Selections from R. J. Gustafson and M. T. Morgan. 2004. Fundamentals of Electricity for Agriculture, 3rd edition. ASABE.

P. 118, BUILDING DEMAND LOAD PROCEDURE

Table 5.1 shows the procedure developed by the NEC (Table 220-40) for determining demand loads from the listed loads for buildings with two or more branch circuits. If the load consists of a single item, such as an irrigation pump or crop dryer, the demand procedure would not be applicable. To apply the procedure, the **"load without diversity"** (l.w.d.) must be determined. The load without diversity is defined as the largest combination of loads that are likely to operate at the same time. Determining load without diversity requires both a knowledge of the farm operation and judgment. Next to your list of loads for the building, identify which items should be included in the l.w.d. Add up these VA and divide by the system voltage to determine the ampere load for the l.w.d.

TABLE 5.1 Farm Building Demand Load Procedure

Ampere Demand Load = Total of:	
(a) 100% of largest of	(1) Load without diversity (amperes at 240 V) (2) 125% of largest motor (amperes at 240 V) (3) Not less than 60 A at 240 V
(b) 50% of up to next 60 A of load not accounted for in (a)	
(c) 25% of remainder, that is, the load not accounted for in (a) and (b)	

P. 128, CAPACITY OF MAIN SERVICE

If a centralized distribution system is used, we can take advantage of the diversity between buildings in sizing the main service. It is not likely that all buildings will operate at their full demand load at the same time. Therefore, a demand method outlined in Table 5.2 and based on NEC Table 220.41 can be used to calculate the necessary capacity of the main service equipment for the farmstead. The minimum capacity for the main service is the sum of the loads times their appropriate demand factors.

The demand load for the residence can be calculated using the procedures outlined in Chapter 6.

TABLE 5.2 Capacity of Main Farmstead Service

Computed Demand Load	Demand Factor
Residence	100%
All other loads:	
Largest load	100%
2nd largest load	75%
3rd largest load	65%
Sum of remaining loads	50%

P. 146 , SIZE OF PANELBOARDS AND FEEDERS

Panelboards house the overcurrent devices which protect the electrical system's components from overload or short circuit damage. Sizing of panelboards involves calculating the total connected load and demand load in order to select their correct ampere rating. The demand load is used in the selection of the panel rating because it represents the maximum load carried by the equipment.

Connected loads include loads served directly from the panel and subfed loads in any downstream panels. They are frequently grouped together in several general categories due to their demand requirements as shown in Table 5.3.

Table 5.3 Connected Load Categories and Demand Factors

Connected Load Category	Demand Factor
Lighting	1.25
Receptacles	1.0 or 0.50
Resistance heat (seasonal)	1.0 or 0.0
Heating system motors (seasonal)	1.0 or 0.0
Air conditioning system motors (seasonal)	1.0 or 0.0
Motors (non-seasonal)	1.0
Other loads	1.0 or 1.25 if continuous
Water heating	1.0
Kitchen	0.65 to 1.0
Spare capacity	1.0
Largest motor	0.25

The demand factors in Table 5.3 are guidelines for determining demands based on these general categories of loads. Additional information on the operational diversity of individual loads, if available, should be used to obtain better estimates of demand loads. The reasoning behind the choice of demand factors for each category are as follows:

- Lighting can be considered as a continuous load and circuits supplying such loads cannot exceed 80% of their rating. Therefore, the lighting demand factor is 1.25.
- General purpose receptacles are typically estimated as 180 VA for each duplex outlet. However, due to their obvious but unknown diversity, a common demand procedure is to use 100% for the first 10 kVA of receptacle load and 50% for the remainder. Again, if knowledge of the actual loads and their operation is known, this information should be used to improve the demand load calculation.
- Heating and air conditioning systems usually do not operate simultaneously. Therefore, only the larger of the two loads should be included in the demand calculation. In many cases, the same air handling motors function during both heating and air conditioning seasons.
- Kitchens are described in the NEC article 220-20 as having demand factors between 65% (for six units) and 100% (or one or two units).
- Spare capacity should include known items of future expansion identified by the owner as well as anticipated load additions based on past experience.
- The largest motor in the panelboard should have its full-load amps multiplied by 1.25 in order to correctly size the panel for overloads and starting currents.

