



# 2014

## Electrical Design/Build Guide

Based on the 2014  
National Electrical Code

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# **Electrical Design/Build Guide 2014**

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**Standard Conduit Fill**  
**THHN, THWN, THWN-2 Type Conductors**  
**All Conductors of Same Size**

**40% Fill (3-Conductors or More)**

WIRE SIZE	CONDUIT TRADE SIZE IN INCHES											
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"	6"
14	11	21	33	52	76	134	193	291	396	517	801	1171
12	8	15	24	38	56	97	141	212	289	377	584	854
10	5	9	15	24	35	61	89	134	182	238	368	538
8	3	5	9	14	20	35	51	77	105	137	212	310
6		4	6	10	14	25	37	55	76	99	153	224
4			4	6	9	15	22	34	46	61	94	138
3			3	5	7	13	19	29	39	51	80	116
2			3	4	6	11	16	24	33	43	67	98
1				3	4	8	12	18	24	32	49	72
1/0					4	7	10	15	20	27	42	61
2/0					3	6	8	12	17	22	35	51
3/0						5	7	10	14	18	29	42
4/0						4	6	8	12	15	24	35
250						3	4	7	9	12	19	28
300						3	4	6	8	11	17	24
350							3	5	7	9	15	21
400							3	5	6	8	13	19
500								4	5	7	11	16
600								3	4	5	9	13
700								3	4	5	8	11
750									3	4	7	11

**31% Fill (2-Conductors)**

WIRE SIZE	CONDUIT TRADE SIZE IN INCHES											
	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	3 1/2"	4"	5"	6"
14	2	2	2	2	2	2	2	2	2	2	2	2
12	2	2	2	2	2	2	2	2	2	2	2	2
10	2	2	2	2	2	2	2	2	2	2	2	2
8	2	2	2	2	2	2	2	2	2	2	2	2
6		2	2	2	2	2	2	2	2	2	2	2
4		2	2	2	2	2	2	2	2	2	2	2
3			2	2	2	2	2	2	2	2	2	2
2			2	2	2	2	2	2	2	2	2	2
1				2	2	2	2	2	2	2	2	2
1/0				2	2	2	2	2	2	2	2	2
2/0					2	2	2	2	2	2	2	2
3/0					2	2	2	2	2	2	2	2
4/0						2	2	2	2	2	2	2
250						2	2	2	2	2	2	2
300						2	2	2	2	2	2	2
350						2	2	2	2	2	2	2
400							2	2	2	2	2	2
500							2	2	2	2	2	2
600								2	2	2	2	2
700								2	2	2	2	2
750								2	2	2	2	2

NOTE: Use this table for all conduit types except PVC Schedule 80 , ENT, and Liquidtight Flexible Nonmetallic Conduits.



**60° C Copper Ampacity**  
**4 - Wire Fill - (Current Carrying Neutral)**  
**2 or 3 - Parallel Raceways**

1	2	3	4	5	6	7	8	9	10	11
DERATED AMPS 80%	60° C WIRE SIZE AWG	GND WIRE SIZE AWG	4-WIRE (40% FILL) CONDUIT SIZE				4-WIRE WITH GROUND (40% FILL) CONDUIT SIZE			
			THW	RHH RHW	THWN THHN	XHHW	THW	RHH RHW	THWN THHN	XHHW
	NOTE #3	NOTE #1 & 3		NOTE #2				NOTE #2		

**2 - PARALLEL RACEWAYS (NOTE #3)**

200	2-1/0	2-6	2-2"	2-2"	2-1 1/2"	2-1 1/2"	2-2"	2-2 1/2"	2-2"	2-2"
232	2-2/0	2-4	2-2"	2-2 1/2"	2-2"	2-2"	2-2"	2-2 1/2"	2-2"	2-2"
264	2-3/0	2-4	2-2"	2-2 1/2"	2-2"	2-2"	2-2 1/2"	2-2 1/2"	2-2"	2-2"
312	2-4/0	2-3	2-2 1/2"	2-2 1/2"	2-2"	2-2"	2-2 1/2"	2-3"	2-2 1/2"	2-2 1/2"
344	2-250	2-3	2-2 1/2"	2-3"	2-2 1/2"	2-2 1/2"	2-3"	2-3"	2-2 1/2"	2-2 1/2"
384	2-300	2-3	2-3"	2-3"	2-2 1/2"	2-2 1/2"	2-3"	2-3 1/2"	2-3"	2-3"
416	2-350	2-2	2-3"	2-3 1/2"	2-3"	2-3"	2-3"	2-3 1/2"	2-3"	2-3"
448	2-400	2-2	2-3"	2-3 1/2"	2-3"	2-3"	2-3"	2-3 1/2"	2-3"	2-3"
512	2-500	2-1	2-3 1/2"	2-3 1/2"	2-3"	2-3"	2-3 1/2"	2-4"	2-3 1/2"	2-3 1/2"
560	2-600	2-1	2-3 1/2"	2-4"	2-3 1/2"	2-3 1/2"	2-4"	2-5"	2-3 1/2"	2-3 1/2"
616	2-700	2-1/0	2-4"	2-5"	2-3 1/2"	2-3 1/2"	2-4"	2-5"	2-4"	2-4"
640	2-750	2-1/0	2-4"	2-5"	2-4"	2-4"	2-4"	2-5"	2-4"	2-4"

