

## **ELECTRICAL REFERENCE GUIDE**

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**Table 250.66 Grounding Electrode Conductor for Alternating-Current Systems**

Size of Largest Ungrounded Service-Entrance Conductor or Equivalent Area for Parallel Conductors (AWG/kcmil)		Size of Grounding Electrode Conductor (AWG/kcmil)	
Copper	Aluminum or Copper-Clad Aluminum	Copper	Aluminum or Copper-Clad Aluminum
2 or smaller	1/0 or smaller	8	6
1 or 1/0	2/0 or 3/0	6	4
2/0 or 3/0	4/0 or 250	4	2
Over 3/0 through 350	Over 250 through 500	2	1/0
Over 350 through 600	Over 500 through 900	1/0	3/0
Over 600 through 1100	Over 900 through 1750	2/0	4/0
Over 1100	Over 1750	3/0	250

**Table 250.122 Minimum Size Equipment Grounding Conductors for Grounding Raceway and equipment**

Rating or Setting of Automatic Overcurrent Device in Circuit Ahead of Equipment, Conduit, etc., Not Exceeding (Amperes)	Size (AWG or kcmil)	
	Copper	Aluminum or Copper-Clad Aluminum*
15	14	12
20	12	10
30	10	8
40	10	8
60	10	8
100	8	6
200	6	4
300	4	2
400	3	1
500	2	1/0
600	1	2/0
800	1/0	3/0
1000	2/0	4/0
1200	3/0	250
1600	4/0	350
2000	250	400
2500	350	600
3000	400	600
4000	500	800
5000	700	1200
6000	800	1200

Note: Where necessary to comply with Section 250.4(A)(5) or 250.4(B)(4), the equipment grounding conductor shall be sized larger than this table.

\* See installation restrictions in Section 250.120.

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

Size AWG or kcmil	Temperature Rating of Conductor (See Table 310.13)						Size AWG or kcmil
	60°C (140°F)		75°C (167°F)		90°C (194°F)		
	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, FEP, FEPB, MI, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Types TW, UF	Types RHW, THHW, THW, THWN, XHHW, USE, ZW	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14	20	20	25	—	—	—	—
12	25	25	30	20	20	25	12
10	30	35	40	25	30	35	10
8	40	50	55	30	40	45	8
6	55	65	75	40	50	60	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	150	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0
250	215	255	290	170	205	230	250
300	240	285	320	190	230	255	300
350	260	310	350	210	250	280	350
400	280	335	380	225	270	305	400
500	320	380	430	260	310	350	500
600	355	420	475	285	340	385	600
700	385	460	520	310	375	420	700
750	400	475	535	320	385	435	750
800	410	490	555	330	395	450	800
900	435	520	585	355	425	480	900
1000	455	545	615	375	445	500	1000
1250	495	590	665	405	485	545	1250
1500	520	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	560	665	750	470	560	630	2000

NOTE: Use 60°C column ampacity for wiring devices <= 100 amp - NEC 110-14(c)(1)

**Tables 110.26(A)(1) and 110-31**

Nominal Voltage to Ground	Minimum Clear Distance (ft)		
	Condition 1	Condition 2	Condition 3
0-150	900 mm (3 ft)	900 mm (3 ft)	900 mm (3 ft)
151-600	900 mm (3 ft)	1 m (3 1/8 ft)	1.2 m (4 ft)
601-2500	900 mm (3 ft)	1.2 m (4ft)	1.5 m (5 ft)
2501-9000	1.2 m (4 ft)	1.5 m (5 ft)	1.8 m (6 ft)
9001-25000	1.5 m (5 ft.)	1.8 m (6 ft.)	2.8 m (9 ft.)

**310.15(B)(2) Adjustment Factors.**

(a) **More than Three Current-Carrying Conductors in a Raceway or Cable.** Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(2)(a).

**Table 310.15(B)(2)(a) Adjustment Factors for More Than Three Current-Carrying Conductors in a Raceway or Cable**

Number of Current-Carrying Conductors	Percent of Values in Tables 310.16 through 310.19 as Adjusted for Ambient Temperature if Necessary
4 - 6	80
7 - 9	70
10 - 20	50
21 - 30	45
31 - 40	40
41 and above	35

**240.6 Standard Ampere Ratings.**

**(A) Fuses and Fixed-Trip Circuit Breakers.** The standard ampere ratings for fuses and inverse time circuit breakers shall be considered 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600, 700, 800, 1000, 1200, 1600, 2000, 2500, 3000, 4000, 5000, and 6000 amperes. Additional standard ampere ratings for fuses shall be 1, 3, 6, 10, and 601. The use of fuses and inverse time circuit breakers with nonstandard ampere ratings shall be permitted.

\*\* 240.4(D) Overcurrent protection shall not exceed 15amp for #14, 20 amp for #12, 30 amp for #10

Note: Where the conditions are as follows:  
**Condition 1** - Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by suitable wood or other insulating materials. Insulated wire or insulated busbars operating at not over 300 volts to ground shall not be considered live parts.  
**Condition 2** - Exposed live parts on one side and grounded parts on the other side. Concrete, brick, or tile walls shall be considered as grounded.  
**Condition 3** - Exposed live parts on both sides of the work space (not guarded as provided in Condition 1) with the operator between.

### KJWW CONDUIT SIZING TABLE

2005 NEC Table C1-C12

MAXIMUM NUMBER OF CONDUCTORS (EMT, IMC, RGS and Schedule 40 PVC Only)

**THHN / THWN, THWN-2 Conductors**

SIZE	KCM	WIRE DIA.												AREA	DIA.
		1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"	6"		
14	4.11	8	14	24	42	57	94	135	209	280	361	568	822	0.0097	0.111
12	6.53	6	11	18	32	44	72	103	160	215	277	436	631	0.0133	0.130
10	10.38	4	8	13	24	32	54	77	119	160	206	325	470	0.0211	0.164
8	16.51	2	4	7	13	18	30	43	66	89	115	181	261	0.0366	0.216
6	26.24	1	4	6	8	11	18	26	40	53	69	109	157	0.0507	0.254
4	41.74	1	1	4	6	8	13	19	30	40	51	81	117	0.0824	0.324
3	52.62	1	1	3	5	7	11	16	25	34	44	69	100	0.0973	0.352
2	66.36	1	1	2	4	6	10	14	22	29	37	59	85	0.1158	0.384
1	83.69		1	1	3	4	7	10	15	20	26	41	60	0.1562	0.446
1/0	105.60		1	1	2	3	6	8	13	17	22	35	51	0.1855	0.486
2/0	133.10		1	1	1	3	5	7	11	15	19	30	43	0.2223	0.532
3/0	167.80		1	1	1	2	4	6	9	12	16	25	36	0.2679	0.584
4/0	211.60			1	1	1	3	5	8	10	13	21	30	0.3237	0.642
250					1	1	3	4	6	8	11	17	25	0.3970	0.711
300					1	1	2	3	5	7	9	15	21	0.4608	0.766
350					1	1	1	3	5	6	8	13	19	0.5242	0.817
400					1	1	1	3	4	5	7	12	17	0.5863	0.864
500					1	1	1	2	3	4	6	10	14	0.7073	0.949
600						1	1	1	3	4	5	8	11	0.8676	1.051
700		CONDUIT FILL PERCENT				1	1	1	2	4	4	7	10	0.9887	1.220
750		NEC CHAPTER 9 TABLE				1	1	1	2	3	4	6	10	1.0496	1.156
800		# OF CONDUCTORS				1	1	1	2	3	4	6	9	1.1085	1.188
900		1	2	OVER 2			1	1	1	3	3	6	8	1.2311	1.252
1000		53%	31%	40%			1	1	1	2	3	5	7	1.3478	1.310

16mm 21mm 27mm 35mm 41mm 53mm 63mm 78mm 91mm 103mm

### XHHW, XHH, XHHW-2 Conductors

Size	KCM	WIRE DIA.												AREA	DIA.	
		1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"	6"			
14	4.11	8	14	24	42	57	94	135	209	280	361	568	822	0.0139	0.133	
12	6.53	6	11	18	32	44	72	103	160	215	277	436	631	0.0181	0.152	
10	10.38	4	8	13	24	32	54	77	119	160	206	325	470	0.0243	0.176	
8	16.51	2	4	7	13	18	30	43	66	89	115	181	261	0.0437	0.236	
6	26.24	1	3	5	10	13	22	32	49	66	85	134	193	0.0590	0.274	
4	41.74	1	2	4	7	9	16	23	35	48	61	97	140	0.0814	0.322	
3	52.62	1	1	3	6	8	13	19	30	40	52	82	118	0.0962	0.350	
2	66.36	1	1	3	5	7	11	16	25	34	44	69	99	0.1146	0.382	
1	83.69	1	1	1	3	5	8	12	19	25	32	51	74	0.1534	0.442	
1/0	105.60	1	1	1	3	4	7	10	16	21	17	43	62	0.1825	0.482	
2/0	133.10		1	1	2	3	6	8	13	17	23	36	52	0.2190	0.528	
3/0	167.80		1	1	1	3	5	7	11	14	19	30	43	0.2642	0.580	
4/0	211.60		1	1	1	2	4	6	9	12	15	24	35	0.3197	0.638	
250				1	1	1	3	5	7	10	13	20	29	0.3904	0.705	
300				1	1	1	3	4	6	8	11	17	25	0.4536	0.760	
350				1	1	1	2	3	5	7	9	15	22	0.5166	0.811	
400					1	1	1	3	5	6	8	13	19	0.5782	0.858	
500					1	1	1	2	4	5	7	11	16	0.6984	0.943	
600					1	1	1	1	3	4	5	9	13	0.8709	1.053	
700		CONDUIT FILL PERCENT				1	1	1	3	4	5	8	11	0.9923	1.124	
750		NEC CHAPTER 9 TABLE				1	1	1	2	3	4	7	11	1.0532	1.158	
800		# OF CONDUCTORS				1	1	1	2	3	4	7	10	1.1122	1.190	
900		1	2	OVER 2			1	1	1	2	3	4	6	9	1.2351	1.254
1000		53%	31%	40%			1	1	1	3	3	6	8	1.3519	1.312	

16mm 21mm 27mm 35mm 41mm 53mm 63mm 78mm 91mm 103mm

CONDUIT AREA (100% SQ. INCHES) 2002NEC Chapt. 9 Table 4												
TYPE	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"	6"
EMT	0.304	0.533	0.864	1.496	2.036	3.356	5.858	8.846	11.545	14.753	N/A	N/A
IMC	0.342	0.586	0.959	1.646	2.223	3.629	5.135	7.922	10.584	13.631	N/A	N/A
RGS	0.341	0.549	0.888	1.526	2.071	3.408	4.866	7.499	10.010	12.833	20.213	29.158
SCH 40-PVC	0.285	0.508	0.832	1.453	1.986	3.291	4.695	7.268	9.737	12.554	19.761	28.567
SCH 80-PVC	0.217	0.409	0.688	1.237	1.711	2.874	4.119	6.442	8.688	11.258	17.855	25.598
LIQUIDTIGHT	0.314	0.541	0.872	1.528	1.979	3.245	4.879	7.475	9.731	12.692	N/A	N/A

EXAMPLE: 3#500, 1#350, 1#3 3\*0.7073+0.5242+0.0937=2.7398 IN2 (2.7398/40% FILL) = 6.849 3" C or 3 1/2" SCH 80 PVC

200 VOLT 3 PH MOTOR			208V SYSTEM				KJWW Engineering			2008 NEC	
F.L.A. H.P. AMPS KVA			FUSES - RK5		CIRCUIT BREAKER		DISC. AMPS	MINIMUM STARTER	MINIMUM WIRE SIZE	GND SIZE FUSE :C/B	MINIMUM CONDUIT SIZE {FLEX}
			BACKUP MOTOR PROTECTION	MAX. GENERIC AMPS	I-LINE						
					ORDINARY SERVICE	HEAVY SERVICE					
1/2	2.5	0.9	3.5	6			30	00 *1	12	12	1/2"
3/4	3.7	1.3	5	10			30	00 *1	12	12	1/2"
1	4.8	1.7	6	10			30	00 *1	12	12	1/2"
1 1/2	6.9	2.4	9	15			30	00 *1	12	12	1/2"
2	7.8	2.7	10	15	15FA	20FA	30	0 *1	12	12	1/2"
3	11	3.8	15	20	20FA	20FA	30	0 *1	12	12	1/2"
5	17.5	6.1	25	35	30FA	35FA	30	1	10	10	1/2"
7 1/2	25.3	8.8	35	45	50FA	50FA	60	1	8	10	3/4"
10	32.2	11.2	45	60	60FA	70FA	60	2	8	10:8	3/4"
15	48.3	16.7	70	90	90FA	110KA	100	3	4	8:6	1"
20	62.1	21.5	80	110	100FA	125KA	100	3	4	8:6	1"
25	78.2	27.1	100	150	110KA	175KA	100	3	3	8:6	1"
30	92	31.9	125	175	125KA	200LA	200	4	1	6	1 1/4"
40	120	41.4	150	225	175KA	250LA	200	4	1/0	6:4	1 1/2"
50	150	51.8	200	300	200LA	300LA	200	5	3/0	6:4	2"
60	177	61.3	225	350	250LA	350LA	400	5	4/0	3	2"
75	221	76.5	300	400	300LA	450MA	400	5	300KCM	3:2	2 1/2"
100	285	98.8	400	500	400LA	600MA	400	6	500KCM	3:1	2 1/2" {3"}
125	359	124.3	450	-	600MA	800MA	600	6	6 #250KCM or 2 SETS 4/0	1:1/0	3" or (2) 2"
150	414	143.3	600	-	600MA	900MA	600	6	6#350KCM or 2 SETS 300KCM	1:2/0	3 1/2" or (2) 2 1/2"
200	552	191.2	-	1000	900MA	1200NA	1200	7	6#600KCM or 2 SETS 500KCM	3/0	4" {no flex} or (2) 3"

\*1 KJWW ENGINEERING SPECIFIES A MINIMUM OF A SIZE 1 STARTER

460 VOLT 3PH MOTOR			480V SYSTEM				KJWW Engineering			2008 NEC	
F.L.A. H.P. AMPS KVA			FUSES - RK5		CIRCUIT BREAKER		DISC. AMPS	MINIMUM STARTER	MINIMUM WIRE SIZE	GND SIZE FUSE :CB	MINIMUM CONDUIT SIZE {FLEX}
			BACKUP MOTOR PROTECTION	MAX. GENERIC AMPS	I-LINE						
					ORDINARY SERVICE	HEAVY SERVICE					
1/2	1.1	0.9	1.4	3			30	00 *1	12	12	1/2"
3/4	1.6	1.3	2	3			30	00 *1	12	12	1/2"
1	2.1	1.7	2.8	6			30	00 *1	12	12	1/2"
1 1/2	3	2.4	4	6			30	00 *1	12	12	1/2"
2	3.4	2.7	4.5	6			30	00 *1	12	12	1/2"
3	4.8	3.8	6	10			30	0 *1	12	12	1/2"
5	7.6	6.1	10	15	15FA	15FA	30	0 *1	12	12	1/2"
7 1/2	11	8.8	15	20	20FA	20FA	30	1	12	12	1/2"
10	14	11.2	17.5	25	25FA	30FA	30	1	12	12:10	1/2"
15	21	16.7	30	40	40FA	45FA	30	2	10	10	1/2" {3/4}
20	27	21.5	35	50	50FA	60FA	60	2	8	10	3/4"
25	34	27.1	45	60	60FA	70FA	60	2	8	10:8	3/4"
30	40	31.9	50	70	80FA	80FA	60	3	6	10:8	3/4"
40	52	41.4	70	100	90FA	110KA	100	3	4	8:6	1"
50	65	51.8	90	125	100FA	150FA	100	3	3	8:6	1"
60	77	61.3	100	150	125KA	175KA	100	4	3	8:6	1"
75	96	76.5	125	175	125KA	200LA	200	4	1	6	1 1/4"
100	124	98.8	175	225	200KA	250LA	200	4	2/0	6:4	1 1/2"
125	156	124.3	200	300	225LA	350LA	200	5	3/0	6:3	2"
150	180	143.4	225	350	250LA	400MA	400	5	4/0	3	2"
200	240	191.2	300	450	350LA	500MA	400	5	350KCM	3:2	2 1/2"
250	302	240.6	400	600	450MA	700MA	400	6	6#4/0 or 2 SETS 3/0	3:1/0	3" or (2) 2"
300	361	287.6	-	700	600MA	800MA	800	6	6#250KCM or 2 SETS 4/0	1/0	3" or (2) 2"
350	414	329.9	-	800	600MA	900MA	800	6	6#350KCM or 2 SETS 300KCM	1/0:2/0	3 1/2" or (2) 2 1/2"
400	477	380.0	-	1000	800MA	1000NA	1200	6	6#400KCM or 2 SETS 350KCM	2/0:3/0	3 1/2" or (2) 2 1/2"
450	515	410.3	-	1000			1200	7	6#500KCM or 2 SETS 400KCM	2/0:3/0	4" or (2) 2 1/2"
500	590	470.1	-	1200	900MA	1200MA	1200	7	2 SETS 500KCM	3/0	(2) 3"

Wye-Delta Conductors = Six (FLA \* 1.25 \* .577) Conductors 350hp 480v 414 A \*1.25\*.577= 298.6 amps Minimum Six Conductor Ampacity

One Conduit = 6#400kcm & 1#1/0 GND. IN 3 1/2"C. or Two conduits 3#350kcm & 1#1/0 GND. in 2 1/2"C.