P. 211 TABLE 8.1 TYPES OF SINGLE PHASE MOTORS AND THEIR CHARACTERISTICS

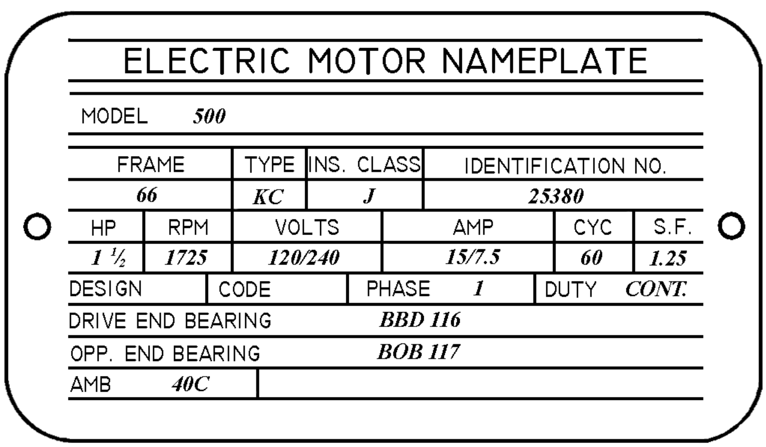
Type/ Power Range	Load-Starting Ability	Starting Current	Characteristics	Electrically Reversible	Typical Uses
Split-Phase 35 to 370 W 1/20 to 1/2 hp	Easy Starting loads. Develops 150 % of full-load torque.	High; five to seven times full-load current.	Inexpensive, simple construction. Small for a given motor power. Nearly constant speed with a varying load.	Yes	Fans, centrifugal pumps; loads that increase as speed increases.
Capacitor-start 100 W to 7.5 kW 1/8 to 10 hp	Hard starting loads. Develops 350 to 400 % of full-load torque.	Medium, three to six times full-load current.	Simple construc-tion, long service. Good general-purpose motor suitable for most jobs. Nearly constant speed with varying load.	Yes	Compressors, grain augers, conveyors, pumps. Specifically designed capacitor motors are suitable for silo unloaders and other augers.
Two-value capacitor 15 to 150 kW 2 to 20 hp	Hard starting loads. Develops 350 to 450 % of full-load	Medium, three to five times full-load current.	Simple construction, long service, w/ min. maintenance. Requires more space to due to larger capacitor.	Yes	Conveyors, barn cleaners, elevators, silo unloaders.
Permanent-split capacitor 35 to 750 W 1/20 to 1 hp	Easy starting loads. Develop 150 percent of full-load torque	Low, two to four times full-load current.	Inexpensive, simple Construc-tion. Has no starting winding switch.	Yes	Fans and blowers.
Shaded pole 3 to 370 W 1/250 to 1/2 hp	Easy starting loads.	Medium	Inexpensive, moderate efficiency, for light duty.	No	Small blowers, fans, small appliances.
Wound-rotor (Repulsion) 125 W to 7.5 kW 1/6 to 10 hp	Very hard starting loads. Develops 350 to 450 % of full-load torque	Low, two to four times full-load current.	Larger than equiv. size split-phase or capacitor motor. Running current varies only slightly with load.	No*	Conveyors, dray burr mills, deep-well pumps, hoists, silo unloaders, bucket elevators.
Universal or series 5 W to 1.5 kW 1/150 to 2 hp	Hard starting loads. Develops 350 to 450 % of full-load torque.	High	High speed, small size for a given hp. Typ. directly connected to load. Speed changes with load variations.	Yes	Portable tools, kitchen appliances.
Synchronous Very small, or > 200 hp			Constant speed.		Clocks and timers. Large compressors
Soft-start 7.5 to 560 kW 10 to 75 hp	Easy starting loads	Low, 1.5 to 2 times full-load current	Excellent for large loads requiring low starting torque	Yes	Crop driers, forage blowers, irrigation pumps, agitators.