**3 - PARALLEL RACEWAYS (NOTE #3)**

300	3-1/0	3-4	3-2"	3-2"	3-1 1/2"	3-1 1/2"	3-2"	3-2 1/2"	3-2"	3-2"
348	3-2/0	3-3	3-2"	3-2 1/2"	3-2"	3-2"	3-2"	3-2 1/2"	3-2"	3-2"
396	3-3/0	3-3	3-2"	3-2 1/2"	3-2"	3-2"	3-2 1/2"	3-2 1/2"	3-2"	3-2"
468	3-4/0	3-2	3-2 1/2"	3-2 1/2"	3-2"	3-2"	3-2 1/2"	3-3"	3-2 1/2"	3-2 1/2"
516	3-250	3-1	3-2 1/2"	3-3"	3-2 1/2"	3-2 1/2"	3-3"	3-3"	3-2 1/2"	3-2 1/2"
576	3-300	3-1	3-3"	3-3"	3-2 1/2"	3-2 1/2"	3-3"	3-3 1/2"	3-3"	3-3"
624	3-350	3-1/0	3-3"	3-3 1/2"	3-3"	3-3"	3-3"	3-3 1/2"	3-3"	3-3"
672	3-400	3-1/0	3-3"	3-3 1/2"	3-3"	3-3"	3-3 1/2"	3-3 1/2"	3-3"	3-3"
768	3-500	3-1/0	3-3 1/2"	3-3 1/2"	3-3"	3-3"	3-3 1/2"	3-4"	3-3 1/2"	3-3 1/2"
840	3-600	3-2/0	3-3 1/2"	3-4"	3-3 1/2"	3-3 1/2"	3-4"	3-5"	3-3 1/2"	3-3 1/2"
924	3-700	3-2/0	3-4"	3-5"	3-3 1/2"	3-3 1/2"	3-4"	3-5"	3-4"	3-4"
960	3-750	3-2/0	3-4"	3-5"	3-4"	3-4"	3-4"	3-5"	3-4"	3-4"

- NOTES: 1. Ground wire sizes are based on non-derated ampacity of phase conductors.  
 2. RHW and RHH conductor fill with outer covering.  
 3. Multiple conductors are per phase, neutral, and ground wire (1-each ) per raceway.

## 75° C Copper Ampacity

### 4 - Wire Fill - (Non-Current Carrying Neutral)

#### 2 or 3 - Parallel Raceways

1	2	3	4	5	6	7	8	9	10	11
	75° C WIRE SIZE AWG	GND WIRE SIZE AWG	4-WIRE (40% FILL) CONDUIT SIZE				4-WIRE WITH GROUND (40% FILL) CONDUIT SIZE			
AMPS			THW	RHH RHW	THWN THHN	XHHW	THW	RHH RHW	THWN THHN	XHHW
	NOTE #3	NOTE #1 & 3		NOTE #2				NOTE #2		

#### 2 - PARALLEL RACEWAYS (NOTE #3)

300	2-1/0	2-4	2-2"	2-2"	2-1 1/2"	2-1 1/2"	2-2"	2-2 1/2"	2-2"	2-2"
350	2-2/0	2-3	2-2"	2-2 1/2"	2-2"	2-2"	2-2"	2-2 1/2"	2-2"	2-2"
400	2-3/0	2-3	2-2"	2-2 1/2"	2-2"	2-2"	2-2 1/2"	2-2 1/2"	2-2"	2-2"
460	2-4/0	2-2	2-2 1/2"	2-2 1/2"	2-2"	2-2"	2-2 1/2"	2-3"	2-2 1/2"	2-2 1/2"
510	2-250	2-1	2-2 1/2"	2-3"	2-2 1/2"	2-2 1/2"	2-3"	2-3"	2-2 1/2"	2-2 1/2"
570	2-300	2-1	2-3"	2-3"	2-2 1/2"	2-2 1/2"	2-3"	2-3 1/2"	2-3"	2-3"
620	2-350	2-1/0	2-3"	2-3 1/2"	2-3"	2-3"	2-3"	2-3 1/2"	2-3"	2-3"
670	2-400	2-1/0	2-3"	2-3 1/2"	2-3"	2-3"	2-3 1/2"	2-3 1/2"	2-3"	2-3"
760	2-500	2-1/0	2-3 1/2"	2-3 1/2"	2-3"	2-3"	2-3 1/2"	2-4"	2-3 1/2"	2-3 1/2"
840	2-600	2-2/0	2-3 1/2"	2-4"	2-3 1/2"	2-3 1/2"	2-4"	2-5"	2-3 1/2"	2-3 1/2"
920	2-700	2-2/0	2-4"	2-5"	2-3 1/2"	2-3 1/2"	2-4"	2-5"	2-4"	2-4"
950	2-750	2-2/0	2-4"	2-5"	2-4"	2-4"	2-4"	2-5"	2-4"	2-4"