**Table 220.11 Lighting Load Demand Factors**

Type of Occupancy	Portion of Lighting Load to Which Demand Factor Applies (Volt-Amperes) (Percent)	Demand Factor
Dwelling units	First 3000 or less at	100
	From 3001 to 120,000 at	35
	Remainder over 120,000 at	25
Hospitals *	First 50,000 or less at	40
	Remainder over 50,000 at	20
Hotels and motels, including apartment houses without provision for cooking by tenants *	First 20,000 or less at	50
	From 20,001 to 100,000 at	40
	Remainder over 100,000 at	30
Warehouses (storage)	First 12,500 or less at	100
	Remainder over 12,500 at	50
All others	Total volt-amperes	100

\* The demand factors of this table shall not apply to the computed load of feeders or services supplying areas in hospitals, hotels, and motels where the entire lighting is likely to be used at one time, as in operating rooms, ballrooms, or dining rooms.

**220.13 Receptacle Loads — Nondwelling Units.** In other than dwelling units, receptacle loads computed at not more than 180 volt-amperes per outlet in accordance with Section 220.3(B)(9) and fixed multi-outlet assemblies computed in accordance with Section 220.3(B)(8) shall be permitted to be added to the lighting loads and made subject to the demand factors given in Table 220.11, or they shall be permitted to be made subject to the demand factors given in Table 220.13.

**Table 220.13 Demand Factors for Nondwelling Receptacle Loads**

Portion of Receptacle Load to Which Demand Factor Applies (Volt-Amperes)	Demand Factor (Percent)
First 10 kVA or less at	100
Remainder over 10 kVA at	50

**Table 430.148 Full-Load Currents in Amperes, Single-Phase Alternating-Current Motors**

The following values of full-load currents are for motors running at usual speeds and motors with normal torque characteristics. Motors built for especially low speeds or high torques may have higher full-load currents, and multispeed motors will have full-load current varying with speed, in which case the nameplate current ratings shall be used.

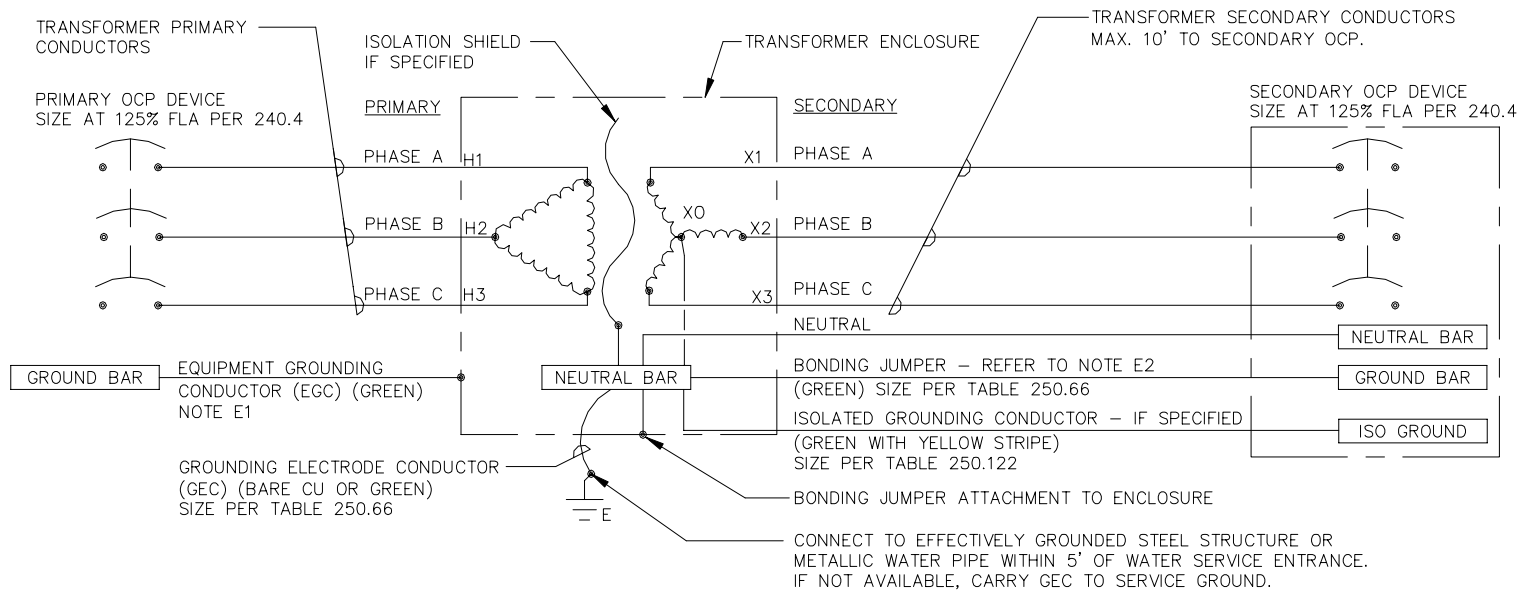
**The voltages listed are rated motor voltages. The currents listed shall be permitted for system voltage ranges of 110 to 120 and 220 to 240 volts.**

Horsepower (HP)	115 Volts		200 Volts		208 Volts		230 Volts	
	Amps	KVA	Amps	KVA	Amps	KVA	Amps	KVA
1/40	0.9	0.10	---	---	---	---	---	---
1/25	1.1	0.12	---	---	---	---	---	---
1/20	1.8	0.21	---	---	---	---	---	---
1/15	2.1	0.24	---	---	---	---	---	---
1/12	2.8	0.32	---	---	---	---	---	---
1/10	3.2	0.37	---	---	---	---	---	---
1/8	3.8	0.44	---	---	---	---	---	---
1/6	4.4	0.51	2.5	0.50	2.4	0.50	2.2	0.51
1/4	5.8	0.67	3.3	0.66	3.2	0.67	2.9	0.67
1/3	7.2	0.83	4.1	0.82	4.0	0.83	3.6	0.75
1/2	9.8	1.13	5.6	1.12	5.4	1.12	4.9	1.02
3/4	13.8	1.59	7.9	1.58	7.6	1.58	6.9	1.44
1	16.0	1.85	9.2	1.84	8.8	1.83	8.0	1.84
1 1/2	20.0	2.30	11.5	2.30	11.0	2.29	10.0	2.30
2	24.0	2.76	13.8	2.76	13.2	2.75	12.0	2.76
3	34.0	3.91	19.6	3.92	18.7	3.89	17.0	3.91
5	56.0	6.44	32.2	6.44	30.8	6.41	28.0	6.44
7	80.0	9.20	46.0	9.20	44.0	9.15	40.0	9.20
10	100.0	11.50	57.5	11.50	55.0	11.40	50.0	11.50

## TRANSFORMER WIRING SCHEDULE

KVA	PRIMARY								SECONDARY							Square D data 150°C TP 1	Square D data 115°/80°C or K4/K13
	VOLTS	PH	FLA	C/B	WIRE	NOTE E1			VOLTS	PH	FLA	C/B	WIRE	BOND JUMP	C		
						EGC	GEC	C									
15	480	3	18.0	30A/3P	3#10	#10	#8	3/4"	208	3	41.6	60A/3P	4#6	#8	1 1/4"	20"wx16"dx27"h 220#	20"wx16"dx27"h 250#
30	480	3	36.1	50A/3P	3#8	#10	#8	1"	208	3	83.3	110A/3P	4#2	#8	1 1/4"	20"wx16"dx27"h 260#	20"wx20"dx30"h 340#
45	480	3	54.1	70A/3P	3#4	#8	#6	1 1/4"	208	3	124.9	150A/3P	4#1/0	#6	2"	20"wx20"dx30"h 370#	30"wx20"dx30"h 500#
75	480	3	90.2	125A/3P	3#1	#6	#2	1 1/2"	208	3	208.2	250A/3P	4#250KCM	#2	2 1/2"	30"wx20"dx30"h 585#	30"wx24"dx37"h 750#
112.5	480	3	135.3	175A/3P	3#2/0	#6	#1/0	2"	208	3	312.3	400A/3P	4#600KCM	#1/0	3 1/2"	30"wx24"dx37"h 620#	32"wx27"dx44"h 850#
150	480	3	180.4	250A/3P	3#250KCM	#4	#1/0	2 1/2"	208	3	416.4	500A/3P	(2) SETS 4#250KCM	#1/0	(2) 2 1/2"	32"wx27"dx44"h 835#	35"wx29"dx50"h 1075#
225	480	3	270.6	350A/3P	3#500KCM	#3	#3/0	3"	208	3	624.5	800A/3P	(2) SETS 4#600KCM	#3/0	(2) 3 1/2"	35"wx29"dx50"h 1110#	41"wx32"dx50"h 1450#
300	480	3	360.8	500A/3P	(2) SETS 3#250KCM	#2	#3/0	(2) 2 1/2"	208	3	832.7	1000A/3P	(3) SETS 4#400KCM	#3/0	(3) 3 1/2"	41"wx32"dx50"h 1350#	48"wx36"dx71"h 2460#
500	480	3	601.4	800A/3P	(2) SETS 3#500KCM	#1/0	#3/0	(2) 3"	208	3	1387.9	1800A/3P	(5) SETS 4#500KCM	#3/0	(5) 3 1/2"	48"wx36"dx71"h 1875#	56"wx41"dx74"h 3950#
750	480	3	902.1	1200A/3P	(3) SETS 3#600KCM	#3/0	#3/0	(3) 3 1/2"	208	3	2081.8	2500A/3P	(6) SETS 4#600KCM	#3/0	(6) 3 1/2"	56"wx41"dx74"h 2965#	
1000	480	3	1202.8	1600A/3P	(4) SETS 3#600KCM	#4/0	#3/0	(4) 3 1/2"	208	3	2775.7	3500A/3P	(9) SETS 4#600KCM	#3/0	(9) 3 1/2"	72"wx54"dx94"h 5200#	

24 HOUR LOADING 0-64%	TRANSFORMER SELECTION 150 DEGREE C TP 1	
65-100%	115 DEGREE OR 80 DEGREE C TP 1	
% NON-LINEAR LOAD 0-49%	TRANSFORMER SELECTION 150 DEGREE C TP 1	NEUTRAL AND PANEL 100% NEUTRAL
50-79%	115 DEGREE OR 80 DEGREE C TP 1	200% NEUTRAL & NON-LINEAR PANEL
80-94%	K4 RATED	200% NEUTRAL & NON-LINEAR PANEL
95%-100%	K13 RATED or UPSIZE K4 TRANSFORMER 1 SIZE HARMONIC MITIGATING	200% NEUTRAL & NON-LINEAR PANEL 200% NEUTRALS & MULTIPLE NON-LINEAR PANELS



### SEPARATELY DERIVED SYSTEM – NEC SECTION 250.30 GROUNDING

**NOTES:**

- E1. CODE REQUIREMENT IS TO SIZE PER 250.122. KJWW PRACTICE IS TO USE THE LARGER OF THE EGC AND GEC (MOST COMMONLY THAT IS THE GEC).
- E2. ONLY APPLIES WHEN THE NEUTRAL-GROUND BOND IS MADE AT THE TRANSFORMER. WHEN NEUTRAL-GROUND BOND IS AT SECONDARY PANEL, THE SYSTEM BONDING JUMPER IS IN THE SECONDARY PANEL.

**Table B.310.7 Ampacities of Three Single Insulated Conductors, Rated 0 Through 2000 Volts, in Underground Electrical Ducts (Three Conductors per Electrical Duct) Based on Ambient Earth Temperature of 20°C (68°F), Electrical Duct Arrangement per Figure B.310.2, Conductor Temperature 75°C (167°F)**

Size AWG or kcmil	1 Electrical Duct (Fig. B.310.2, Detail 1)			3 Electrical Ducts (Fig. B.310.2, Detail 2)			6 Electrical Ducts (Fig. B.310.2, Detail 3)			1 Electrical Duct (Fig. B.310.2, Detail 1)			3 Electrical Ducts (Fig. B.310.2, Detail 2)			6 Electrical Ducts (Fig. B.310.2, Detail 3)			Size AWG or kcmil
	Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			Types RHW, THHW, THW, THWN, XHHW, USE			
	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	RHO	
	60	90	120	60	90	120	60	90	120	60	90	120	60	90	120	60	90	120	
8	63	58	57	61	51	49	57	44	41	49	45	44	47	40	38	45	34	32	8
6	84	77	75	80	67	63	75	56	53	66	60	58	63	52	49	59	44	41	6
4	111	100	98	105	86	81	98	73	67	86	78	76	79	67	63	77	57	52	4
3	129	116	113	122	99	94	113	83	77	101	91	89	83	77	73	84	65	60	3
2	147	132	128	139	112	106	129	93	86	115	103	100	108	87	82	101	73	67	2
1	171	153	148	161	128	121	149	106	98	133	119	115	126	100	94	116	83	77	1
1/0	197	175	169	185	146	137	170	121	111	153	136	132	144	114	107	133	94	87	1/0
2/0	226	200	193	212	166	156	194	136	126	176	156	151	165	130	121	151	106	98	2/0
3/0	260	228	220	243	189	177	222	154	142	203	178	172	189	147	138	173	121	111	3/0
4/0	301	263	253	280	215	201	255	175	161	235	205	198	219	168	157	199	137	126	4/0
250	334	290	279	310	236	220	281	192	176	261	227	218	242	185	172	220	150	137	250
300	373	321	308	344	260	242	310	210	192	293	252	242	272	204	190	245	165	151	300
350	409	351	337	377	283	264	340	228	209	321	276	265	296	222	207	266	179	164	350
400	442	376	361	394	302	280	368	243	223	349	297	284	321	238	220	288	191	174	400
500	503	427	409	460	341	316	412	273	249	397	338	323	364	270	250	326	216	197	500
600	552	468	447	511	371	343	457	296	270	446	373	356	408	296	274	365	236	215	600
700	602	509	486	553	402	371	492	319	291	488	408	389	443	321	297	394	255	232	700
750	632	529	505	574	417	385	509	330	301	508	425	405	461	334	309	409	265	241	750
800	654	544	520	597	428	395	527	338	308	530	439	418	481	344	318	427	273	247	800
900	692	575	549	628	450	415	554	355	323	563	466	444	510	365	337	450	288	261	900
1000	730	605	576	659	472	435	581	372	338	597	494	471	538	385	355	475	304	276	1000

Ambient Temp. (°C)	For ambient temperatures other than 20°C (68°F), multiply the ampacities shown above by the appropriate factor					
6-10	1.09	1.09	1.09	1.09	1.09	1.09
11-15	1.04	1.04	1.04	1.04	1.04	1.04
16-20	1.00	1.00	1.00	1.00	1.00	1.00
21-25	0.95	0.95	0.95	0.95	0.95	0.95
26-30	0.90	0.90	0.90	0.90	0.90	0.90

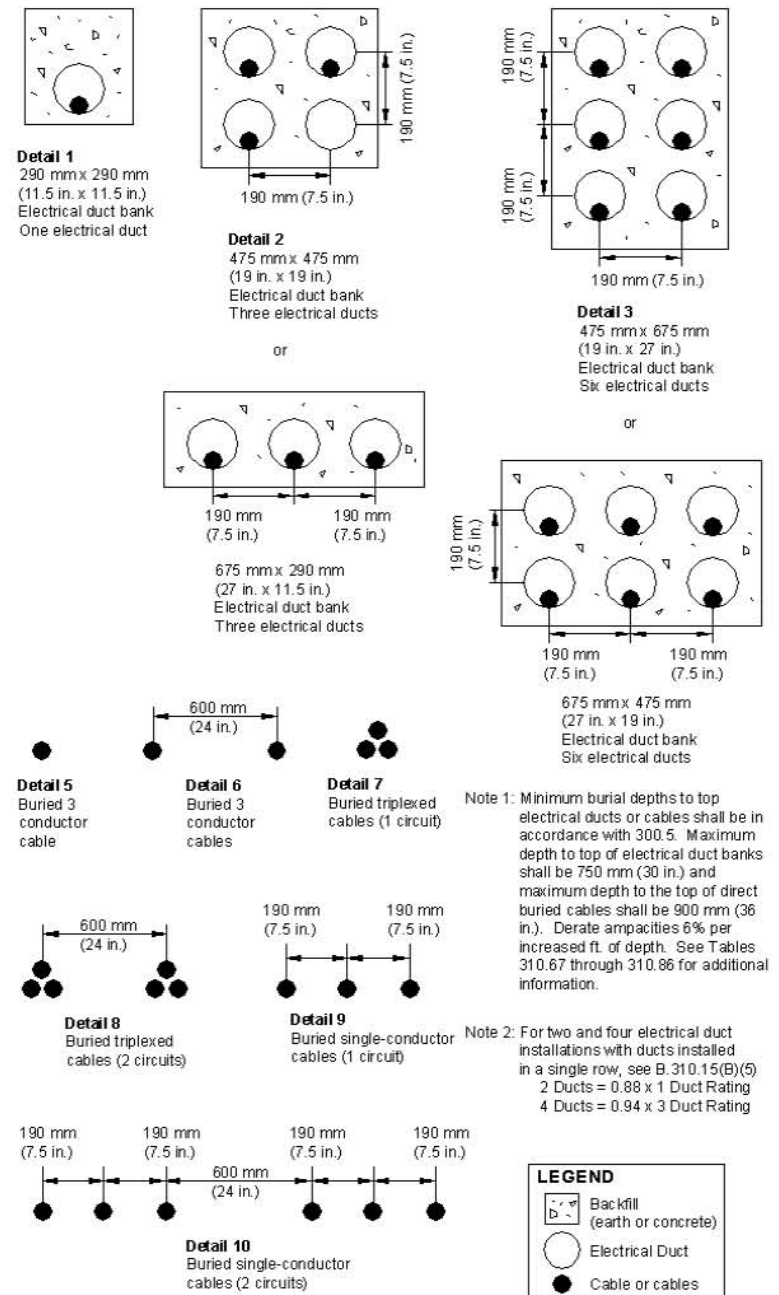


Figure B.310.2 Cable installation dimensions for use with Table B.310.5 through Table B.310.10.