* Reversible by brush ring change.
Source: Soderholm and Puckett (1974)

P. 221 TABLE 8.2 Characteristics of Three-Phase Induction Motor Designs

NEMA Design	Starting Torque (% of rated torque)	Starting Current (% of full-load current)	Characteristics	Applications
A	Average; 150 to 200%	High; typically 800% or greater	General purpose, more overload capacity & higher efficiency than design B. Requires reduced-voltage starting above 7.5 hp.	Same as design B where more chance for overload is possible
B	Average; Typically 150%	Medium; 450 to 800%	General purpose, most commonly used. For easy starting loads. Full-load slip typically < 3%.	Fans, blowers, rotary pumps, machine tools
C	High; 200 to 250%	Medium; 450 to 800%	For hard-to-start loads. Dual rotor bar design.	High inertia loads, conveyors, reciprocating pumps, compressors, pulverizers
D	Very High; > 275%	Medium; 450 to 800%	Maximum torque produced at starting. Lower efficiency and higher slip (5 to 13%) than other designs.	Very high inertia loads, punch presses, elevators, cranes, hoists

p. 223-5, FIG. 8.20 TYPICAL ELECTRIC MOTOR NAMEPLATE



The following list gives a brief summary of the items generally found on the nameplate of a motor. Some items are discussed in more detail following the list.

Name of the Manufacturer
Frame Designation—the NEMA designation of frame size.
Power or Horsepower—full-load wattage or horsepower rating for output power.
Motor Code—letter designating starting current requirement.
Cycles or Hertz—frequency of the source to be used.
Phase—number of phases of the source (single-phase, three-phase).
Revolutions per Minute—rated speed of the motor at full-load.
Voltage—voltage or voltages at which the motor is designed to operate.
Thermal Protection—indicates if built-in overload protection is provided.

Amperes—rated current at full-load.

Ambient Temperature or Temperature Rise—maximum environmental temperature at which the motor should operate, or temperature rise of the motor above ambient at full-load.

Time Rating—duty rating, continuous or intermittent.

Service Factor—the amount of over load the motor can tolerate continuously at rated voltage and frequency.

Insulation Class—a designation of winding insulation generally used only for rewinding.

Identification of Bearings—type of bearings sleeve or ball.

Power Factor—power factor at full-load appears on some recently manufactured motors.

Efficiency—NEMA nominal efficiency of the motor.

Standard size frames and shaft heights have been established by NEMA for integral horsepower motors. Standardization allows interchangeability between motors from different manufacturers. A NEMA **frame designation** appears on the motor nameplate. Shaft height in inches for integral horsepower motors may be obtained by dividing the first two numbers of the frame size by four. Shaft height in inches for fractional horsepower motors may be obtained by dividing the frame size by 16. Both the mounting method/hole pattern and the shaft height are important when selecting a replacement motor to match an existing installation.

In cases where the maximum starting current that the motor draws may strain the power system, the designation of the starting current **(locked-rotor current)** for the motor is helpful. A motor code, designated by a letter on the nameplate, indicates the starting current required. Table 8.3 shows some of the common letter designations. The higher the locked-rotor kilowatt-ampere rating the higher the starting current surge will be. Motors with very high starting current may not be permitted to start on full voltage due to the branch circuit design or power company regulations. In this case, reduced-voltage starting as described in Section 8.7.3 may be required.

