	130	50	52	57.2	65	50	42	46.2	52.5
60	123	135.3	153.75	60	61	67.1	76.25	60	49	53.9	61.25
75	155	170.5	193.75	75	78	85.8	97.5	75	62	68.2	77.5
100	202	222.2	252.5	100	101	111.1	126.25	100	81	89.1	101.25
125	253	278.3	316.25	125	126	138.6	157.5	125	101	111.1	126.25
150	302	332.2	377.5	150	151	166.1	188.75	150	121	133.1	151.25
200	400	440	500	200	201	221.1	251.25	200	161	177.1	201.25

Household Dryer Demand - 1 and 3 Phase Service

From Reference Formulas Appendix.

Residential Dryer Feeder Demand - 1Ø and 3Ø - NEC® 220.18

			Total Feeder Demand					Total Feeder Demand	
# dryers	twice	%	1ØkVA	3ØkVA	# dryers	twice	%	1ØkVA	3ØkVA
1	no	100	5	5	26	18	33.5	43.55	30.15
2	2	100	10	10	27	18	33	44.55	29.7
3	2	100	15	10	28	20	32.5	45.5	32.5
4	4	100	20	20	29	20	32	46.4	32
5	4	85	21.25	17	30	20	31.5	47.25	31.5
6	4	75	22.5	15	31	22	31	48.05	34.1
7	6	65	22.95	19.5	32	22	30.5	48.8	33.55
8	6	60	24	18	33	22	30	49.5	33
9	6	55	24.75	16.5	34	24	29.5	50.15	35.4
10	8	50	25	20	35	24	29	50.75	34.8
11	8	47	25.85	18.8	36	24	28.5	51.3	34.2
12	8	46	27.6	18.4	37	26	28	51.8	36.4
13	10	45	29.25	22.5	38	26	27.5	52.25	35.75
14	10	44	30.8	22	39	26	27	52.65	35.1
15	10	43	32.25	21.5	40	28	26.5	53	37.1
16	12	42	33.6	25.2	41	28	26	53.3	36.4
17	12	41	34.85	24.6	42	28	25.5	53.55	35.7
18	12	40	36	24	43	30	25	53.75	37.5
19	14	39	37.05	27.3	44	30	25	55	37.5
20	14	38	38	26.6	45	30	25	56.25	37.5
21	14	37	38.85	25.9	46	32	25	57.5	40
22	16	36	39.6	28.8	47	32	25	58.75	40
23	16	35	40.25	28	48	32	25	60	40
24	16	34.5	41.4	27.6	49	34	25	61.25	42.5
25	18	34	42.5	30.6	50	34	25	62.5	42.5

1Ø Single Phase Service - For dryers over 5kVA, find the total nameplate times demand % based on # of dryers. Use 5kVA for any that are less then 5kVA.

3Ø Three Phase Service -When single phase clothes dryers are connected to a three phase service in a residential dwelling building, the NEC allows the feeder demand for dryers to be calculated on the basis of twice the maximum number connected between any two legs.

Note: Twice column is for twice the maximum number that can be connected between any two legs.

Technique of solution for any number of dryers connected to a 3Ø service regardless of nameplate:
The total number of actual appliances divided by three. If this results in a decimal (.33 or .66) round up to the next whole number. Multiply this number times two. Multiply the result times the nameplate or 5kVA, which ever is larger. Then multiply by the demand factor from Table 220.18 for the total number of actual dryers (not the twice number). When the number of dryers is over fifty, this demand factor will always be 25%. The result is the three phase feeder demand for dryers.

From Reference Formulas Appendix.

SINGLE PHASE RANGES SUPPLIED BY 3Ø FEEDER

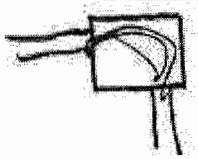
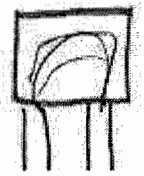
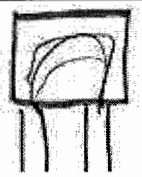
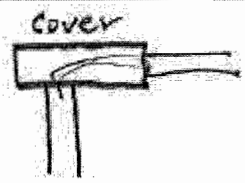
When two or more single-phase household cooking appliances like counter-mounted cooking units, wall-mounted ovens, and ranges are supplied by a 3-phase 4-wire feeder, the feeder demand is given below. Find the number of appliances. Determine the average by adding nameplates (using 12kW for any that are less). Drop the decimal for the average if it is .4999 or less. If the decimal of the average is .5 or more, round up to the next kW. Follow across the line for the number of appliances to determine demand for this kW average.