# Copper Conductors—Ratings and Volt Loss

Conduit	Wire Size	Ampacity			Direct Current	Volt Loss (See Explanation p. 35)					Single-Phase				
		Type	Type	Type		Three-Phase					(60 Cycle, Lagging Power Factor.)				
						T, TW (60°C Wire)	RH, THWN, RHW, THW (75°C Wire)	RHH, THHN, XHHW (90°C Wire)	100%	90%	80%	70%	60%	100%	90%
Steel Conduit	14	20*	20*	25*	6140	5369	4887	4371	3848	3322	6200	5643	5047	4444	3836
	12	25*	25*	30*	3860	3464	3169	2841	2508	2172	4000	3659	3281	2897	2508
	10	30	35*	40*	2420	2078	1918	1728	1532	1334	2400	2214	1995	1769	1540
	8	40	50	55	1528	1350	1264	1148	1026	900	1560	1460	1326	1184	1040
	6	55	65	75	982	848	812	745	673	597	980	937	860	777	690
	4	70	85	95	616	536	528	491	450	405	620	610	568	519	468
	3	85	100	110	490	433	434	407	376	341	500	501	470	434	394
	2	95	115	130	388	346	354	336	312	286	400	409	388	361	331
	1	110	130	150	308	277	292	280	264	245	320	337	324	305	283
	0	125	150	170	244	207	228	223	213	200	240	263	258	246	232
	00	145	175	195	193	173	196	194	188	178	200	227	224	217	206
	000	165	200	225	153	136	162	163	160	154	158	187	188	184	178
	0000	195	230	260	122	109	136	140	139	136	126	157	162	161	157
	250	215	255	290	103	93	123	128	129	128	108	142	148	149	148
	300	240	285	320	86	77	108	115	117	117	90	125	133	135	135
	350	260	310	350	73	67	98	106	109	109	78	113	122	126	126
	400	280	335	380	64	60	91	99	103	104	70	105	114	118	120
	500	320	380	430	52	50	81	90	94	96	58	94	104	109	111
	600	335	420	475	43	43	75	84	89	92	50	86	97	103	106
	750	400	475	535	34	36	68	78	84	88	42	79	91	97	102
1000	455	545	615	26	31	62	72	78	82	36	72	84	90	95	
Non-Magnetic Conduit (Lead Covered Cables or Installation in Fibre or Other Non-Magnetic Conduit, Etc.)	14	20*	20*	25*	6140	5369	4876	4355	3830	3301	6200	5630	5029	4422	3812
	12	25*	25*	30*	3464	3464	3158	2827	2491	2153	4000	3647	3264	2877	2486
	10	30	35*	40*	2420	2078	1908	1714	1516	1316	2400	2203	1980	1751	1520
	8	40	50	55	1528	1350	1255	1134	1010	882	1560	1449	1310	1166	1019
	6	55	65	75	982	848	802	731	657	579	980	926	845	758	669
	4	70	85	95	616	536	519	479	435	388	620	599	553	502	448
	3	85	100	110	470	433	425	395	361	324	500	490	456	417	375
	2	95	115	130	388	329	330	310	286	259	380	381	358	330	300
	1	110	130	150	308	259	268	255	238	219	300	310	295	275	253
	0	125	150	170	244	207	220	212	199	185	240	254	244	230	214
	00	145	175	195	193	173	188	183	174	163	200	217	211	201	188
	000	165	200	225	153	133	151	150	145	138	154	175	173	167	159
	0000	195	230	260	122	107	127	128	125	121	124	147	148	145	140
	250	215	255	290	103	90	112	114	113	110	104	129	132	131	128
	300	240	285	320	86	76	99	103	104	102	88	114	119	120	118
	350	260	310	350	73	65	89	94	95	94	76	103	108	110	109
	400	280	335	380	64	57	81	87	89	89	66	94	100	103	103
	500	320	380	430	52	46	71	77	80	82	54	82	90	93	94
	600	335	420	475	43	39	65	72	76	77	46	75	83	87	90
	750	400	475	535	34	32	58	65	70	72	38	67	76	80	83
1000	455	545	615	26	25	51	59	63	66	30	59	68	73	77	

\* The overcurrent protection for conductor types marked with an (\*) shall not exceed 15 amperes for 14 AWG, 20 amperes for 12 AWG, and 30 amperes for 10 AWG copper; or 15 amperes for 12 AWG and 25 amperes for 10 AWG aluminum and copper-clad aluminum after any correction factors for ambient temperature and number of conductors have been applied.

† Figures are L-L for both single-phase and three-phase. Three-phase figures are average for the three-phase.

### How to Figure Volt Loss

Multiply *distance* (length in feet of one wire) by the *current* (expressed in amperes) by the *figure* shown in table for the kind of current and the size of wire to be used, by one over the number of conductors per phase.

Then, put a decimal point in front of the last 6 digits—you have the *volt loss* to be expected on that circuit.

**Example –** No. 6 copper wire in 180 feet of iron conduit—3 phase, 40 amp load at 80% power factor.

Multiply feet by amperes: 180 x 40 = 7200

Multiply this number by number from table for No. 6 wire three-phase at 80% power factor: 7200 x 745 = 5364000

Multiply by  $\frac{1}{\text{\#/phase}}$  5364000 x  $\frac{1}{1}$  = 5364000

Place decimal point 6 places to left.

This gives volt loss to be expected: 5.364 volts

(For a 240 volt circuit the % voltage drop is  $\frac{5.364}{240}$  x 100 or 2.23%).

### How to Select Size of Wire

Multiply *distance* (length in feet of one wire) by the *current* (expressed in amperes), by one over the number of conductors per phase.

Divide that figure into the permissible *volt loss* multiplied by 1,000,000.

Look under the column applying to the type of current and power factor for the figure nearest, but not above your result—you have the size of wire needed.

**Example –** Copper in 180 feet of steel conduit—3 phase, 40 amp load at 80% power factor—volt loss from local code equals 5.5 volts.

Multiply feet by amperes by  $\frac{1}{\text{\#/phase}}$  180 x 40 x  $\frac{1}{1}$  = 7200.

Divide permissible volt loss multiplied by 1,000,000 by this number:  $\frac{5.5 \times 1,000,000}{7200} = 764$ .

Select number from Table, three-phase at 80% power factor, that is nearest but not greater than 764. This number is 745 which indicates the size of wire needed: No. 6.



INTERNATIONAL ENERGY CONSERVATION CODE (IECC) & ASHRAE 90.1 ALLOWED INTERIOR LIGHTING POWER										
Building or Area Type	IECC 5.05.5					ASHRAE 90.1 Section 9				
	2000 & 2001		2003 & 2004		2006	1989	1999	2001	2004	2007
	Entire Building	Tenant Area	Entire Building	Tenant Area	Entire Building	Entire Building	Entire Building	Entire Building	Entire Building	Entire Building
Auditorium	NA	1.6	NA	1.8	-	-	-	-	-	-
Automotive facility	-	-	0.9	NA	0.9	0.96	1.5	1.5	0.9	0.9
Bank/Financial	NA	2.0	NA	1.5	-	-	-	-	-	-
Classroom/lecture hall	NA	1.6	NA	1.4	-	-	-	-	-	-
Convention, conference, meeting	NA	1.5	1.2	1.3	1.2	2.07	1.4	1.4	1.2	1.2
Corridor, restroom, support area	NA	0.8	NA	0.9	-	-	-	-	-	-
Court house/town hall	-	-	1.2	NA	-	-	-	-	-	-
Court house	-	-	-	-	1.2	1.44	1.4	1.4	1.2	1.2
Dining	NA	1.4	NA	0.9	-	-	-	-	-	-
Dining: Bar lounge/leisure	-	-	-	-	1.3	1.37	1.5	1.5	1.3	1.3
Dining: Cafeteria/fast food	-	-	-	-	1.4	1.37	1.8	1.8	1.4	1.4
Dining: Family	-	-	-	-	1.6	1.37	1.9	1.9	1.6	1.6
Dormitory	-	-	1.0	NA	1.0	1.15	1.5	1.5	1.0	1.0
Exercise center	1.4	1.1	1.0	0.9	1.0	2.07	1.4	1.4	1.0	1.0
Exhibition hall	NA	3.3	NA	1.3	-	-	-	-	-	-
Grocery store	1.9	2.1	1.5	1.6	-	-	-	-	-	-
Gym (playing surface)	NA	1.9	NA	1.4	1.1	2.07	1.7	1.7	1.1	1.1
Healthcare - Clinic	-	-	-	-	1.0	1.44	1.6	1.6	1.0	1.0
Hospital	-	-	-	-	1.2	1.44	1.6	1.6	1.2	1.2
Hotel function	NA	2.4	1.0	1.3	1.0	1.15	1.7	1.7	1.0	1.0
Industrial work, <20' ceiling	NA	2.1	NA	1.2	-	-	-	-	-	-
Industrial work, 20' ceiling	NA	3.0	NA	1.7	-	-	-	-	-	-
Kitchen	NA	2.2	NA	1.2	-	-	-	-	-	-
Library	1.5	1.8	1.3	1.7	1.3	1.29	1.5	1.5	1.3	1.3
Lobby - hotel	NA	1.9	NA	1.1	-	-	-	-	-	-
Lobby - other	NA	1.0	NA	1.3	-	-	-	-	-	-
Mall, arcade, or atrium	NA	1.4	NA	0.6	-	-	-	-	-	-
Manufacturing facility	-	-	-	-	1.3	0.96	2.2	2.2	1.3	1.3
Medical and clinical care	1.6	1.6	1.2	1.2	-	-	-	-	-	-
Motel	-	-	1.0	NA	1.0	1.15	2.0	2.0	1.0	1.0
Multifamily	-	-	0.7	NA	0.7	1.15	1.0	1.0	0.7	0.7
Museum	1.6	1.6	1.1	1.0	1.1	2.07	1.6	1.6	1.1	1.1
Office	1.3	1.5	1.0	1.1	1.0	1.26	1.3	1.3	1.0	1.0
Parking garage	-	-	0.3	NA	0.3	1.03	0.3	0.3	0.3	0.3
Penitentiary	-	-	1.0	NA	1.0	1.44	1.2	1.2	1.0	1.0
Performing Arts Theater	-	-	-	-	-	-	-	-	-	1.6
Police/fire station	-	-	1.0	NA	1.0	1.44	1.3	1.3	1.0	1.0
Post office	-	-	1.1	NA	1.1	1.44	1.6	1.6	1.1	1.1
Religious worship	2.2	3.2	1.3	2.4	1.3	2.07	2.2	2.2	1.3	1.3
Restaurant	1.7	1.7	1.6	0.9	-	-	-	-	-	-
Retail sales, wholesale showroom	1.9	2.1	1.5	1.7	1.5	2.25	1.9	1.9	1.5	1.5
School	1.5	NA	1.2	NA	1.2	1.29	1.5	1.5	1.2	1.2
Sports arena	-	-	-	-	1.1	2.07	1.5	1.5	1.1	1.1
Storage, industrial and commercial	0.6	1.0	0.8	0.8	0.8	1.03	1.2	1.2	0.8	-
Theaters - motion picture	1.1	1.0	1.2	1.2	1.2	2.07	1.6	1.6	1.2	-
Theaters - performance	1.4	1.5	1.6	2.6	1.6	2.07	1.5	1.5	1.6	-
Town hall	-	-	-	-	1.1	1.44	1.4	1.4	1.1	1.1
Transportation	-	-	1.0	NA	1.0	2.07	1.2	1.2	1.0	1.0
Warehouse	-	-	-	-	-	-	-	-	-	0.8
Workshop	-	-	-	-	1.4	0.96	1.7	1.7	1.4	1.4
Other	0.6	1.0	0.6	1.0	-	-	-	-	-	-

Key:

- : Type does not exist for this code year

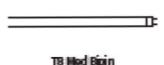

NA : Calculation method is not allowed for this area or tenant space

Note: Several occupancy types have keynotes that provide exceptions or additional requirements, refer to code for details.




CONTROLS	IECC 2006	ASHRAE 90.1 2004
Lighting Controls (Mandatory)	505.2	9.4
Additional Control	505.2.2	9.4.1.4
Light Reduction Controls	505.2.2.1 at least 50% reduction, see exceptions	-
Automatic Lighting Shutoff	505.2.2.2 time-of-day or max 30 minute occupant sensor	9.4.1.1
Occupant Override	505.2.2.2.1 accessible, manual, 2 hr max, within sight	-
Holiday Scheduling	505.2.2.2.2 24 hour off	-
Sleeping Units	505.2.3	-
Tandem Wiring	505.3	9.4.2
Exterior Lighting Controls	505.2.4	9.4.1.3

INTERNATIONAL ENERGY CONSERVATION CODE (IECC) & ASHRAE 90.1 ALLOWED EXTERIOR LIGHTING POWER		
Other exterior areas not listed below	IECC 2006 505.6.2	ASHRAE 90.1 9.4.5
Uncovered parking lots and drives	.15 W /ft <sup>2</sup>	.15 W /ft <sup>2</sup>
Walkways less than 10' wide	1 W /lin. ft.	1 W /lin. ft.
Walkway 10 feet wide or greater, plaza areas special features	2 W /ft <sup>2</sup>	.2 W /ft <sup>2</sup>
Stairways	1 W /ft <sup>2</sup>	1 W /ft <sup>2</sup>
Main entries	30 W /lin. ft. of door width	30 W /lin. ft. of door width
Other doors	20 W /lin. ft. of door width	20 W /lin. ft. of door width
Canopies (freestanding and attached and overhangs)	1.25 W /ft <sup>2</sup>	1.25 W /ft <sup>2</sup>
Building Façade - Non-Tradable	2 W /ft <sup>2</sup> of illuminated surface or 5.0 W /lin. ft. of illuminated wall or surface length	2 W /ft <sup>2</sup> of illuminated surface or 5.0 W /lin. ft. of illuminated wall or surface length

**KJWW Lamp Designations**

NEMA Lamp Designation ##W shape color K +80 CRI	Dim.	Watts	Lamp Description first line Wattage 2nd line lamps shape 3rd line color °K & CRI if different than header	LAMP LUMENS			color temp °K	CRI	life HRS rated life @ 3 hour starts	LAMP LPW Lumens / Watts	ANSI LAMP & BALLAST															
				Initial	Mean	LLD					KJWW DESIGN VA				ANSI WATTAGE				ANSI WATTAGE							
				initial rated lumens	@40% rated life	lumen deprecation					1	2	3	4	1	2	3	4	1	2	3	4				
<b>T8 - 265mA</b>																										
16WATT F16T8/U1-5/8 RS	10.5" U	16	1' T8 U TUBE 1 5/8" SPACING	1,125	1,035	0.92	3000, 3500, 4100	+70	20,000	70.3	1	2	3	4	1	2	3	4	1	2	3	4				
17WATT F17T8 RS	2'	17	2' T8	1,300	1,240	0.95	3000, 3500, 4100	+70	20,000	76.5	25	45	65	80	22	39	61	79	20	35	47	61				
17WATT F17T8 RS XL	2'	17	2' T8 EXTENDED LIFE	1,400	1,340	0.96	3000, 3500, 4100	+80	24,000	82.4	25	45	65	80	22	39	61	79	20	35	47	61				
24WATT F24T8/U1-5/8RS	1.5' U	24	1.5' T8 U TUBE 1 5/8" SPACING	1,925	1,771	0.92	3000, 3500, 4100	+70	20,000	80.2	30	55	80	105					30	54	74	89				
25WATT F25T8 RS	3'	25	3' T8	2,100	1,975	0.94	3000, 3500, 4100	+70	20,000	84.0	30	55	80	105	28	53	77	101	30	54	74	89				
25WATT F25T8 RS XL	3'	25	3' T8 EXTENDED LIFE	2,250	2,090	0.93	3000, 3500, 4100	+80	24,000	90.0	30	55	80	105	28	53	77	101	30	54	74	89				
31WATT F31T8/U1-5/8RS	2' U	31	T8 U TUBE 1 5/8" SPACING	2,725	2,507	0.92	3000, 3500, 4100	+70	20,000	87.9	40	65	95	125	38	64	94	122	38	65	94	112				
31WATT F31T8/U1-5/8RS/XL	2' U	31	T8 U TUBE 1 5/8" SPACING EXTENDED LIFE	2,725	2,507	0.92	3000, 3500, 4100	+70	20,000	87.9	40	65	95	125	38	64	94	122	38	65	94	112				
31WATT F31T8/U1-5/8 RS XLP	2' U	31	T8 U TUBE 1 5/8" SPACING EXTENDED PERFORMANCE	2,750	2,636	0.96	3000, 3500, 4100	+70	24,000	88.7	40	65	95	125	38	64	94	122	38	65	94	112				
31WATT F31T8/U6 RS	2' U	31	2' T8 U TUBE 6" SPACING	2,750	2,507	0.91	3000, 3500, 4100	+70	20,000	88.7	40	65	95	125	38	64	94	122	38	65	94	112				
32WATT F32T8RS	4'	32	4' T8	2,950	2,850	0.97	3000, 3500, 4100	+70	20,000	92.2	40	65	95	125	38	64	94	122	38	65	94	112				
32WATT F32T8RS XL	4'	32	4' T8 EXTENDED LIFE	3,000	2,850	0.95	3000, 3500, 4100	+80	24,000	93.8	40	65	95	125	38	64	94	122	38	65	94	112				
32WATT F32T8RS XLP	4'	32	4' T8 EXTENDED PERFORMANCE	3,100	2,945	0.95	3000, 3500, 4100	+80	30,000 PRS	96.9	40	65	95	125	38	64	94	122	38	65	94	112				
59WATT F59T8 RS	8'	59	8' T8	5,700	5,428	0.95	3000, 3500, 4100	+70	15,000	96.6			145				110			72	110					
96WATT F96T8HO	8'	96	8' T8 HIGH OUTPUT	8,200	7,380	0.90	3500, 4100	+70	18,000	85.4	105	190				88	160									