#### 3 - PARALLEL RACEWAYS (NOTE #3)

450	3-1/0	3-2	3-2"	3-2"	3-1 1/2"	3-1 1/2"	3-2"	3-2 1/2"	3-2"	3-2"
525	3-2/0	3-1	3-2"	3-2 1/2"	3-2"	3-2"	3-2"	3-2 1/2"	3-2"	3-2"
600	3-3/0	3-1	3-2"	3-2 1/2"	3-2"	3-2"	3-2 1/2"	3-3"	3-2"	3-2"
690	3-4/0	3-1/0	3-2 1/2"	3-2 1/2"	3-2"	3-2"	3-2 1/2"	3-3"	3-2 1/2"	3-2 1/2"
765	3-250	3-1/0	3-2 1/2"	3-3"	3-2 1/2"	3-2 1/2"	3-3"	3-3"	3-2 1/2"	3-2 1/2"
855	3-300	3-2/0	3-3"	3-3"	3-2 1/2"	3-2 1/2"	3-3"	3-3 1/2"	3-3"	3-3"
930	3-350	3-2/0	3-3"	3-3 1/2"	3-3"	3-3"	3-3"	3-3 1/2"	3-3"	3-3"
1005	3-400	3-3/0	3-3"	3-3 1/2"	3-3"	3-3"	3-3 1/2"	3-4"	3-3"	3-3"
1140	3-500	3-3/0	3-3 1/2"	3-3 1/2"	3-3"	3-3"	3-3 1/2"	3-4"	3-3 1/2"	3-3 1/2"
1260	3-600	3-4/0	3-3 1/2"	3-4"	3-3 1/2"	3-3 1/2"	3-4"	3-5"	3-3 1/2"	3-3 1/2"
1380	3-700	3-4/0	3-4"	3-5"	3-3 1/2"	3-3 1/2"	3-4"	3-5"	3-4"	3-4"
1425	3-750	3-4/0	3-4"	3-5"	3-4"	3-4"	3-5"	3-5"	3-4"	3-4"

NOTES: 1. Ground wire sizes are based on conductor ampacity as shown in Column 1.

2. RHW and RHH conductor fill with outer covering.

3. Multiple conductors are per phase, neutral, and ground wire (1-each ) per raceway.

**90° C Copper Ampacity**  
**3 - Wire Fill**  
**2 or 3 - Parallel Raceways**

1	2	3	4	5	6	7	8	9	10	11
AMPS	90° C WIRE SIZE	GND WIRE SIZE	3-WIRE (40% FILL) CONDUIT SIZE				3-WIRE WITH GROUND (40% FILL) CONDUIT SIZE			
	AWG	AWG	THW-2	RHH RHW-2	THWN-2 THHN	XHHW	THW-2	RHH RHW-2	THWN-2 THHN	XHHW
	NOTE #3	NOTE #1 & 3		NOTE #2				NOTE #2		

**2 - PARALLEL RACEWAYS (NOTE #3)**

340	2-1/0	2-3	2-1 1/2"	2-2"	2-1 1/2"	2-1 1/2"	2-2"	2-2"	2-1 1/2"	2-1 1/2"
390	2-2/0	2-3	2-1 1/2"	2-2"	2-1 1/2"	2-1 1/2"	2-2"	2-2"	2-2"	2-2"
450	2-3/0	2-2	2-2"	2-2"	2-2"	2-1 1/2"	2-2"	2-2 1/2"	2-2"	2-2"
520	2-4/0	2-1	2-2"	2-2 1/2"	2-2"	2-2"	2-2 1/2"	2-2 1/2"	2-2"	2-2"
580	2-250	2-1	2-2"	2-2 1/2"	2-2"	2-2"	2-2 1/2"	2-3"	2-2 1/2"	2-2 1/2"
640	2-300	2-1/0	2-2 1/2"	2-3"	2-2"	2-2"	2-2 1/2"	2-3"	2-2 1/2"	2-2 1/2"
700	2-350	2-1/0	2-2 1/2"	2-3"	2-2 1/2"	2-2 1/2"	2-3"	2-3"	2-2 1/2"	2-2 1/2"
760	2-400	2-1/0	2-2 1/2"	2-3"	2-2 1/2"	2-2 1/2"	2-3"	2-3 1/2"	2-3"	2-3"
860	2-500	2-2/0	2-3"	2-3"	2-3"	2-3"	2-3"	2-3 1/2"	2-3"	2-3"
950	2-600	2-2/0	2-3"	2-3 1/2"	2-3"	2-3"	2-3 1/2"	2-4"	2-3"	2-3 1/2"
1040	2-700	2-3/0	2-3 1/2"	2-3 1/2"	2-3"	2-3"	2-3 1/2"	2-4"	2-3 1/2"	2-3 1/2"
1070	2-750	2-3/0	2-3 1/2"	2-4"	2-3 1/2"	2-3 1/2"	2-3 1/2"	2-4"	2-3 1/2"	2-3 1/2"