TABLE 8.3 Motor Code Letters, Applied to Motor Starting on Full Voltage

Code Letter	Locked-Rotor kVA per hp	Locked-Rotor kVA per kW
D	4.0 to 4.5	5.4 to 6.0
E	4.5 to 5.0	6.0 to 6.7
F	5.0 to 5.6	6.7 to 7.5
G	5.6 to 6.3	7.5 to 8.4
H	6.3 to 7.1	8.4 to 9.5
J	7.1 to 8.0	9.5 to 10.7
K	8.0 to 9.0	10.7 to 12.1
L	9.0 to 10.0	12.1 to 13.4
M	10.0 to 11.2	13.4 to 15.0
N	11.2 to 12.5	15.0 to 16.8
P	12.5 to 14.0	16.8 to 18.8
V	22.4 and up	.

P. 245, OVERLOAD PROTECTION

For any control device used, the heater/overload protection device is generally a removable item that should be selected based on the nameplate current rating of the motor to be controlled. Overload devices come in a wide range of rated tripping currents. Since the needs of a particular motor may not exactly match a standard, higher ratings will be necessary. Table 8.7 gives the recommended and maximum ratings for overload protection by percentage of full-load current rating.

TABLE 8.7 Overload Protection Rating as Percent of Nameplate Full-load Current

Motor	Recommended	Maximum
Motors with service factor of 1.15 or greater	125%	140%
Motors with a marked temperature rise not over 40°C	125%	140%
All other motors	115%	130%

P. 315 -318, LIGHTING REQUIREMENTS

It is important to understand the visual requirements and physical environment of an area in order to correctly specify the illumination level and equipment needed. Recommended levels of illumination for different areas and tasks are given in references such as the IES Lighting Handbook, American National Standards Institute publications, and American Society of Agricultural Engineers Standards. Tables 11.8 through 11.11 give some of the recommendations for levels of illumination in farm and home situations. More detailed explanations of the recommendations are given in the original sources.

TABLE 11.8 Recommended Illumination for Poultry Farm Industry Tasks[a]

	Minimum Light on Task At Any Time	
Areas and Visual Task	lx	fc
Brooding, Production, and Laying Houses		
Feeding, inspection and cleaning	200	20
Charts and records	500	50
Thermometers, thermostats, and time clock	500	50
Hatcheries		
General area and loading platform	200	20
Inside incubators	500	50
Dubbing station	2,000	200
Sexing	10,000	1,000
Egg Handling, Packing, and Shipping		
General cleanliness	1,000	100
Egg quality inspection	1,000	100
Loading platform, egg storage area, etc.	200	20
Egg Processing		
General lighting	1,000	100
Fowl Processing Plant		
General (excluding killing and unloading areas)	1,000	100
Government inspection and grading station	1,000	100
Unloading and killing area	200	20
Feed Storage		
Grain, feed rations	200	20
Processing	200	20
Charts and records	500	50

[a] Source: ASAE Standards. 2003. ASAE EP344.2 DEC99: Lighting for Dairy Farms and the Poultry Industry. ASAE, St. Joseph, MI.

TABLE 11.9 Recommended Illumination for Dairy Farms [a]

Areas and Visual Task	Minimum Light on Task At Any Time	
	lx	fc
Milking Operation Area (Milking Parlor & Stall Barn)		
General	200	20
Cow's udder	500	50
Milk Handling Equipment and Storage Area (Milk House or Milk Room)		
General	200	20
Washing area	1,000	100
Bulk tank interior	1,000	100
Loading platform	200	20
Feeding Area (Stall Barn Feed Alley, Pens, and Loose Housing area)	200	20
Feed Storage Area, Forage		
Haymow	50	5
Hay inspection area	200	20
Ladders and stairs	200	20
Silo	50	5
Silo Room	200	20
Feed Storage Area, Grain and Concentrates		
Grain bin	50	5
Concentrate storage area	100	10
Feed Processing Area	100	10
Livestock Housing Area (Community, Maternity, Individual Calf pens, and Loose-Housing and Resting Areas)	100	10

[a] Source: ASAE Standards. 2003. ASAE EP344.2 DEC99: Lighting for Dairy Farms and the Poultry Industry. ASAE, St. Joseph, MI.