**T5 & T5 HO, T5 CIRCLINE, T5 TWIN (BIAX,- PL-H)**

14WATT FP14/T5	2'	14	2' T5	1,220	1,116	0.91	3000, 3500, 4100	80	20,000	87.1	1	2	3	4	1	2		
21WATT FP21/T5	3'	21	3' T5	1,890	1,767	0.93	3000, 3500, 4100	80	20,000	90.0	25	55			26	48		
28WATT FP28/T5	4'	28	4' T5	2,610	2,418	0.93	3000, 3500, 4100	80	20,000	93.2	35	70			32	63		
35WATT FP35/T5	5'	35	5' T5	3,290	3,069	0.93	3000, 3500, 4100	80	20,000	94.0	45	80			42	78		
24WATT FP24/T5HO	2'	24	2' T5HO	1,760	1,627	0.92	3000, 3500, 4100	80	20,000	73.3					27	52		
39WATT FP39/T5HO	3'	39	3' T5HO	3,080	2,883	0.94	3000, 3500, 4100	80	20,000	79.0	45	90			42	87		
54WATT FP54/T5HO	4'	54	4' T5HO	4,400	4,178	0.95	3000, 3500, 4100	80	20,000	81.5	65	125			62	120		
84WATT FP84/T5HO	5'	84	5' T5HO	6,160	5,719	0.93	3000, 3500, 4100	80	20,000	73.3	95				91			
22WATT FPC22/2G13	9"Φ	22	9" CIRCLINE T5	1,800	1,585	0.88	3000, 3500, 4100	80	12,000	81.8	30				27	52		
40WATT FPC40/2G13	12"Φ	40	12" CIRCLINE T5	3,200	2,815	0.88	3000, 3500, 4100	80	12,000	80.0	45				40			
55WATT FPC55/2G13	12"Φ	55	12" CIRCLINE T5HO	4,000	3,520	0.88	3000, 3500, 4100	80	12,000	72.7	70				64			
18WATT FT18/2G11	4.8"	18	18W FLAT TWIN TUBE	1,250	946	0.76	3000, 3500, 4100	80	10,000	69.4	30	60			20	39		
24WATT FT24/2G11	6.7"	24	24W FLAT TWIN TUBE	1,800	1,462	0.81	3000, 3500, 4100	80	10,000	75.0	40				27	52		
36WATT FT36/2G11	8.6"	36	36W FLAT TWIN TUBE	2,900	2,408	0.83	3000, 3500, 4100	80	10,000	80.6	50				39	73		
40WATT FT40/2G11	22.6"	40	40W LONG TWIN TUBE	3,150	2,709	0.86	3000, 3500, 4100	80	20,000	78.8	45	85	125		44	79	110	
50WATT FT50/2G11	22.6"	50	50W LONG TWIN TUBE	4,300	3,870	0.90	3000, 3500, 4100	80	20,000	86.0	55	110			51	100		
55WATT FT55/2G11	21.1"	55	55W LONG TWIN TUBE	4,800	4,128	0.86	3000, 3500, 4100	80	20,000	87.3	55	115			59			

**KJWW Lamp Designations**

NEMA Lamp Designation	Dim.	Watts	Lamp Description	LAMP LUMENS			color temp °K	life CRI	life HRS	LAMP LPW	KJWW DESIGN VA				ANSI WATTAGE					
				Initial	Mean	LLD					1	2	3	4	1	2	3	4		
<b>T4 COMPACT FLUORESCENT - FOR DIMMING AND ELECTRONIC BALLASTS</b>																				
13WATT CFQ13W/ G24Q	5.2	13	13W COMPACT FLUORESCENT QUAD TUBE	900	755	0.84	2700, 3000, 3500, 4100	+80	10,000	69.2	30	40					16	29		
18WATT CFQ18W/ G24Q	5.8"	18	18W COMPACT FLUORESCENT TWIN TUBE	1,250	1,032	0.83	2700, 3000, 3500, 4100	+80	10,000	69.4	30	40					20	38		
26WATT CFQ26W/ G24Q	6.5"	26	26W COMPACT FLUORESCENT QUAD TUBE	1,800	1,548	0.86	2700, 3000, 3500, 4100	+80	10,000	69.2	28	55								
26W CFTR26W/ GX24q-3	5.2"	26	26W COMPACT FLUORESCENT TRIPLE TUBE	1,800	1,548	0.86	2700, 3000, 3500, 4100	+80	10,000	69.2	35	60					28	55		
32W CFTR32W/ GX24q-3	5.8"	32	32W COMPACT FLUORESCENT TRIPLE TUBE	2,400	2,064	0.86	2700, 3000, 3500, 4100	+80	10,000	75.0	40	85					36	69		
42W CFTR42W/ GX24q-4	6.4"	42	42W COMPACT FLUORESCENT TRIPLE TUBE	3,200	2,752	0.86	2700, 3000, 3500, 4100	+80	10,000	76.2	50	95					46	93		
57W CFTR57W/ GX24q-5	7.8"	57	57W COMPACT FLUORESCENT TRIPLE TUBE	4,200	3,698	0.88	2700, 3000, 3500, 4100	+80	10,000	73.7	64	128					65	128		GE High Lumen Biax
55W FT55W/2G8	7.17"	55	55W LONG COMPACT FLUORSCENT	4,800	4,128	0.86	3000, 4100	+80	18,000	87.3										Philips PL-H
70W CFTR70W/ GX24q-6	7.9"	70	70W COMPACT FLUORESCENT QUAD TUBE	5,200	4,472	0.86	3000, 3500, 4100, 5000	+80	12,000	74.3	78	156					75	156		GE High Lumen Biax
80W FT80W/2G8	8.78"	80	80W LONG COMPACT FLUORSCENT	6,000	5,160	0.86	3000, 4100	+80	18,000	75.0										Philips PL-H

**2D COMPACT FLUORESCENT**

NEMA Lamp Designation	Dim.	Watts	Lamp Description	LAMP LUMENS Initial	LAMP LUMENS Mean	LAMP LUMENS LLD	color temp °K	life CRI	life HRS	LAMP LPW	KJWW DESIGN VA		ANSI WATTAGE	
											1	2	1	2
10 WATT F102D/827/4P	3.6"	10	4-PIN	650	545	0.84	2,700	82	10,000	65.0	15			13
16 WATT F162D/8xx/4P	5.5"	16	4-PIN 2700K, 3500K	1,050	880	0.84	2700, 3500	82	10,000	65.6	20			17
21 WATT F212D/8xx/4P	5.5"	21	4-PIN 2700K, 3500K	1,350	1,135	0.84	2700, 3500	82	10,000	64.3	25			20
28 WATT F282D/8xx	8.1"	28	2-PIN 2700K, 3500K	2,050	1,720	0.84	2700, 3500	82	10,000	73.2				
28 WATT F282D/8xx/4P	8.1"	28	4-PIN 2700K, 3500K	2,050	1,720	0.84	2700, 3500	82	10,000	73.2	30			27
38 WATT F382D/8xx/4P	8.1"	38	4-PIN 2700K, 3500K	2,850	2,395	0.84	2700, 3500	82	10,000	75.0	40			31
55 WATT F55/2D/8xx/4P	8.1"	55	4-PIN 2700K, 3500K	3,900	3,300	0.85	2700, 3500	82	10,000	70.9	60			

**INDUCTION FLUORESCENT LAMPS 100,000 HOURS**

NEMA Lamp Designation	Dim.	Watts	Lamp Description	LAMP LUMENS Initial	LAMP LUMENS Mean	LAMP LUMENS LLD	color temp °K	life CRI	life HRS	LAMP LPW	KJWW DESIGN VA		ANSI WATTAGE	
											1	2	1	2
70 WATT ICE/70/8xx	70	70	70-T17	6,200	4,598	0.74	3500, 4100	+80	100,000	88.6	110			107 Osram
100 WATT ICE/100/8xx	100	100	100-T16.5	8,000	5,820	0.73	3500, 4100	+80	100,000	80.0	110			107 Osram
150 WATT ICE/150/8xx	150	150	150-T16.5	12,000	8,990	0.75	3500, 4100	+80	100,000	80.0	165			157 Osram
55 WATT QL55W/8xx	55	55	P-27	3,500	2,800	0.80	3000, 4000	+80	100,000	63.6	60			55 Philips
85 WATT QL85W/8xx	85	85	P-35, or R	6,000	4,800	0.80	3000, 4000	+80	100,000	70.6	100			85 Philips
165 WATT QL165W/8xx	175	165	P-41	12,000	9,600	0.80	3000, 4000	+80	100,000	68.6	175			165 Philips

**COMPACT FLUORESCENT - PREHEAT (NON-DIM) 2 PIN**

NEMA Lamp Designation	Dim.	Watts	Lamp Description	LAMP LUMENS Initial	LAMP LUMENS Mean	LAMP LUMENS LLD	color temp °K	life CRI	life HRS	LAMP LPW	KJWW DESIGN VA		ANSI WATTAGE	
											1	2	1	2
5 WATT CTF5W/G23	1.2"	5	5W TWIN TUBE	230	199	0.87	2700, 4100	82	10,000	46.0	10	15		8 14
7 WATT CTF7W/G23	5.3"	7	7W TWINTUBE	400	344	0.86	2700,3500 4100,5000	82	10,000	57.1	15	20		10 18
9 WATT CTF9W/G23	6.5"	9	9W TWINTUBE	580	499	0.86	2700,3500 4100,5000	82	10,000	64.4	15	25		12 22
13 WATT CTF13W/GX23	7.1"	13	13W TWINTUBE	800	698	0.87	2700,3500 4100,5000	82	10,000	61.5	20	40		17 29
9 WATT CFQ9W/G23-2	4.3"	9	9W DOUBLE TWIN TUBE	525	452	0.86	2700,3500 4100,5000	82	10,000	58.3	15	25		12 22
13 WATT CFQ13W/GX23-2	4.6"	13	13W DOUBLE TWIN TUBE	780	688	0.88	2700, 3500	82	10,000	60.0	20	40		16 29
18 WATT CFQ18W/G24D-2	6.0"	18	18W DOUBLE TWIN TUBE	1,150	1,075	0.93	2700, 3000, 3500	82	10,000	63.9	25	50		20 38
26 WATT CFQ26W/G24D-3	6.8"	26	26W DOUBLE TWIN TUBE	1,710	1,548	0.91	2700, 3000, 3500	82	10,000	65.8	30	65		28 55

**KJWW Lamp Designations**

1/22/2008

ANSI LAMP & BALLAST

NEMA Lamp Designation	Dim.	Watts	Lamp Description	LAMP LUMENS			color temp °K	CRI	life HRS	LAMP LPW	KJWW DESIGN VA				ANSI WATTAGE				ANSI WATTAGE			
				Initial	Mean	LLD					1	2	3	4	1	2	3	4	1	2	3	4
<b>T12- LAMPS</b>											EB-RS											
25 WATT F25T12/RS/ES	3'	25	ENERGY SAVING	2,050	1,904	0.93	3000, 3500	70	18,000	82.0	30	50	90	27	48	80						
30 WATT F30T12/RS	3'	30	DESIGNER 80+CRI	2,290	2,061	0.90	3000, 4100	80	18,000	76.3	35	65	95	31	60	90						
34 WATT F34T12/ES	4'	34	DESIGNER ENERGY SAVING	2,800	2,355	0.84	3000, 4100	70	20,000	82.4	35	65	85	37	62	91						
40 WATT F40T12/1F	4'	40	INCANDESCENT FLOURESCENT	1,480	1,273	0.86	2,750	89	20,000	37.0	45	75	95	45	72	107						
55 WATT F72T12	6'	55	SLIMLINE, INSTANT START	4,500	3,960	0.88	3000, 3500, 4100	70	12,000	81.8	90	145										
75 WATT F96T12	8'	75	SLIMLINE, INSTANT START	6,420	5,906	0.92	3000, 3500, 4100	70	12,000	85.6	100	195										
<b>HIGH OUTPUT (HO) 800mA</b>																						
25 WATT F18T12/HO	18"	25	25W RECESSED DOUBLE CONTACT	950	740	0.78	4,100	60	9,000	38.0												
35 WATT F24T12/HO	24"	35	35W RECESSED DOUBLE CONTACT	1,620	1,337	0.83	4,100	60	9,000	46.3	100	135	195	220	66	101	148	183				
42 WATT F30T12/HO	30"	42	42W RECESSED DOUBLE CONTACT	2,250	1,825	0.81	4,100	60	9,000	53.6					125							
45 WATT F36T12/HO	36"	45	45W RECESSED DOUBLE CONTACT	2,350	1,825	0.78	4,100	60	9,000	52.2	105	130	195	230	73	116	166	212				
55 WATT F42T12/HO	42"	55	55W RECESSED DOUBLE CONTACT	3,400	2,754	0.81	4,100	60	9,000	61.8	105	145			139							
55 WATT F48T12/HO/ES	48"	55	55W RECESSED DOUBLE CONTACT	3,750	3,375	0.90	4,100	60	9,000	68.2	105											
60 WATT F48T12/HO	48"	60	60W RECESSED DOUBLE CONTACT	4,050	3,281	0.81	4,100	60	12,000	67.5	130	155	230	240	87	153	217	288				
75 WATT F60T12/HO	60"	75	75W RECESSED DOUBLE CONTACT	4,400	3,825	0.87	4,100	60	12,000	58.7	115	180	230	285	98	178	246	312				
80 WATT F64T12/HO	64"	80	80W RECESSED DOUBLE CONTACT	5,750	4,253	0.74	4,100	60	12,000	71.9	130	180	255	320	107	178	246	312				
85 WATT F72T12/HO	72"	85	85W RECESSED DOUBLE CONTACT	6,650	5,995	0.90	4,100	60	12,000	78.2	130	225	290	330	113	214	291	323				
95 WATT F96T12/HO/ES	96"	95	85W RDC, ENERGY SAVING	7,700	6,237	0.81	4,100	60	12,000	81.1	130	235			125	222						
100 WATT F84T12/HO	84"	100	100W RECESSED DOUBLE CONTACT	7,550	6,115	0.81	4,100	60	12,000	75.5	145				113	209						
110 WATT F96T12/HO	96"	110	110W RECESSED DOUBLE CONTACT	9,050	8,145	0.90	4,100	60	12,000	82.3	150	260	300		140	255	292					
<b>VERY HIGH OUTPUT (VHO) 1500mA</b>																						
110 WATT F48T12/ 1500	48"	110	110W VHO RECESSED DOUBLE CONTACT	6,200	4,620	0.75	4,100	60	10,000	56.4	165	260	310									
165 WATT F72T12/ 1500	72"	165	165W VHO RECESSED DOUBLE CONTACT	9,400	6,590	0.70	4,100	60	10,000	57.0	195	390	430									
185 WATT F96T12/1500/ ES	96"	185	185W VHO RECESSED DOUBLE CONTACT	13,000	9,100	0.70			9,000	70.3	240	420										
<b>U LAMPS</b>																						
34 WATT F34T12/U6/ES	22.5" U	34	6" U BENT T12 K ENERGY SAVING	2,730	2,457	0.90	3000, 3500, 4100	70	18,000	80.3	35	65	85	37	62	91						
40 WATT F40T12/U6	22.5" U	40	6" U BENT T12	3,050	2,745	0.90	3000, 3500, 4100	70	18,000	76.3	45	75	95	45	72	107						
<b>TRIGGER START LAMPS</b>																						
F15T12		14	PREHEAT-TRIGGER START	650	566	0.87		70	7,500	46.4	70	110										
F20T12		20	PREHEAT-TRIGGER START	1,350	1,242	0.92		70	9,000	67.5	70	100										
<b>CIRCULINE LAMPS (PRE-HEAT REQUIRES STARTER)</b>																						
20 WATT FC6T9	6.75"	20	20W CIRCULINE	800	696	0.87	WW, CW	52	8,000	40.0	45			25								
22 WATT FC8T9	8.5"	22	22W CIRCULINE	1,050	914	0.87	WW, CW, DL	52	12,000	47.7	40			29								
32 WATT FC12T9	12"	32	32W CIRCULINE	1,950	1,697	0.87	WW, CW, DL	52	15000	60.9	90			38	79							
40 WATT FC16T9	16"	40	40W CIRCULINE	2,750	2,393	0.87	WW, CW, DL	52	18000	68.8	75			48	90							
32 & 40 WATT FC12T9 & FC16T9	12" & 16"	72	Dual Ballast 1-FC12T9/RS(32W) & 1-FC12T9(40W)	4,700	4,090	0.87	WW, CW, DL	52	15000	65.3	90			90								
<b>T5- Miniture Preheat Fluorescent (Programmed Start)</b>																						
F4T5	6"	4	COOL WHITE	135	117	0.87	4,200	62	6,000	33.8	10	15										
F4T5/D	6"	4	DAYLIGHT	115	100	0.87	6,500	76	6,000	28.8												
F6T5/WWW	9"	6	WARM LIGHT	275	239	0.87	3,000	52	7,500	45.8	10	15		9	15							
F6T5/D	9"	6	DAYLIGHT	260	226	0.87	6,527	76	7,500	43.3				9	15							
F8T5/WWW	12"	8	WARM LIGHT	400	348	0.87	3,000	52	7,500	50.0	15	25		11	21							
F8T5/DSGN50	12"	8	DESIGNER	280	244	0.87	5,000	90	7,500	35.0				11	21							
F13T5/WW	21"	13	WARM LIGHT	880	776	0.88	3,000	52	7,500	67.7	20	40		17	32							