# APP's	12kW	13kW	14kW	15kW	16kW	17kW	*factor
1-3	11	11.55	12.1	12.65	13.2	13.75	.55
4-6	17	17.85	18.7	19.55	20.4	21.25	.85
7-9	21	22.05	23.1	24.15	25.2	26.25	1.05
10-12	23	24.15	25.3	26.45	27.6	28.75	1.15
13-15	25	26.25	27.5	28.75	30.0	31.25	1.25
16-18	27	28.35	29.7	31.05	32.4	33.75	1.35
19-21	29	30.45	31.9	33.35	34.8	36.25	1.45
22-24	31	32.55	34.1	35.65	37.2	38.75	1.55
25-27	33	34.65	36.3	37.95	39.6	41.25	1.65
28-30	35	36.75	38.5	40.25	42.0	43.75	1.75
31-33	37	38.85	40.7	42.55	44.4	46.25	1.85
34-37	39	40.95	42.9	44.85	46.8	48.75	1.95
37-39	41	43.05	45.1	47.15	49.2	51.25	2.05
40-42	43	45.15	47.3	49.45	51.6	53.75	2.15
43-45	45	47.25	49.5	51.75	54.0	56.25	2.25
46-48	47	49.35	51.7	54.05	56.4	58.75	2.35
49-51	49	51.45	53.9	56.35	58.8	61.25	2.45
52-54	51	53.55	56.1	58.65	61.2	63.75	2.55
55-57	53	55.65	58.3	60.95	63.3	66.25	2.65
58-60	55	57.75	60.5	63.25	66.0	68.75	2.75
61-63	56.5	59.325	62.15	64.975	67.8	70.625	2.825
64-66	58	60.9	63.8	66.7	69.6	72.5	2.9
67-69	59.5	62.475	65.45	68.425	71.4	74.375	2.975
70-72	61	64.05	67.1	70.15	73.2	76.25	3.05
73-75	62.5	65.625	68.75	71.875	75.0	78.125	3.125
76-78	64	67.2	70.4	73.6	76.8	80.0	3.2
79-81	65.5	68.775	72.05	75.325	78.6	81.875	3.275
82-84	67	70.35	73.7	77.05	80.4	83.75	3.35
85-87	68.5	71.925	75.35	78.775	82.2	85.625	3.425
88-90	70	73.5	77.0	80.5	84.0	87.5	3.5
91-93	71.5	75.075	78.65	82.225	85.8	89.375	3.575
94-96	73	76.65	80.3	83.95	87.6	91.25	3.65
97-99	74.5	78.225	81.95	85.675	89.4	93.125	3.725
factor**	1.5	1.575	1.65	1.725	1.8	1.875	.075

If the average is greater than 17kW, add the *factor for each kW greater than 17kW. For more than 99 appliances, add the **factor for each group of 3 appliances greater than 99 appliances.

Straight, Angle and U Pulls

Here is an example of measurements for various possible installations. Let's assume for purposes of this example that there are four #1 THWN conductors which are not shielded and are not lead covered. They are installed in a 1 1/4 inch EMT electrical metallic tubing. Then here are the measurements for pull boxes of various installations if under 600 volts and if over 600 volts.

Drawing	If Under 600 Volts	If Over 600 Volts
	Straight Pull is 8 times trade diameter Between raceways NEC 314.28A1 So distance between would be 8 X 1 1/4 = 10 inches	Straight Pull is 32 times conductor diameter So it would be NEC 314.71A 32 X .446 = 14.272 inches
	Angle Pull is 6 times trade diameter To opposite wall NEC 314.28A2 So to opposite wall would be 6 X 1 1/4 = 7 1/2 inches	Angle Pull is 24 times conductor diameter So it would be NEC 314.71B1 24 X .446 = 10.704 inches
	U Pull is 6 times trade diameter Between raceways NEC 314.28A2 So distance between would be 6 X 1 1/4 = 7 1/2 inches	U Pull between raceways Is 24 times conductor diameter So it would be NEC 314.71B2 24 X .466 = 10.704
	U Pull is 6 times trade diameter To opposite wall NEC 314.28A2 So to opposite wall would be 6 X 1 1/4 = 7 1/2 inches	U Pull to opposite wall Is 24 times conductor diameter So it would be 314.71B1 24 X .446 = 10.704 inches
	Raceway in back of the box Opposite a removable cover is NEC table 312.6A for 1 wire per Terminal Lookup so #1AWG = 3 inches	Raceway in back of the box Opposite removable cover is NEC 300.34 8 times conductor diameter 8 X .446 = 3.568 inches

Find conductor diameter Chapter 9 Table 5. #1 AWG THWN is outside diameter .446 inches