TABLE 11.10 Recommended Illumination for General Areas Associated with Dairy and Poultry Facilities [a]

Areas and Visual Tasks	Minimum Light on Tasks At Any Time	
	lx	fc
Machine Storage		
Garage and machine shed	100	10
Farm Shop		
Active storage area	100	10
General shop	500	50
Rough bench machine work	500	50
Miscellaneous		
Farm office	1,000	10
Restroom	200	20
Pumphouse	200	20
Exterior		
General inactive areas	5	0.5
General active areas (paths, rough storage, barn lots)	50	5
Service area (fuel storage, shop, feedlots, bldg entrances)	30	3

[a] Source: ASAE Standards. 2003. ASAE EP344.2 DEC99: Lighting for Dairy Farms and the Poultry Industry. ASAE, St. Joseph, MI.

TABLE 11.11 Recommended Illumination for Residences [a]

Areas and Visual Tasks	Minimum Light on Task At Any Time	
	lx	fc
General Lighting		
Conversation, relaxation, entertainment	100	10
Passage areas for safety	100	10
Areas involving visual tasks, other than kitchen	500	50
Kitchen	500	50
Specific Visual Tasks		
Dining	150	15
Grooming, shaving, make-up	500	50
Ironing	500	50
Kitchen Duties		
Food preparation, sorting, inspection	1500	150
Serving and other non-critical tasks	500	50
Laundry		
Preparation, sorting, inspection	500	50
Tub area-soaking, tinting	500	50
Washer and dryer areas	300	30
Sewing (Hand and Machine)		
Dark fabrics	2,000	200
Medium fabrics	1,000	100
Light fabrics	300	30
Study	700	70
Table Games	300	30

[a] Source: Kaufman, J. E., and J. F. Christensen. 1984. *IES Lighting Handbook, Reference Volume*. Illuminating Engineering Soc. of North America, New York, NY.

TABLE A.3 Full-Load Currents (Amperes) for Single-Phase Motors [a]

	Single-Phase AC Motor Voltage		
Hp	kW	115V	230V
1/6	0.124	4.4A	2.2A
1/4	0.187	5.8	2.9
1/3	0.249	7.2	3.6
1/2	0.373	9.8	4.9
3/4	0.56	13.8	6.9
1	0.75	16	8
1 1/2	1.12	20	10
2	1.49	24	12
3	2.2	34	17
5	3.73	56	28
7 1/2	5.60	80	40
10	7.46	100	50

Notes: The voltages are rated motor voltages. The currents listed shall be permitted for system voltages ranges of 110 to 120 and 220 to 240.

[a] Source: Source: NFPA. 2002. *National Electric Code 2002*. Table 430.48. Natl. Fire Protection Assoc., Boston, MA.

TABLE A.4 Full-Load Currents (Amperes) for Induction-Type and Wound Rotor, Three-Phase Motors [a]

Hp	kW	115V	230V	460V
1/2	0.373	4.4	2.2	1.1
3/4	0.560	6.4	3.2	1.6
1	0.746	8.4	4.2	2.1
1 1/2	1.12	12.0	6.0	3.0
2	1.49	13.6	6.8	3.4
3	2.24		9.6	4.8
5	3.73		15.2	7.6
7 1/2	5.60		22	11
10	7.46		28	14
15	11.2		42	21
20	14.9		54	27
25	16.4		68	34
30	22.4		80	40
40	29.8		104	52
50	37.3		130	65

[a] Source: Source: NFPA. 2002. *National Electric Code 2002*. Table 430.150. Natl. Fire Protection Assoc., Boston, MA.

TABLE A.6 Allowable Ampacity of Insulated Copper, Aluminum, and Copper-Clad Aluminum Conductors [a]

PART 1 – Not More Than Three Current-Carrying Conductors in ***Raceway, Cable, or Earth (Directly Buried)***, Based on Ambient Temperature of 30°C (86°F).**

Rated 0 through 2,000 V, 60°C through 90°C (140°F through 194°F).