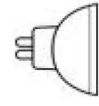
**KJWW Lamp Designation**  
 ###W  
 shape  
 color K +80 CRI

Dim. Watts Lamp Description  
 first line Wattage  
 2nd line lamps shape  
 3rd line color °K & CRI if different than header

rated life  
 @ 3 hour starts

LAMP initial LPW Lumens / Watts

CBCP (Center Beam Candle Power)  
 SP NFL FL



**MR16 Reflectorized Lamps**

KJWW Lamp Designation	Dim.	Watts	Lamp Description	rated life @ 3 hour starts	LAMP initial LPW Lumens / Watts	CBCP (Center Beam Candle Power)				
						SP	NFL	FL		
37MR16/GU5.3	2"Φ	37	MR-16, infra-red (HIR)	4,000			10°	25°	40°	
50MR16/GU5.3	2"Φ	50	MR-16, infra-red (HIR)	4,000			13,100	4,600	2,500	Replaces 50 watt MR16
20MR16/GU5.3	2"Φ	20	Dichroic reflector (Tru-Aim) 10°, 40°, 60°	4,000			15,700	6,000	3,000	
20MR16/GU5.3	2"Φ	20	Aluminized (Brilliant) 8°, 35°	4,000			5,000	700	350	
35MR16/GU5.5	2"Φ	35	Dichroic reflector 10°, 25°, 40°, 60°	4,000			4,650	625		Dichroic reflectors reduce IR heat in the beam, and have a colored glow behind the reflector. Dichroic reflectors color shift.
35MR16/GU5.6	2"Φ	35	Aluminized 10°, 35°	4,000			8,300	3,100	1,250	
50MR16/GU5.7	2"Φ	50	Dichroic reflector 10°, 25°, 40°, 60°	4,000			8,700	1,300		Aluminized reflectors eliminate backlight.
50MR16/GU5.8	2"Φ	50	Aluminized 11°, 25°, 35°	4,000			11,500	3,200	2,000	
65MR16/GU5.9	2"Φ	65	Dichroic reflector 10°, 25°, 40°, 60°	4,000			10,500	3,000	1,900	
65MR16/GU5.10	2"Φ	65	Aluminized 11°, 25°, 35°	4,000			14,000	4,000	2,100	
20MR11	1.4"Φ	20	Dichroic reflector 10°, 35°	4,000			12,500	3,600	2,100	
35MR11	1.4"Φ	35	Dichroic reflector 10°, 35°	4,000			5,500	700		
20AR70	70mm	20	Aluminized reflector 8°, 25°	3,000			8,500	1,500		AR lamps are excellent for very narrow beams at long throw distances. AR lamps have integral glare shields. More expensive than MR16
50AR70	70mm	50	Aluminized reflector 8°, 25°	3,000			12,500	2,600		
35AR111		35	Aluminized reflector 4°, 8°, 25°	3,000			45,000	14,000	2,500	
50AR111	111	50	Aluminized reflector 4°, 8°, 25°	3,000			50,000	20,000	3,500	
75AR111	mm	75	Aluminized reflector 8°, 25°, 45°	3,000			30,000	5,300	1,700	
100AR111		100	Aluminized reflector 8°, 25°, 45°	3,000			48,000	8,500	2,800	
36PAR36	4"Φ	36	36PAR36	4,000	500	13.9	17,000	3,500	1,000	
50PAR36	4"Φ	50	50PAR36	4,000	700	14.0	25,000			

**KJWW Lamp Designation**

**PAR Parabolic Aluminized Reflector Lamps**

rated life

LAMP initial LPW

CBCP SP NFL FL

KJWW Lamp Designation	Dim.	Watts	Lamp Description	rated life	LAMP initial LPW	CBCP				
						SP	NFL	FL		
50W PAR30/HIR	4"Φ	50	PAR30 HALOGEN INFRARED 9°, 25°, 40°	3,000	900	18.0	13,000	2,900	1,400	Halogen Infrared to replace 75, 90, 120 watt lamp for reduced wattage and longer life
50W PAR38/HIR	5"Φ	50	PAR38 HALOGEN INFRARED 9°, 25°	3,000	850	17.0	14,000	3,000		
60W PAR38/HIR	5"Φ	60	PAR38 HALOGEN INFRARED 9°, 12°, 25°, 30°	3,000	1110	18.5	20,000	5,000	3,600	
80W PAR38/HIR	5"Φ	80	PAR38 HALOGEN INFRARED 10°, 25°	3,000	1500	18.8	25,000	5,500		
100W PAR38/HIR	5"Φ	100	PAR38 HALOGEN INFRARED 10°, 25°, 40°	3,000	2070	20.7	29,000	6,300	3,400	
50W PAR16 /FL	2"Φ	50	PAR16 40°	2,000	650	13.0			800	
60W PAR16	2"Φ	60	PAR16 10°, 30°	2,000	650	10.8	5,000	1,300		
75W PAR16	2"Φ	75	PAR16 10°, 30°	2,000	900	12.0	7,500	1,900		
35W PAR20	3"Φ	35	PAR20 10°, 30°, 40°	2,500	350	10.0	3,000	800	500	
50W PAR20	3"Φ	50	PAR20 10°, 30°, 40°	2,500	360	7.2	4,600	1,200	900	
50W PAR30	4"Φ	50	PAR30 9°, 25°, 40°	2,500	660	13.2	8,800	2,300	1,300	
60W PAR30	4"Φ	60	PAR30 9°, 25°	2,500	860	14.3	12,000	3,500		Replace BR lamps for higher light output and longer life
70W PAR30	4"Φ	70	PAR30 9°, 25°, 40°	3,000	1130	16.1	15,400	4,000	2,100	
35W PAR30/LN	4"Φ	35	PAR30/LN 9°, 50°	2,500	450	12.9	5,700	450		
50W PAR30/LN	4"Φ	50	PAR30/LN 9°, 25°, 50°	2,500	660	13.2	8,800	2,300	900	
75W PAR30/LN	4"Φ	75	PAR30/LN 9°, 25°, 50°	2,500	1130	15.1	15,400	4,000	1,100	
45W PAR38	5"Φ	45	PAR38 9°, 12°, 30°, 50°	2,500	560	12.4	10,000	1,500	700	
60W PAR38	5"Φ	60	PAR38 9°, 12°, 25°, 30°	3,000	850	14.2	16,000	3,300	2,500	
75W PAR38	5"Φ	75	PAR38 9°, 12°, 30°, 50°	2,500	1060	14.1	19,200	3,150	1,300	
90W PAR38	5"Φ	90	PAR38 9°, 12°, 25°, 30°, 50°	2,500	1310	14.6	22,200	4,700	1,600	
120W PAR38	5"Φ	120	PAR38 10°, 25°, 30°, 55°	3,000	1800	15.0	22,500	7,700	4,600	
250W PAR38	5"Φ	250	PAR38 10°, 30°	4,500	3600	14.4	46,500	9,000		

Designation	Dim.	Watts	Lamp Description	rated life	LAMP	
					initial	LPW
<b>Standard Incandescent "A" Lamps</b>						
30W A19 /ES/130	30	40A34SS/130V	OPERATING AT 120V	3,750	285	10
34W A19 /ES	34	40A34SS	40A19 SUPER SAVER	1,500	375	11
52W A19 /ES/130	46	60A52SS/130V	OPERATING AT 120V	2,500	550	12
52W A19 /ES	52	60A52SS	60A19 SUPER SAVER	1,000	750	14
67W A19 /ES/130	59	75A67SS/130V	OPERATING AT 120V	1,875	770	13
75W A19 /RS/130	66	75A/RS/XL/130V	ROUGH SERVICE @120	12,500	495	8
67W A19 /ES	67	75A67SS	75A19 SUPER SAVER	750	1065	16
75W A19 /RS	75	75A/RS/XL	ROUGH SERVICE	5,000	450	6
90W A19 /ES/130	79	100A90SS/130V	OPERATING AT 120V	1,875	1125	14
100W A21 /RS/130	88	100A/RS/130V	ROUGH SERVICE @120	12,500	760	9
100W A21 /130	88	100A21/130V	OPERATING AT 120V	1,875	1230	14
90W A19 /ES	90	100A90SS	100A19 SUPER SAVER	750	1550	17
100W A21 /RS	100	100A/RS	ROUGH SERVICE	5,000	450	5
100W A21	100	100A21	100A21	750	1690	17
135W A21 /ES/130	119	150A135SS/130V	OPERATING AT 120V	1,875	1840	15
135W A21 /ES/XL/130	119	150A135SS/XL/130V	OPERATING AT 120V	6,250	1580	13
135W A21 /ES	135	150A135SS	150A21 SUPER SAVER	750	2485	18
135W A21 /ES/EX	135	150A135SS/XL	150A21 SUPER SAVER	2,500	2135	16
200W 21	200	200A21		750	3800	19

**NOTES:**

1 Reducing the voltage 10% below rated voltage will extend lamp life 2X, and reduces lumen output 15%.



Designation	Dim.	Watts	Lamp Description	rated life	LAMP LUMENS	
					Initial	LPW
<b>Incandescent "R" or "BR" Lamps</b>						
50W R20	50	50R20	45 DEGREE	2,000	330	6.6
45W BR30/FL	45	45BR30/FL	30 DEGREE	2,000	400	8.9
65W BR30/FL	65	65BR30/FL	60 DEGREE	2,000	640	9.8
65W BR30/SP	65	65BR30/SP	30 DEGREE	2,000	640	9.8
75W BR/FL	75	75BR/FL	60 DEGREE, BR40	2,000	680	9.1
100W BR/FL	100	100BR/FL	60 DEGREE, BR40	2,000	935	9.4
120W BR/FL	120	120BR/FL	60 DEGREE, BR40	2,000	1210	10.1
150W PAR/FL	150	150OPAR/FL	45 DEGREE OUTDOOR	2,000	1350	9.0
250W K/BR38/FL	250	250K/BR38/FL	KRYPTON REFLECTOR	4,000	3100	12.4
300W BR/FL	300	300BR/FL	60 DEGREE, BR40	2,000	3030	10.1
300W BR/FL/130V	264	300BR/FL/130V	OPERATING AT 120V	5,000	2240	8.5



Designation	Dim.	Watts	Lamp Description	rated life	LAMP LUMENS	
					Initial	LPW
##W			first line Wattage	@ 3	initial	Lumens
shape			2nd line lamps shape	hour	rated	/ Watts
color K +80 CRI			3rd line color °K & CRI if different than header	starts	lumens	



**A lamp Replacements**

42MB/CAP	42	Mid-Break A-Line		3,500	570	13.6
52MB/CAP	52	Mid-Break A-Line		3,500	770	14.8
72MB/CAP	72	Mid-Break A-Line		3,500	1,150	16.0
50A/HAL/CRYSTAL	50			2,500	860	17.2
60A/HAL	60			3,000	960	16.0
75A/HAL	75			3,000	1,300	17.3
75A/HAL/CRYSTAL	75			3,000	1,330	17.7
100A/HAL	100			3,000	1,800	18.0
75T10/HAL/CL	75	T10 Tubular, Clear		2,000	1,100	14.7
75T10/HAL/F	75	T10 Tubular, Frosted		2,000	1,050	14.0
100T10/HAL/CL	100	T10 Tubular, Clear		2,000	1,500	15.0
100T10/HAL/F	100	T10 Tubular, Frosted		2,000	1,430	14.3
150T10/HAL/CL	150	T10 Tubular, Clear		2,000	2,500	16.7
150T10/HAL/F	150	T10 Tubular, Frosted		2,000	2,400	16.0
250T10/HAL/CL	250	T10 Tubular, Clear		2,000	4,200	16.8
250T10/HAL/F	250	T10 Tubular, Frosted		2,000	4,000	16.0

Replaces standard A-lamp for higher light output, longer life and reduced dimming hum.

Replaces standard A-lamp in prismatic applications for higher light output, and reduced dimming hum.



**Single Ended Quartz**

75Q/CL	75	75Q/CL		2,000	1,400	18.7
100Q/CL	100	100Q/CL		1,000	1,600	16.0
100Q	100	100Q		1,000	1,750	17.5
150Q/CL	150	150Q/CL		2,000	2,800	18.7
150Q	150	150Q		2,000	2,700	18.0
250Q/CL	250	250Q/CL		2,000	5,000	20.0
250Q	250	250Q		2,000	4,850	19.4
500W/CL	500	500W/CL		2,000	10,450	20.9
500Q	500	500Q		2,000	10,100	20.2
750Q/CL	750	750Q/CL		750	16,500	22.0



**Double Ended Quartz**

100T3	100	100T3		2,000	1,600	16.0
150T3Q	150	150T3Q		2,000	2,800	18.7
200T3Q	200	200T3Q		2,000	3,600	18.0
300T3Q	300	300T3Q		2,000	6,000	20.0
350T3/CL/HIR	350	350T3/CL/HIR		2,000	10,000	28.6
500T3Q	500	500T3Q		2,000	8,750	17.5



# KJWW Lamp Designations - HID

4/17/2008

ANSI LAMP & BALLAST

NEMA Lamp Designation	Dim.	Watts	Lamp Description	LAMP LUMENS			color temp °K	CRI	rated life HRS	LAMP LPW	KJWW DESIGN VA	ANSI LAMP & BALLAST	
				Initial	Mean	LLD						E	M
##W shape color K +80 CRI			first line Wattage 2nd line lamps shape 3rd line color °K & CRI if different than header	initial rated lumens	@40% rated life	lumen deprecia tion			rated life @ 3 hour starts	Lumens / Watts		E	M
<b>(CMH) Ceramic Metal Halide - High CRI, Pulse Start</b>											1		
20 WATT CMH20/BT5	BT5	20	CDM20/TM/830	1,500	1,050	0.70	3000°	80	9,000	75.0	30		26
39 WATT CMH39/T6	T6	39	MC39T6/U/G12/830	3,300	2,600	0.79	3000°	80	10,000	84.6	100	46	56
70 WATT CMH70/T4.5	T4	70	MC70TC/U/G8.5/830	6,600	5,300	0.80	3000°	83	9,000	94.3	100	82	90
39 WATT CMH39/T6	T6	70	CDM70/T6/830	6,600	4,950	0.75	3000°	82	15,000	94.3	100		94
70 WATT CMH70 T6	T6	70	MC70T6/U/G12/830	6,600	5,200	0.79	3000°	83	15,000	94.3	100	82	90
70 WATT CMH70 T6	T6	70	MC70T6/DE/830	6500V 6300H		0.00	3000°	83	15,000	90.0	100		94
70 WATT CMH70T6/G12	T6	70	MC70T6/U/G12	5,800	4,620	0.80	4200°	90	15,000	82.9	100	82	90
150 WATT CMH150T6/G12	T6	150	MC150T6/U/G12/830	14,000	9,800	0.70	3000°	85	12,000	93.3	210		190
150 WATT CMH150T6/G12	T6	150	MC150T6/U/G12/940	12,700	8,900	0.70	4200°	90	12,000	84.7	210		190
150 WATT CMH150T7	T7	150	MC150T7/DE/830	13,500	11,260	0.83	3000°	85	12,000	90.0	445		189
70 WATT CMH70 E17	E17	70	MCP70/C/U/MED/830	5,500	3,995	0.73	3000°	88	12,000	78.6	100	82	90
100 WATT CMH100 E17	E17	100	MCP100/C/U/MED /830	8,500	6,450	0.76	3000°	85	12,000	85.0	140	112	129
150 WATT CMH150 E17	E17	150	MCP150/C/U/MED /830	12,800	9,545	0.75	3000°	89	12,000	85.3	210		190
20 WATT CMH20 PAR20	PAR20	20	CDM20PAR20/M /830/XX	940		0.00	3000°	83	9,000	47.0	30		26
39 WATT CMH39 PAR20	PAR20	39	MCP39PAR20/U /830/XX	2,000	1,300	0.65	3000°	85	10,000	51.3	195	46	56
20 WATT CMH20 PAR30	PAR30	20	CDM20PAR30/M /830/XX	1,200		0.00	3000°	83	9,000	60.0	30		26
39 WATT CMH39 PAR30	PAR30	39	MCP39PAR30LN/U /830/XX	2,300	1,430	0.62	2900°	85	10,000	59.0	100	46	56
70 WATT CMH70 PAR30	PAR30	70	MCP70PAR30LN/U /830/XX	4,400	3,050	0.69	2900°	85	10,000	62.9	100	82	90
70 WATT CMH70 PAR38	PAR38	70	MCP70PAR38/U /830/XX	4,300	2,870	0.67	3000°	85	10,000	61.4	100	82	90
100 WATT CMH100 PAR38	PAR38	100	MCP100PAR38/U /830/XX	6,500	4,340	0.67	3000°	85	10,000	65.0	140	112	128
<b>(PSMH) Metal Halide - Pulse Start - Reduced Color Shift</b>											1	E	M
50 WATT PSMH50/E17	E17	50	MP50/C/U/MED	3,200	1,820	0.57	3000°	70	10,000	64.0	75	57	72
70 WATT PSMH70/E17	E17	70	MP70/U/MED	4,700	3,100	0.66	2900°	75	15000V	67.0	100	82	90
70 WATT PSMH70/E17/840	E17	70	MPD70/U/MED/840	5,100	3,800	0.75	4200°	82	7500V 6000H	73.0	100	82	90
100 WATT PSMH100/E17	E17	100	MP100/U/MED	7,900	5,800	0.73	2900°	75	15000V	79.0	140	112	129
100 WATT PSMH100/E17/840	E17	100	MP100/U/MED/840	7,700	5,500	0.71	4000°	82	7500V 6000H	77.0	140	112	129
150 WATT PSMH150/E17	E17	150	MP150/C/U/MED	11600 11,500	7500 9,500	.65 .83	2900° 4000°	75 85	7500V 6000H	77.0	210		190
175 WATT PSMH175/ED17	ED17	175	MS175W/C/BU/MED /PS	16,600	12,500	0.75	3700°	70	15,000	95.0	210		208
200 WATT PSMH200		200	MH200W/C/PS	16000V 14400H			3700°	70	15,000V 11,250H	91.0	255		232
200 WATT PSMH200/730		200	MP200W/C/V/PS /3K	15,200		0.00	3200°	70	15,000	87.0	255		232

<b>(PSMH) Metal Halide - Pulse Start - Reduced Color Shift</b>										°K	CRI	HRS	LPW	1	E	M
250 WATT PSMH250		250	MS250/C/PS /BU-ONLY	21,500		0.00	3000°	70	10,000	86.0	310		288			
350 WATT PSMH350/BT28	BT28	320	MP320/350/C/PS /BU-ONLY/BT28	28500V 21500H			3900° 3800°	70	20,000	89.0	435		368			
350 WATT PSMH350/BU		350	MS350/400/C/PS /BU-ONLY	39000V 32000H			3500° 3300°	70	20,000	91.0	490		452			
400 WATT PSMH400/BU		400	MS400/C/PS /BU-ONLY	42,000		0.00	3600°	70	20,000	105.0	490		455			
400 WATT PSMH400		400	MP450W/C/BU/PS	45,200		0.00	3700°	70	20,000	113.0	555		590			
400 WATT PSMH400/840		400	CDM400/C/V/O/PS/4K	34,000		0.00	3700°	90	20,000	85.0	485		465			
1000 WATT PSMH1000/BT37	BT37	1000	M1000/PS/U/BT37	110000V 107800H			3800°	65	15000V 9000H	110.0	1210		1080			
70 WATT PSMH70/PAR38	PAR38	70	MP70PAR38/U/xx /ECO 20°, 35°, 65°	3,400		0.00	3200°	75	8,500	49.0	100	82	90			
100 WATT PSMH100/PAR38	PAR38	100	MP100PAR38/U/xx /ECO 20°, 35°, 65°	5,800		0.00	3000°	75	8,500	58.0	140	112	128			
150 WATT PSMP150/PAR38	PAR38	150	MP150PAR38/U/xx /ECO 20°, 35°, 65°	8,800		0.00	3200°	75	8,500	59.0	210		190			

<b>(SMH) Metal Halide - Position Dedicated</b>										°K	CRI	HRS	LPW	1	E	M
175 WATT SMH175/BT28	BT28	175	MS175/C/HOR	14,500	8,000	0.55	4000°	70	7,500	83.0	225	226				
250 WATT SMH250 BT28	BT28	250	MS250/3K/HOR	17,200	13,500	0.78	3200°	70	10,000	69.0	310	303				
400 WATT SHM400 BT28	BT28	400	MS400/C/HOR/BT28	36,500	24,000	0.66	3800°	70	20,000	91.0	490	475	900			
400 WATT SHM400 BT28/3K	BT28	400	MS400/3K/HOR	35,000	22,000	0.63	3200°	70	20,000	84.0	490	475	900			
400 WATT SHM400 /BU/BT28	BT28	400	MS400/3K/BU-ONLY	35,000	22,000	0.63	3200°	70	20,000	88.0	490	475	900			
10000 WATT SHM1000 BT28	BT28	1000	MS1000/C/BU-ONLY	110,000	88,000	0.80	3400°	70	18,000	110.0	1600	1000				

<b>(MH) Metal Halide - Standard (PROBE START - will be discontinued)</b>										°K	CRI	HRS	LPW	1	E	M
175 WATT MH175/ED17	ED17	175	M175/C/U/MED	12,800	9,300	0.73	3600°	70	10000V 7500H	74.0	225	226				
175 WATT MH175 BT28	BT28	175	M175/C/U	12,800	9,300	0.73	3800°	70	1000V 7500H	80.0	225	226				
175 WATT MH175 BT28	BT28	175	M175/3K/BU-ONLY	11,800	7,600	0.64	3200°	70	10,000	67.0	225	226				
250 WATT MH250 BT28	BT28	250	M250/C/U	20,000	13,000	0.65	3800°	70	10,000	86.0	310	303				
250 WATT MH250/BU/BT28	BT28	250	M250/3K/BU-ONLY	17,500	13,000	0.74	3200°	70	10,000	70.0	310	303				
400 WATT MH400 BT28	BT28	400	M400/C/U/BT28	33,000	21,500	0.65	3600°	70	20000V 15000H	90.0	490	475	900			
400 WATT MH400 BT37	BT37	400	M400/C/U	32,000	20,500	0.64	3700°	70	20000V 15000H	90.0	490	475	900			
1000 WATT MH1000 BT37	BT37	1000	M1000/U/BT37	107,800	86,300	0.80	3800°	65	15000V 9000H	110.0	1600	1100				
1000 WATT MH1000 BT56	BT56	1000	M1000/C/U	107,800	86,000	0.80	3400°	70	18000V	107.0	1600	1100				
1500 WATT MH1500 BT56	BT56	1500	M1500/BD	153,000	140000	0.92	4000°	70	3,000	111.0	1600	1590				

<b>(MH) Metal Halide - Energy Saving Retrofit</b>										°K	CRI	HRS	LPW	1	E	M
150 WATT M150/BT28/ES	BT28	150	M150/SS/U/BT-28	13000V 12000H		0.00	4000°	65	10000V 7500H	67.0	215	210				
360 WATT MH360 BT28	BT28	360	MS360/SS/BU-HOR	36000V 30000H		0.00	4000° 3600°	65	20000V 15000H	100.0	465	460	890			
360 WATT MH360 BT28/BU	BT28	360	MSP360/C/SS /BU-ONLY	34,500		0.00	4000° 3600°	70	20,000	96.0	465	460	890			



<b>(MHI) Metal Halide - Double Ended - Enclosed Luminaires</b>												°K	CRI	HRS	LPW	1	E	M
70 WATT MH70/T6/DE	T6	70	M70T6/DE	5,000	4,400	0.88	3200°	70	7,500	69.0	195	94						
150 WATT MH150 T7	T7	150	M150T7/DE	11,250	9,500	0.84	3400°	75	7,500	87.0	475	180						
1000 WATT MH1000 T7	T7	1000	M1000T7/DE	100,000		0.00	4200°	65	6,000	100.0	1085		1080					
1500 WATT MH1500 T7	T7	1500	M1500T7/DE	150,000	127500	0.85	4200°	65	3,000	100.0	1635		1615					
1500 WATT MH1500 T8	T8	1500	M1500T8/DE	150,000	127500	0.85	4200°	65	6,000	100.0	1635		1615					
2000 WATT MH2000 T8	T8	2000	M2000T8/DE	200,000	170000	0.85	4200°	65	3,000	100.0	2220		2140					
2000 WATT MH2000 T9	T9	2000	M2000T9/DE	200,000	170000	0.85	4200°	65	3,000	100.0	2220		2140					
<b>(MHI) Metal Halide - Double Ended - Enclosed Luminaires HIGH CRI</b>												1	E	M				
70 WATT MHI70/T6/DE	T6	70	HQI-DE70/WDX	4,700		0.00	3000°	80	10,000	67.0	195		94					
70 WATT MHI70 T6	T6	70	HQI-DE70/WDX-E	6,000		0.00	3000°	85	10,000	86.0	195		94					
70 WATT MHI70 T7.5	T7.5	70	HQI-SE70/WDX	5,200		0.00	3000°	80	9,000	74.0	195		94					
150 WATT MHI150 T7	T7	150	HQI-DE150/WDX	11,000		0.00	3000°	81	10,000	73.0	435		189					
150 WATT MHI150 T7	T7	150	HQI-DE150/NDX	11,250		0.00	4200°	85	10,000	75.0	435		189					
150 WATT MHI150 T7.5	T7.5	150	HQI-SE150/WDX	12,000		0.00	3000°	80	9,000	80.0	435		189					
150 WATT MHI150 T7.5	T7.5	150	HQI-SE150/NDX	12,500		0.00	4200°	85	9,000	83.0	435		189					
250 WATT MHI250 T9.5	T9.5	250	HQI-DE250/NDX	20,000		0.00	4200°	85	10,000	80.0	665		189					
250 WATT MHI250 T9.5	T9.5	250	HQI-DE250/DX	20,000		0.00	5000°	93	10,000	80.0	665		290					
250 WATT MHI250 T14.5	T14.5	250	HQI-SE250/DX	19,000		0.00	5200°	90	9,000	380.0	665		290					
250 WATT MHI250 T15	T15	250	ARC250/T/H/960/E	19,000		0.00	6000°	90	10,000	76.0	490		455					
250 WATT MHI250 T15	T15	250	MH250/T15	21,000		0.00	4000°	65	10,000	84.0	315		303					
400 WATT MHI400 T14.5	T14.5	400	HQI-SE400/DX	33,000		0.00	5200°	90	9,000	83.0			460					
<b>(HS) High Pressure Sodium</b>				Initial	Mean	LLD	°K	CRI	HRS	LPW	1	E	M					
35 WATT HS35/E17	E17	35	LU35/D/MED	2,100	1,935	0.92	1900°	22	16,000	60.0	65		54					
50 WATT HS50 E17	E17	50	LU50/D/MED	3,800	3,420	0.90	1900°	22	24,000	74.0	90		76					
50 WATT HS50 ET23.5 /XP	ET23.5	50	LU50/ECO	4,000	3,600	0.90	1900°	22	24,000	80.0	90		76					
50 WATT HS50 ET23.5	ET23.5	50	LU50/D	3,700	3,420	0.92	1900°	22	24,000	74.0	90		76					
50 WATT HS50 ET23.5 /XLP	ET23.5	50	LU50/PLUS/ECO	4,000	3,600	0.90	1900°	22	30,000	80.0	90		76					
70 WATT HS70 E17	E17	70	LU70/D/MED	5,800	5,270	0.91	1900°	22	24,000	83.0	110	80	96					
70 WATT HS70 ET23.5/XP	ET23.5	70	LU70/ECO	6,300	5,850	0.93	1900°	22	24,000	90.0	110	80	96					
70 WATT HSWATTET23.5	ET23.5	70	LU70/D/MED	5,500		0.00	1900°	22	24,000	79.0	110	80	96					
70 WATT HS70 ET23.5/XP	ET23.5	70	LU70/PLUS/ECO	6,300	5,670	0.90	1900°	22	30,000	90.0	110	80	96					
100 WATT HS100 E17	E17	100	LU100/D/MED	8,800	7,920	0.90	2100°	22	24,000	88.0	155	112	132					
100 WATT HS100 ET23.5/XP	ET23.5	100	LU100/ECO	9,500	8,550	0.90	2100°	22	24,000	95.0	155	112	132					
100 WATT HS100 ET23.5	ET23.5	100	LU100/D	8,800		0.00	2100°	22	24,000	88.0	155	112	132					
100 WATT HS100 ET23.5/XP	ET23.5	100	LU100/PLUS/ECO	9,800		0.00	2100°	22	30,000	98.0	155	112	132					

	<b>(HS) High Pressure Sodium</b>			Initial	Mean	LLD	°K	CRI	HRS	LPW	1	E	M
150 WATT HS150 E17	E17	150	LU150/D/MED	14,500	13,500	0.93	2100°	22	24,000	97.0	225		195
150 WATT HS150 ET23.5/XP	ET23.5	150	LU150/ECO	16,000	14,220	0.89	2100°	22	24,000	107.0	225		195
150 WATT HS150 ET23.5	ET23.5	150	LU150/D	14,000		0.00	2100°	22	24,000	93.0	225		195
150 WATT HS150 ET23.5/XP	ET23.5	150	LU150/55/PLUS/ECO	16,000	14,400	0.90	2100°	22	30,000	107.0	225		195
150 WATT HS150 BT28	BT28	150	LU150/100	15,700	14,220	0.91	2100°	22	24,000	105.0	220		188
200 WATT HS200 ET18/XP	ET18	200	LU200/PLUS/ECO	22,000	19,260	0.88	2100°	22	30,000	110.0	280		241
200 WATT HS200 ET18	ET18	200	LU200/ECO	22,000		0.00	2100°	22	24,000	110.0	280		241
250 WATT HS250 ET18/XP	ET18	250	LU250/PLUS/ECO	29,000		0.00	2100°	22	30,000	116.0	355		305
250 WATT HS250 ET18	BT28	250	LU250/D	26,000	24,300	0.93	2100°	22	24,000	104.0	355		305
250 WATT HS250 ET18/XP	ET18	250	LU250/ECO	29,000		0.00	2100°	22	24,000	116.0	355		305
310 WATT HS310 ET18/XP	ET18	310	LU310/ECO	37,000		0.00	2100°	22	24,000	119.0	420		305
400 WATT HS400/ET18/XLP	ET18	400	LU400/PLUS/ECO	50,000		0.00	2100°	22	30,000	125.0	545		470
400 WATT HS400/ET18/XP	ET18	400	LU400/ECO	50,000	45,000	0.90	2100°	22	24,000	125.0	545		470
400 WATT HS400 T7	T7	400	LU400T7/RCS	46,000		0.00	2100°	21	24,000	115.0	545		470
400 WATT HS400 BT37	BT37	400	LU400/D	47,500		0.00	2100°	21	24,000	119.0	545		470
600 WATT HS600 T16	T16	600	LU6000SUPER	90,000	81,000	0.90	2100°	22	24,000	150.0	775		670
750 WATT HS750 BT37	BT37	750	LU750	105,000		0.00	2100°	22	24,000	140.0	980		850
1000 WATT HS1000/ED25	E25	1000	LU1000	130,000	112000	0.86	2100°	22	24,000	130.0	1260		1096
	<b>Retrofit Metal Halide for High Pressure Sodium</b>						°K	CRI	HRS	LPW	1	E	M
CDM250S50/O/4K	ED18	250	CDM250S50/V/O/4K	22,500			4000°	90	20,000	90.0	340		300
MVR250/VBU/R	ED28	250	MVR250/VBU/R	18,500			4500°	65	10,000	74.0	340		300
MVR250/C/VBU/R	ED28	250	MVR250/C/VBU/R	18,000			4000°	70	10,000	72.0	340		300
CDM400/S51/O/4K	ED18	400	CDM400/S51/V/O/4K	36,000			4000°	90	20,000	90.0	505		460
MVR400/U/ED28/R	ED28	400	MVR400/U/ED28/R	36000V 33100H			4000°	65	20000V 15000H	90.0	505		460
MVR400/VBU/R	ED37	400	MVR400/VBU/R	37,600			4500°	65	20,000	94.0	505		460
MVR400/C/VBU/R	ED37	400	MVR400/C/VBU/R	35,700			4000°	70	20,000	89.0	505		460
	<b>White SON High Pressure Sodium</b>			Initial	Mean	LLD	°K	CRI	HRS	LPW	1	E	M
50 WATT HSW50/T10	T10	50	SDW-T 50W/LV	2,300	2,070	0.90	2700°	85	10,000	50.0	170	72	
50 WATT HSW50/ED17	ED17	50	SDW-50W/LV/D	2,350	2,000	0.85	2700°	85	10,000	47.0	170	72	
100 WATT HSW100/T10	T10	100	SDW-T 100W/LV	5,000	4,250	0.85	2700°	85	10,000	52.0	280	125	
100 WATT HSW100/ED17	ED17	100	SDW-100W/LV/D	4,900	4,170	0.85	2700°	85	10,000	49.0	280	125	