Size AWG or r kcmil	Temperature Rating of Conductor					
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)
	Types TW, UF	Types RHW, THHW, THW, THWN, ZHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHN, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM		
18	–	–	14	–	–	–
16	–	–	18	–	–	–
14*	20	20	25	–	–	–
12*	25	25	30	20	20	25
10*	30	35	40	25	30	35
8	40	50	55	30	40	45
6	55	65	75	40	50	60
4	70	85	95	55	65	75
3	85	100	110	65	75	85
2	95	115	130	75	90	100
1	110	130	150	85	100	115
1/0	125	150	170	100	120	135
2/0	145	175	195	115	135	150
3/0	165	200	225	130	155	175
4/0	195	230	260	150	180	205
250	215	255	290	170	205	230
300	240	285	320	190	230	255
350	260	310	350	210	250	280
400	280	335	380	225	270	305
500	320	380	430	260	310	350
600	355	420	475	285	340	385
700	385	460	520	310	375	420
750	400	475	535	320	385	435
800	410	490	555	330	395	450
900	435	520	585	355	425	480

* Overcurrent protection not to exceed 15 A for 14 AWG, 20 A for 12 AWG, and 30 A for 10 AWG [See NEC Art. 240.4(D).]

** Corrections for ambient temperature other than 30°C (86°F) see NEC Table 310.16.

PART 2 – *Single-Insulated Conductors in Free Air,*

Based on Ambient Temperature of 30°C (86°F).** Rated 0 Through 2000 V.

Size AWG or kcmil	Temperature Rating of Conductor					
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)
	Types TW,UF	Types RHW, THHW, THW, THWN, ZHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHN	Types TBS,SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2
	COPPER			ALUMINUM OR COPPER-CLAD ALUMINUM		
18	–	–	18	–	–	–
16	–	–	24	–	–	–
14*	25	30	35	–	–	–
12*	30	35	40	25	30	35
10*	40	50	55	35	40	40
8	60	70	80	45	55	60
6	80	95	105	60	75	80
4	105	125	140	80	100	110
3	120	145	165	95	115	130
2	140	170	190	110	135	150
1	165	195	220	130	155	175
1/0	195	230	260	150	180	205
2/0	225	265	300	175	210	235
3/0	260	310	350	200	240	275
4/0	300	360	405	235	280	315
250	340	405	455	265	315	355
300	375	445	505	290	350	395
350	420	505	570	330	395	445
400	455	545	615	355	425	480
500	515	620	700	405	485	545
600	575	690	780	455	540	615
700	630	755	855	500	595	675
750	655	785	885	515	620	700
800	680	815	920	535	645	725
900	730	870	985	580	700	785

* Overcurrent protection not to exceed 15 A for 14 AWG, 20 A for 12 AWG, and 30 A for 10 AWG [See NEC Art. 240.4(D).]

** Corrections for Ambient Temperature other than 30°C (86°F) see NEC Table 310.17.

PART 3 – Not More than ***Three Single Insulated Conductors Supported on a Messenger,*** Based on Ambient Temperature of 40°C (104°F).** Rated 0 Through 2000 V.

Size AWG or kcmil	Temperature Rating of Conductor			
	75°C (167°F)	90°C (194°F)	75°C (167°F)	90°C (194°F)
	Types RHW, THHW, THW, THWN, ZHHW, ZW	Types MI, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types RHW, THW, THWN, XHHN	Types THHN, THHW, THW-2, THWN-2, RHH, RHW-2, XHHW, XHHW-2, USE-2, ZW-2
	COPPER		ALUMINUM OR COPPER-CLAD ALUMINUM	
8	57	66	44	51
6	76	89	59	69
4	101	117	78	91
3	118	138	92	107
2	135	158	106	123
1	158	185	123	144
1/0	183	214	143	167
2/0	212	247	165	193
3/0	245	287	192	224
4/0	287	335	224	262
250	320	374	251	292
300	359	419	282	328
350	397	464	312	364
400	430	503	339	395
500	496	580	392	458
600	553	647	440	514
700	610	714	488	570
750	638	747	512	598
800	660	773	532	622
900	704	826	572	669
1000	748	879	612	716

** Corrections for Ambient Temperature other than 30°C (86°F) see NEC Table 310.20.

[a] Source: NFPA. 2002. *National Electric Code 2002*. Tables 310.15 through 310.20. Natl. Fire Protection Assoc., Boston, MA.