RECOMMENDED LIGHT LEVELS - IESNA 9th EDITION					RECOMMENDED FOOT-CANDLES (FC)	
INTERIOR	HORIZ	VERT	Max/Min	Avg/Mir	CHAPTER	
Conference Rooms (Video Conference)	50	30	3:1	11	11	Office Buildings
Open Office (Intermittent Computer Use)	50	5	3:1	11	11	Office Buildings
Classrooms (General)	50	50	3:1	12	12	Educational Facilities
Corridors	10	10		12	12	Educational Facilities
Art Rooms	50	30	3:1	12	12	Educational Facilities
Science Labs	50	30	3:1	12	12	Educational Facilities
Lecture Halls (Audience)	50	50	3:1	12	12	Educational Facilities
Music Rooms	30	10	3:1	12	12	Educational Facilities
Cafeterias	30	3	3:1	12	12	Educational Facilities
Gymnasiums (high school class II, college class II)	50/80	30	3:1 2.5:1	12,20	12,20	Educational Facilities/Sports and Rec. Lighting
Shops	50	5	3:1	12,19	12,19	Educational Facilities/Industrial Lighting
Cardiac Function Lab	50	10	3:1	16	16	Health Care Facilities
Central Sterile Supply	50	10	3:1	16	16	Health Care Facilities
Critical Care Areas (Exam)	50	10	3:1	16	16	Health Care Facilities
Recovery (General)	10	3	3:1	16	16	Health Care Facilities
Dialysis (task / general / reading)	100/50/30	30	3:1	16	16	Health Care Facilities
Emergency (General)	50	10	3:1	16	16	Health Care Facilities
Endoscopy	50	10	3:1	16	16	Health Care Facilities
Lab (Specimen Collecting)	50	10	3:1	16	16	Health Care Facilities
Soiled/Clean Utility	30	10	3:1	16	16	Health Care Facilities
Medical Records	50	10	3:1	16	16	Health Care Facilities
Nurseries (Observation)	50	10	3:1	16	16	Health Care Facilities
Nurse Station (Desk)	50	10	3:1	16	16	Health Care Facilities
LDRP (General)	50	10	3:1	16	16	Health Care Facilities
General Patient Rooms (Exams)	50	10	3:1	16	16	Health Care Facilities
Physical Therapy	30	5	3:1	16	16	Health Care Facilities
Radiology (General)	3	3	3:1	16	16	Health Care Facilities
Operating Rooms	300	50	3:1	16	16	Health Care Facilities
Waiting Areas (Reading)	30	5		16	16	Health Care Facilities
Storage Rooms	10	3		16,19	16,19	Health Care Facilities/Industrial Lighting
General lighting should be 1/3 the intensity of task lighting. Contrast ratio should be 10:1 or less.						
RECOMMENDED FOOT-CANDLES (FC)						
EXTERIOR	HORIZ	VERT	Max/Min	Avg/Mir	CHAPTER	
BUILDING ENTRANCES	5	3				
PEDESTRIAN MALLS	5	3			21	
PARKING LOT	0.2	0.1	20:1		22	MINIMUM MAINTAINED, MAX-MIN
PARKING LOT ENHANCED SECURITY	0.5	0.3	15:1		22	MINIMUM MAINTAINED, MAX-MIN
PARKING RAMP DAY	2	1	10:1		22	MINIMUM MAINTAINED, MAX-MIN
PARKING RAMP NIGHT	1	0.5	10:1		22	MINIMUM MAINTAINED, MAX-MIN
EMERGENCY & EGRESS LIGHTING						
		NFPA 101 7.8.1.3 2003		RECOMMENDED FOOT-CANDLES (FC)		
		HORIZ	VERT	Avg/Mir	CHAPTER	
EGRESS PATH		1		10:1	29	MINIMUM .1 ftc along band 3' band centered on
Areas adjacent to EGRESS PATH		0.05			29	egress path
STAIRWELLS 10 ftc Normal		1			29	
EXTERIOR PATH OF EGRESS		1			29	To public way, or safe distance from exit discharge
Failure of 1 lamp shall not leave an area in total darkness <=.2 ftc						NFPA 101 7.8.1.4, NEC 700.16, UBC 1006.1, IBC 1003.2.11

**LIGHTING CALCULATIONS**

B.F. = Ballast factor

L.L.F. = Lamp Lumen Depreciation \* Dirt Depreciation

$$\text{Room Cavity Ratio (RCR)} = \frac{5 * \text{Working Cavity} * (L+W)}{\text{Spare (Area)}}$$

$$\text{Maintained Foot Candles (FC)} = \frac{\#Lamps * Lumens * CU * LLF * BF}{\text{Spare (Area)}}$$

## COLOR RENDERING INDEX (CRI)

COLOR RENDERING INDEX (CRI)					MANUFACTURER'S DESIGNATION		
LAMP COLOR DESCRIPTION	COLOR °K	CRI	LUMEN PER WATT	PHILIPS	OSRAM SYLVANIA	GENERAL ELECTRIC	
CW COOL WHITE	4100	62	78.8	CW	CW	CW	
CWX COOL WHITE DELUXE	4175	89	56.3	CWX	CWX	CWX	
WW WARM WHITE	3000	52	81.3	WW	WW	WW	
W WHITE	3450	60	80	WW	WW	WW	
D DAYLIGHT	6250	75	65	D	D	D	
730 3000°K LAMP	3000	>70	81.3	730	D30	SP30	
735 3500°K LAMP	3500	>70	82	735	D35	SP35	
741 4100°K LAMP	4100	>70	82	741	D41	SP41	
765 6500°K LAMP - (SIGN)	6500	>70			765	SP65	
50K 5000°K COLOR CORRECTED	5000	90	55.3	C50	DSN50	C50	
830 3000°K LAMP 80 CRI	3000	>80	81.5	830	D830	SPX30	
835 3500°K LAMP 80 CRI	3500	>80	82.5	835	D835	SPX35	
841 4100°K LAMP 80 CRI	4100	>80	84.3	841	D841	SPX41	
850 5000°K LAMP 80 CRI	5000	>80		850	850	SPX50	
865 6500°K LAMP 80 CRI	6500	>80			D865		
930 3000°K LAMP HIGH CRI	3000	>90	62.5	930			
950 5000°K LAMP HIGH CRI	5000	>90	62.5	950	950		
ES ENERGY SAVER				EW	SS	WM	
ESP ENERGY SAVER W/ CATHODE CUTOFF					SSP	WMP	
ECO TCLP COMPLIANT				ALTO	ECO	ECO	
XP EXTENDED LIFE 24000 HR				PLUS	XP	XL	
XPS EXTENDED LIFE & OUTPUT 24000 HR & 3100 LUMENS			97	ADV	XPS	HL	
MH METAL HALIDE	4100	65	80	MH	M	MVR	
MH/C METAL HALIDE COATED	3900	70		MH/C	M/C	MVR/C	
PSMH PULSE START METAL HALIDE				MS/PS	MP	MXR	
SMH SUPER METAL HALIDE	3100	65	91.4	MS	MS	MVR	
CERAMIC METAL HALIDE				CDM	MP	MXR	
HPS HIGH PRESSURE SODIUM	2100	21	110	C### S	LU	LU	
HPS/DX HPS COLOR CORRECTED	2200	65	90	C###S/C		LU/DX	



**Smoke Detectors on Smooth Ceilings (NFPA 72 5.7)**

- Space on a 30'x30' grid (15' from the walls). No part of the ceiling may be more than 21' from a device.
- Space on maximum of 30' centers in corridors (15' from ends). 24' spacing is recommended to allow adjustment during last-minute coordination.
  - If ceiling slope is greater than 10 degrees, the bottom row of detectors (the ones 15' from the wall) can be omitted.
- Use in most areas except where controlled combustion, excessive dust or chemical fumes are present and could initiate the device. Use heat detectors in these areas.
- For high ceilings or where large quantities of smoke detectors are required, consider the use of projected-beam or air sampling smoke detectors.
- In very tall rooms, such as atria, multiple levels of beam detectors may be required.

**Smoke Spacing on Exposed Struc. Ceilings (NFPA 72 5.7)**

- For smoke detector layout solid joists are the same as solid beams.
- Where structure depths greater than 1' deep or for ceiling heights greater than 12' spot smoke detectors shall be located in every pocket.
- Where beam depths are less than 1' deep and for ceiling heights less than 12', spacing shall be 1/2 the smooth ceiling spacing perpendicular to the beam or joist (in the pocket or on bottom of the beam)
- Where ceiling is sloped and the beams run up the slope, use the spacing for level beamed ceilings.
  - Height shall be the average over slope.
  - If slope is greater than 10 degrees the bottom row of detectors (the ones 15' from the wall) can be omitted.
- Where ceiling is sloped and the beams run perpendicular to the slope, the spacing for level beamed ceilings shall be used. Height shall be the average over the slope.

**Smoke Detectors for Smoke Door Closure (NFPA 72 5.14.6)**

- If top of door less than 2' below ceiling both sides:
  - Locate one SD on either side within 5'.
- If top of door greater than 2' below ceiling on one side:
  - Locate one SD on high side within 5'.
- If top of door greater than 2' below ceiling on both sides:
  - Locate an SD on both sides within 5'.

**Smoke Detectors for Smoke Damper Release (NFPA 72 5.14)**

- **2000 IBC/1998 IMC and 1997 UBC/UMC:** Choose: 1) In duct within 5 feet of damper; 2) on wall or ceiling within 5 feet of damper, if unducted; 3) in ceiling within 5 feet on both sides of smoke door, if damper above door; 4) complete area smoke detection; 5) complete area smoke detection in corridor, if damper is in a corridor wall.
- **1999 BOCA:** Choose: 1) In duct near damper; 2) on wall near damper, if unducted; 3) in ceiling within 5 feet on both sides of smoke door, if damper above door.
- **2001 NFPA:** Locations not specified, but smoke detection system must release dampers.
- Smoke dampers shall be powered from either Equipment or Critical branch circuits.
- Complete area smoke detection should be carefully evaluated to determine most cost-effective design.

**Smoke Detector Locations for Fan Shutdown:**

- **2000 IBC/1998 IMC:** greater than 2000cfm—return; exception—complete area smoke detection. Greater than 15000cfm and multiple stories—at each story ahead of return riser.
- **1997 UBC/UMC:** greater than 2000cfm—supply; exceptions—complete area smoke detection or direct exit to outside from all occupied spaces served by unit.
- **1999 BOCA:** greater than 2000cfm—supply. Greater than 15000cfm—supply and return (if system exhaust greater than 50% of supply also install in exhaust duct). Exception to detectors in returns—complete area smoke detection. Multiple stories—at each story ahead of return riser.
- **2001 NFPA:** greater than 2000cfm—supply. Greater than 15000cfm and multiple stories—at each story ahead of return riser. Exception to detectors in returns—complete area smoke detection. Complete area smoke detection should be carefully evaluated to determine most cost-effective design.

**Pull Stations Spacing and Mounting (NFPA 72 5.12)**

- Locate within 5' of exit doors on ground floors and stairway entrances on upper floors.
- Locate on each floor within 200' travel distance of any part of the floor
- Locate on both sides of door groups larger than 40' wide.
- Use double action where there is a **chance** of nuisance alarms.
- Use an auxiliary alarm cover in schools, nursing homes and other places where there is a **high probability** of tampering or nuisance alarms.
- Provide a wire guard in gymnasiums. Some double action devices won't work with a wireguard, so coordinate or use a single-action device.

**Elevators (ANSI Elevator Code):**

- Provide 3 addressable relays at each elevator controller (for recall, alternate recall and firefighters warning light).
- Provide an addressable relay controlling a shunt-trip breaker in the switchboard that the elevator is fed from. Provide a monitor module and continuous rated relay to monitor shunt trip power.
- Provide smoke detectors in equip room, top of shaft and within 5' of elevator on each floor served by that elevator.
- Provide heat detectors within 2' of every sprinkler head in the equip room, pit and top of shaft. (Note that large elevator equip rooms may have more than one sprinkler head)

**Fire Protection Systems:**

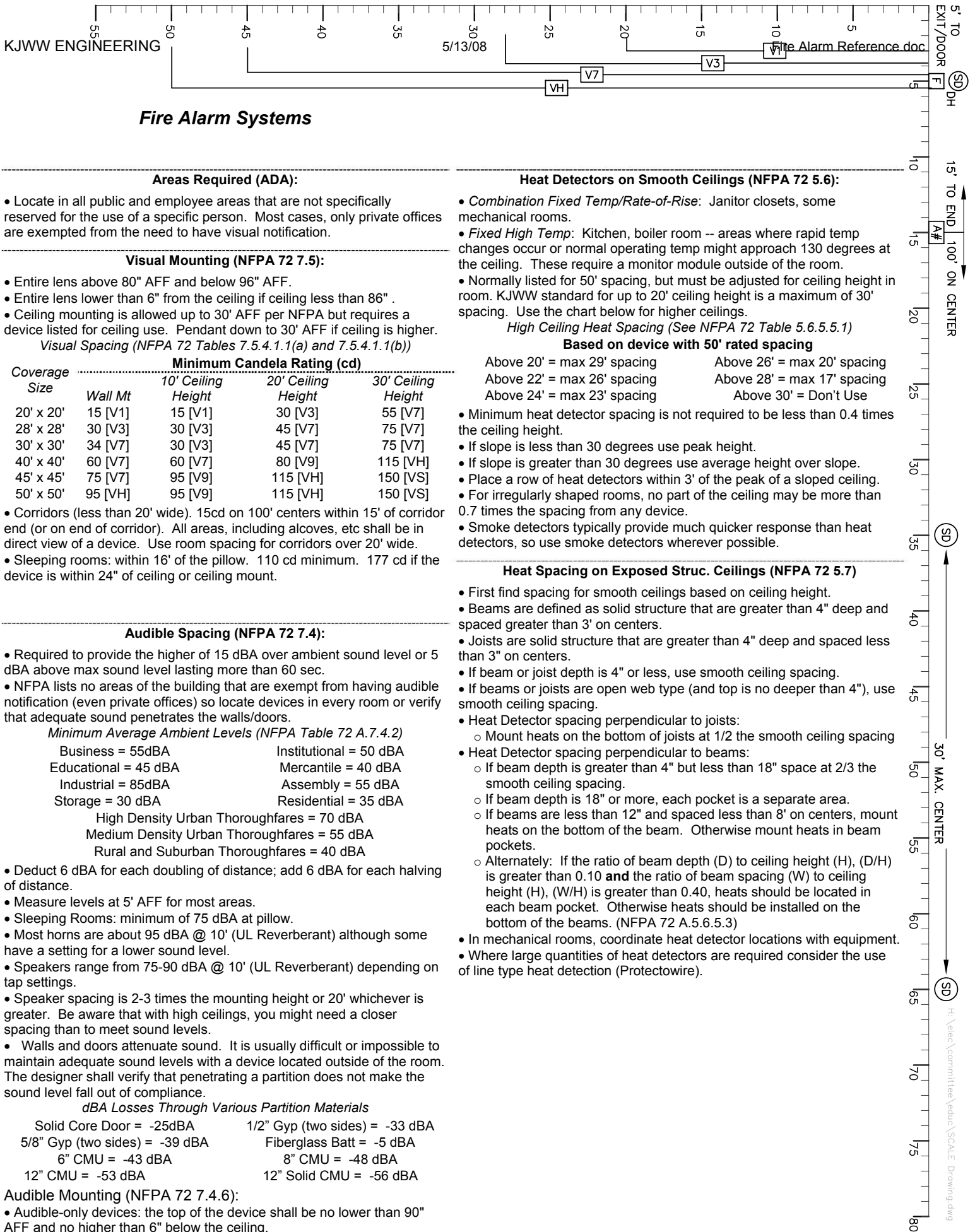
- Provide one monitor module for each flow switch.
- Provide one monitor module for each group of tamper switches, in a single location.
- Provide addressable relay and power connection to sprinkler bell.
- Some local codes also require a weatherproof strobe over the fire department sprinkler connection.