TABLE A.7 Conductor Applications and Insulations [a]

Trade Name	Type Letter	Max. Operating Temperature	Application	Insulation
Mineral insulation (metal sheated)	MI	90°C (194°F)	Dry and wet locations	Magnesium oxide
Thermoset	RHH	90°C (194°F)	Dry and damp locations	
Moisture-resistant thermoset	RHW	75°C (167°F)	Dry and wet locations	Flame-retardant, moisture-resistant thermoset
Moisture-resistant thermoset	RHW-2	90°C (194°F)	Dry and wet locations	Flame-retardant, moisture-resistant thermoset
Heat-resistant thermoplastic	THHN	90°C (194°F)	Dry and damp locations	Flame-retardant, moisture- and heat- resistant thermoplastic
Moisture- and heat-resistant thermoplastic	THHW	75°C (167°F) 90°C (194°F)	Dry and wet locations	Flame-retardant, moisture- and heat- resistant thermoplastic
Moisture- and heat-resistant thermoplastic	THW	75 °C (167°F) 90°C (194°F)	Dry and wet locations Special applications	Flame-retardant, moisture- and heat- resistant thermoplastic
Moisture- and heat-resistant thermoplastic	THWN	75°C (167°F)	Dry and wet locations	Flame-retardant, moisture- and heat- resistant thermoplastic
Moisture-resistant thermoplastic	TW	60°C (140°F)	Dry and wet locations	Flame-retardant, moisture-resistant thermoplastic
Underground feeder and branch circuit cable: single conductor	UF	60°C (140°F) 75°C (167°F)	See Article 340 of NEC	Moisture-resistant Moisture-and heat- resistant
Underground service entrance cable: single conductor	USE	75°C (167°F)	See Article 338 of NEC	Heat- and moisture-resistant
Thermoset	XHH	90°C (194°F)	Dry and damp locations	Flame-retardant, thermoset
Moisture-resistant thermoset	XHHW	90°C (194°F) 75°C (167°F)	Dry and damp locations Wet locations	Flame-retardant, moisture-retardant thermoset

[a] Source: NFPA. 2002. *National Electric Code 2002*. Table 310.13. Natl. Fire Protection Assoc., Boston, MA.

TABLE A.8 Power Factor Improvement Table [a]

Figures below × kilowatt input = kVAr of capacitors required to improve from one power factor to another.

Original Power Factor (%)	Desired Improved Power Factor					
	80%	85%	90%	92%	95%	100%
50	0.982	1.112	1.248	1.306	1.403	1.732
52	0.809	0.939	1.075	1.133	1.230	1.559
58	0.655	0.785	0.921	0.979	1.076	1.405
60	0.583	0.713	0.849	0.907	1.004	1.33
62	0.516	0.646	0.782	0.840	0.937	1.266
64	0.451	0.581	0.717	0.775	0.872	1.201
66	0.388	0.518	0.654	0.712	0.809	1.138
68	0.328	0.458	0.594	0.652	0.749	1.078
70	0.270	0.400	0.536	0.594	0.691	1.020
72	0.214	0.344	0.480	0.538	0.635	0.964
74	0.159	0.289	0.425	0.483	0.580	0.909
76	0.105	0.235	0.371	0.429	0.526	0.855
78	0.052	0.182	0.318	0.376	0.473	0.802
80		0.130	0.266	0.324	0.421	0.750
82		0.078	0.214	0.272	0.369	0.698
84		0.026	0.162	0.220	0.317	0.646
86			0.109	0.167	0.264	0.593
88			0.56	0.114	0.211	0.540
90				0.058	0.155	0.484
92					0.097	0.426
94					0.034	0.363
96						0.292
98						0.203
99						0.143