**Double-Interlock Preaction Dry Pipe Systems**

- Sprinkler system will not fill with water unless it receives a signal from the fire alarm. Complete and conservative fire alarm coverage is required for the sprinkler system to function.
- Addressable relays (1 per zone) to interface with release panel.
- Monitor modules (coordinate with mechanical) to monitor release panel status, tamper and trouble conditions.
- Coordinate with mechanical for other requirements.

**Rated Door Releasing**

- Separate Material List items are available for each scenario. Show the appropriate door hold symbol, an addressable relay, power (coordinate voltage) and smoke detection for each of these instances.
- Magnetic Door Hold
  - Provided by EC. Coordinate wall or floor mounted.
  - Usually used in retrofits.
- Integral Door Hold (built into the door)
  - Provided by GC, Wired by EC.
- Power Door Override
  - Provided by GC, Modified and Wired by EC.
  - Most power door operators have a toggle switch that holds the door in the open position. If these doors are in rated partitions, this switch needs to be overridden by a fire alarm addressable relay (to allow the door to close). In many cases, this involves a modification of the internal wiring of the operator.



## Fire Alarm Systems

### Areas Required (ADA):

- Locate in all public and employee areas that are not specifically reserved for the use of a specific person. Most cases, only private offices are exempted from the need to have visual notification.

### Visual Mounting (NFPA 72 7.5):

- Entire lens above 80" AFF and below 96" AFF.
  - Entire lens lower than 6" from the ceiling if ceiling less than 86".
  - Ceiling mounting is allowed up to 30' AFF per NFPA but requires a device listed for ceiling use. Pendant down to 30' AFF if ceiling is higher.
- Visual Spacing (NFPA 72 Tables 7.5.4.1.1(a) and 7.5.4.1.1(b))*

Coverage Size	Wall Mt	Minimum Candela Rating (cd)		
		10' Ceiling Height	20' Ceiling Height	30' Ceiling Height
20' x 20'	15 [V1]	15 [V1]	30 [V3]	55 [V7]
28' x 28'	30 [V3]	30 [V3]	45 [V7]	75 [V7]
30' x 30'	34 [V7]	30 [V3]	45 [V7]	75 [V7]
40' x 40'	60 [V7]	60 [V7]	80 [V9]	115 [VH]
45' x 45'	75 [V7]	95 [V9]	115 [VH]	150 [VS]
50' x 50'	95 [VH]	95 [V9]	115 [VH]	150 [VS]

- Corridors (less than 20' wide). 15cd on 100' centers within 15' of corridor end (or on end of corridor). All areas, including alcoves, etc shall be in direct view of a device. Use room spacing for corridors over 20' wide.
- Sleeping rooms: within 16' of the pillow. 110 cd minimum. 177 cd if the device is within 24" of ceiling or ceiling mount.

### Audible Spacing (NFPA 72 7.4):

- Required to provide the higher of 15 dBA over ambient sound level or 5 dBA above max sound level lasting more than 60 sec.
- NFPA lists no areas of the building that are exempt from having audible notification (even private offices) so locate devices in every room or verify that adequate sound penetrates the walls/doors.

#### Minimum Average Ambient Levels (NFPA Table 72 A.7.4.2)

Business = 55dBA	Institutional = 50 dBA
Educational = 45 dBA	Mercantile = 40 dBA
Industrial = 85dBA	Assembly = 55 dBA
Storage = 30 dBA	Residential = 35 dBA
High Density Urban Thoroughfares = 70 dBA	
Medium Density Urban Thoroughfares = 55 dBA	
Rural and Suburban Thoroughfares = 40 dBA	

- Deduct 6 dBA for each doubling of distance; add 6 dBA for each halving of distance.
- Measure levels at 5' AFF for most areas.
- Sleeping Rooms: minimum of 75 dBA at pillow.
- Most horns are about 95 dBA @ 10' (UL Reverberant) although some have a setting for a lower sound level.
- Speakers range from 75-90 dBA @ 10' (UL Reverberant) depending on tap settings.
- Speaker spacing is 2-3 times the mounting height or 20' whichever is greater. Be aware that with high ceilings, you might need a closer spacing than to meet sound levels.
- Walls and doors attenuate sound. It is usually difficult or impossible to maintain adequate sound levels with a device located outside of the room. The designer shall verify that penetrating a partition does not make the sound level fall out of compliance.

#### dBa Losses Through Various Partition Materials

Solid Core Door = -25dBA	1/2" Gyp (two sides) = -33 dBA
5/8" Gyp (two sides) = -39 dBA	Fiberglass Batt = -5 dBA
6" CMU = -43 dBA	8" CMU = -48 dBA
12" CMU = -53 dBA	12" Solid CMU = -56 dBA

### Audible Mounting (NFPA 72 7.4.6):

- Audible-only devices: the top of the device shall be no lower than 90" AFF and no higher than 6" below the ceiling.
- Audible-visual devices can be mounted as low as 80" to strobe bottom.
- Ceiling audible devices are allowed but sound levels must be met and devices with strobes are limited to 30' AFF.

### Heat Detectors on Smooth Ceilings (NFPA 72 5.6):

- **Combination Fixed Temp/Rate-of-Rise:** Janitor closets, some mechanical rooms.
- **Fixed High Temp:** Kitchen, boiler room -- areas where rapid temp changes occur or normal operating temp might approach 130 degrees at the ceiling. These require a monitor module outside of the room.
- Normally listed for 50' spacing, but must be adjusted for ceiling height in room. KJWW standard for up to 20' ceiling height is a maximum of 30' spacing. Use the chart below for higher ceilings.

#### High Ceiling Heat Spacing (See NFPA 72 Table 5.6.5.5.1)

##### Based on device with 50' rated spacing

Above 20' = max 29' spacing	Above 26' = max 20' spacing
Above 22' = max 26' spacing	Above 28' = max 17' spacing
Above 24' = max 23' spacing	Above 30' = Don't Use

- Minimum heat detector spacing is not required to be less than 0.4 times the ceiling height.
- If slope is less than 30 degrees use peak height.
- If slope is greater than 30 degrees use average height over slope.
- Place a row of heat detectors within 3' of the peak of a sloped ceiling.
- For irregularly shaped rooms, no part of the ceiling may be more than 0.7 times the spacing from any device.
- Smoke detectors typically provide much quicker response than heat detectors, so use smoke detectors wherever possible.

### Heat Spacing on Exposed Struc. Ceilings (NFPA 72 5.7)

- First find spacing for smooth ceilings based on ceiling height.
- Beams are defined as solid structure that are greater than 4" deep and spaced greater than 3' on centers.
- Joists are solid structure that are greater than 4" deep and spaced less than 3" on centers.
- If beam or joist depth is 4" or less, use smooth ceiling spacing.
- If beams or joists are open web type (and top is no deeper than 4"), use smooth ceiling spacing.
- Heat Detector spacing perpendicular to joists:
  - o Mount heats on the bottom of joists at 1/2 the smooth ceiling spacing
- Heat Detector spacing perpendicular to beams:
  - o If beam depth is greater than 4" but less than 18" space at 2/3 the smooth ceiling spacing.
  - o If beam depth is 18" or more, each pocket is a separate area.
  - o If beams are less than 12" and spaced less than 8' on centers, mount heats on the bottom of the beam. Otherwise mount heats in beam pockets.
  - o Alternately: If the ratio of beam depth (D) to ceiling height (H), (D/H) is greater than 0.10 **and** the ratio of beam spacing (W) to ceiling height (H), (W/H) is greater than 0.40, heats should be located in each beam pocket. Otherwise heats should be installed on the bottom of the beams. (NFPA 72 A.5.6.5.3)
- In mechanical rooms, coordinate heat detector locations with equipment.
- Where large quantities of heat detectors are required consider the use of line type heat detection (Protectowire).

# SYSTEMS SYMBOL LIST

SYMBOL: DESCRIPTION:

WALL	CLG	FLOOR	MOUNT	DESCRIPTION
<b>D</b>	<b>Ⓚ</b>			NURSE CALL – DOME LIGHT
	<b>Ⓚ<sub>Z</sub></b>			NURSE CALL – ZONE DOME LIGHT
<b>N</b>				NURSE CALL – SINGLE PATIENT STATION
<b>N2</b>				NURSE CALL – DUAL PATIENT STATION
<b>NT</b>				NURSE CALL – TOILET STATION PULL CORD
<b>NS</b>				NURSE CALL – SHOWER PULL CORD
<b>NA</b>				NURSE CALL – STAFF ASSIST BUTTON
<b>NE</b>				NURSE CALL – EMERGENCY CALL BUTTON
<b>NEC</b>				NURSE CALL – PATIENT WITH CODE BLUE
<b>NC</b>				NURSE CALL – CODE BLUE BUTTON
<b>NL</b>	<b>Ⓚ</b>			NURSE CALL – PRESENCE LOCATOR
<b>DTY</b>				NURSE CALL – DUTY STATION
<b>STF</b>				NURSE CALL – STAFF STATION
<b>NR</b>				NURSE CALL – EQUIPMENT RECEPTACLE
<b>NB</b>				NURSE CALL – BED INTERFACE
<b>MAS</b>				NURSE CALL – MASTER STATION
<b>NCA</b>				NURSE CALL – VISUAL ANNUNCIATOR

## OPTIONS:

Patient Bed	Headwall location, patient console, or wall mount Pillow Speaker- Push Button, Geriatric light pressure call Button, Air bulb call switch Pillow Speaker- Push Button, Entertainment - TV - Radio Patient Light Controls, Motorized Shade control Bed Interface to Hill-Rom Side Comm & Stryker beds
Staff Locator	Infrared, RF radio frequency, badge, manual push button
Equipment Locator	Infrared, RF radio frequency
Wireless Interface	wireless phone, tablet, pocket pager
Infant Abduction Alarm	RF radio frequency, bractlet
Geriatric Wander Alarm	RF radio frequency, ankle bractlet
Hospital HL7	Admit, Discharge, transfer information

## NURSE CALL SYSTEM

	Hospital Chap. 7	Nursing Chap. 8	Outpatient Chap. 9	Rehab Chap. 10	Psychiatric Chap. 11
LOCATION	A/V System	Visual System	Not Required	Visual System	Not Required
Admissions / Discharge	<b>NE</b>				
Bath / Shower / Sitz	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	
Cardiac Cath Lab	<b>NE</b>				
Charting	<b>DTY</b>				
Clean Linen	<b>DTY</b>	<b>DTY</b>		<b>DTY</b>	
Corridor	<b>Ⓚ</b> <b>Ⓚ</b> <b>Ⓚ</b> <b>Ⓚ<sub>Z</sub></b>	<b>Ⓚ</b> <b>Ⓚ</b> <b>Ⓚ</b> <b>Ⓚ<sub>Z</sub></b>	<b>Ⓚ</b> <b>Ⓚ</b> <b>Ⓚ</b> <b>Ⓚ<sub>Z</sub></b>	<b>Ⓚ</b> <b>Ⓚ</b> <b>Ⓚ</b> <b>Ⓚ<sub>Z</sub></b>	<b>Ⓚ</b> <b>Ⓚ</b> <b>Ⓚ</b> <b>Ⓚ<sub>Z</sub></b>
Critical Care	<b>N</b> <b>NE</b> <b>NC</b>				
Emerg. Exam / Treatment	<b>NE</b> <b>NC</b>				
Equipment Storage	<b>DTY</b>				
Exam / Treatment	<b>NE</b> <b>NC</b>		<b>NE</b>		
Imaging Suite Patient Toilets	<b>NT</b>		<b>NT</b>		
Intermediate Care (ICU)	<b>NE</b> <b>NC</b>				
Isolation / Seclusion	<b>NE</b>				
Medication	<b>DTY</b>				
Nourishment	<b>DTY</b>				
Nurse Station	<b>MAS</b>	<b>MAS</b>		<b>MAS</b>	
Nursery	<b>NE</b> <b>NC</b>				
O.R. / Delivery	<b>NE</b> <b>NC</b>		<b>NE</b> <b>NC</b>		
Outpatient Surgery	<b>NE</b>		<b>NE</b>		
Patient Bed	<b>N</b> <b>N2</b>	<b>N</b> <b>N2</b>		<b>N</b> <b>N2</b>	<b>N</b> <b>N2</b> <b>NE</b> removable or cover
Patient Toilet	<b>NT</b>	<b>NT</b>	<b>NT</b>	<b>NT</b>	
Pre-OP	<b>N</b> <b>NC</b>	<b>N</b> <b>NC</b>	<b>N</b> <b>NC</b>		
Procedure Room	<b>NE</b> <b>NC</b>		<b>NE</b> <b>NC</b>		
Psychiatric Toilet, Bathing, Dining, Activity, Exam, Treatment	<b>NE</b> tamper				<b>NE</b> tamper
Renal Dialysis Patient Toilet	<b>NT</b>		<b>NT</b>		
Recovery, PACU	<b>N</b> <b>NE</b> <b>NC</b>	<b>N</b>			
Soiled Utility	<b>DTY</b>	<b>DTY</b>		<b>DTY</b>	
Staff Lounge	<b>DTY</b> <b>STF</b>		<b>DTY</b> <b>STF</b>		
Stress Test / E.K.G.	<b>NE</b> <b>NC</b>				
Triage	<b>NE</b> <b>NC</b>				

## NOTES:

1. Reference : 2006 Edition of AIA Guidelines For Design and Construction of Hospital and Health Care Facilities.
2. Devices shown DARK are AIA minimum. Devices shown light are optional.
3. All devices in Psychiatric areas shall be tamper resistant.

**ESSENTIAL ELECTRICAL DISTRIBUTION**

Type 1 Systems  
 NFPA 99 Section 4.4.2.2  
 NEC 517 Section III 517.30

based on NFPA 2002 version  
 based on NEC 2008 version

**EMERGENCY SYSTEM**

(transfer within 10 seconds)  
 NFPA 99 4.4.2.2.2 NEC 517.31

**EQUIPMENT SYSTEM**

NFPA 99 4.4.2.2.3 NEC 517.34

**LIFE SAFETY BRANCH**

NFPA 99. 4.4.2.2.2.2  
 NEC 517.32

**CRITICAL BRANCH**

NFPA 99. 4.4.2.2.2.3  
 NEC 517.33

**DELAYED AUTOMATIC CONNECTION**

NFPA 99. 4.4.2.2.3.4  
 NEC 517.34 (A)

**DELAYED OR MANUAL CONNECTION**

NFPA 99. 4.4.2.2.3.5  
 NEC 517.34 (B)

- |  |   |  |  |
|--|---|--|--|
| <p>1 egress illumination</p> <p>2 exit signs [101 7.10]</p> <p>3 fire alarms [101.9.6] &amp; medical gas alarms [99 4.4.2.2.2(3)]</p> <p>4 emergency communication systems</p> <p>5 generator task illumination, selected receptacles</p> <p>6 elevator cab (lighting, controls, communications and signals systems)</p> <p>7 egress automatic doors [99:4.4.2.2.2(7)]</p> <p>8 transfer switch location illumination</p> <p>9 generator set accessories as required for generator performance</p> | <p>1 critical location using anesthesia gases, task illumination, selected receptacles, and fixed equipment</p> <p>2 isolated power systems</p> <p>3 patient care area - task illumination &amp; selected receptacles in nurseries: selected acute nursing areas, med prep, pharmacy dispensing and psychiatric bed areas: ward treatment rooms; nurses' stations.</p> <p>4 additional specialized patient care task illumination and receptacles</p> <p>5 nurse call systems, telemetry</p> <p>6 blood, bone, tissue banks</p> <p>7 telephone rooms, closets</p> <p>8 task illumination, selected receptacles/power circuits for: general care beds, angiographic, cardiac, catheterization &amp; human physiology labs; coronary/ICU units; hemodialysis, emergency treatment room, post-op recovery rooms</p> <p>9 additional task illumination receptacles &amp; selected power circuits for effective facilities operation. Single phase fractional horsepower motors. [99:4.4.2.2.3(9)]</p> | <p>1 central suction (vacuum) permitted to be on critical</p> <p>2 sump pumps</p> <p>3 compressed air systems (permitted to be on critical branch also)</p> <p>4 smoke control and stair pressurization systems</p> <p>5 kitchen ventilation hoods</p> <p>6 supply, return and/or exhaust systems for infectious/isolation rooms, protective environment, lab fume hoods, nuclear med. Lab, ETO evacuation, anesthetic evacuation</p> <p>7 controls for equipment listed in 99:4.4.2.2.3 Generator transfer fuel pump, motorized louvers,</p> <p>8 supply, return and/or exhaust systems for operating and delivery rooms nuclear med. Lab, ETO evacuation, anesthetic evacuation</p> <p>9 other selected equipment (kitchen, laundry, radiology, refrigeration, etc.)</p> | <p>1 heating equipment [517.34(B)(1)]</p> <p>2 selected elevators [517.34 (B)(2)]</p> <p>3 selected ventilation (OR, ICU, nurseries, lab hoods, etc.)</p> <p>4 hyperbaric facilities</p> <p>5 hypobaric facilities</p> <p>6 power operated doors</p> <p>7 autoclaves</p> <p>8 controls for equipment listed in 99:4.4.2.2.3.5(8)</p> |
|--|---|--|--|