**3 - PARALLEL RACEWAYS (NOTE #3)**

510	3-1/0	3-1	3-1 1/2"	3-2"	3-1 1/2"	3-1 1/2"	3-2"	3-2"	3-1 1/2"	3-1 1/2"
585	3-2/0	3-1	3-1 1/2"	3-2"	3-1 1/2"	3-1 1/2"	3-2"	3-2 1/2"	3-2"	3-2"
675	3-3/0	3-1/0	3-2"	3-2"	3-2"	3-1 1/2"	3-2"	3-2 1/2"	3-2"	3-2"
780	3-4/0	3-1/0	3-2"	3-2 1/2"	3-2"	3-2"	3-2 1/2"	3-2 1/2"	3-2"	3-2"
870	3-250	3-2/0	3-2"	3-2 1/2"	3-2"	3-2"	3-2 1/2"	3-3"	3-2 1/2"	3-2 1/2"
960	3-300	3-2/0	3-2 1/2"	3-3"	3-2"	3-2"	3-2 1/2"	3-3"	3-2 1/2"	3-2 1/2"
1050	3-350	3-3/0	3-2 1/2"	3-3"	3-2 1/2"	3-2 1/2"	3-3"	3-3"	3-2 1/2"	3-2 1/2"
1140	3-400	3-3/0	3-2 1/2"	3-3"	3-2 1/2"	3-2 1/2"	3-3"	3-3 1/2"	3-3"	3-3"
1290	3-500	3-4/0	3-3"	3-3"	3-3"	3-3"	3-3"	3-3 1/2"	3-3"	3-3"
1425	3-600	3-4/0	3-3"	3-3 1/2"	3-3"	3-3"	3-3 1/2"	3-4"	3-3 1/2"	3-3 1/2"
1560	3-700	3-4/0	3-3 1/2"	3-3 1/2"	3-3"	3-3"	3-3 1/2"	3-4"	3-3 1/2"	3-3 1/2"
1605	3-750	3-250	3-3 1/2"	3-4"	3-3 1/2"	3-3 1/2"	3-4"	3-4"	3-3 1/2"	3-3 1/2"

- NOTES: 1. Ground wire sizes are based on conductor ampacity as shown in Column 1.  
2. RHW and RHH conductor fill with outer covering.  
3. Multiple conductors are per phase, neutral, and ground wire (1-each ) per raceway.

## 4 - Wire Panel Schedules

### 60° C - Copper Conductors (Non-Current Carrying Neutral)

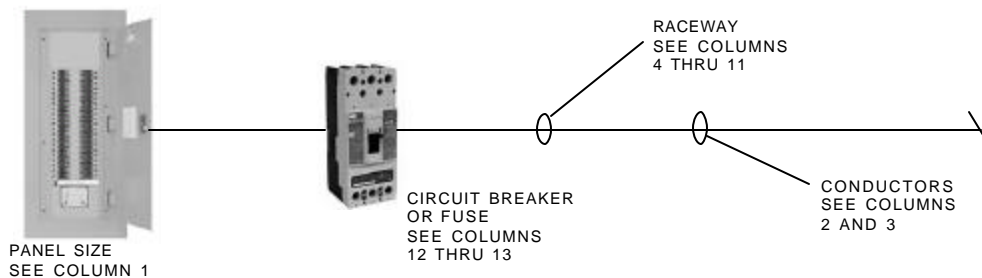
1	2	3	4	5	6	7	8	9	10	11	12	13
PANEL SIZE	CU WIRE SIZE AWG	GND WIRE SIZE AWG	4-WIRE (40% FILL)				4-WIRE WITH GROUND (40% FILL)				BKR FUSE AMPS	FUSED SWITCH SIZE AMPS
AMPS			THW	RHH RHW	THWN THHN	XHHW	THW	RHH RHW	THWN THHN	XHHW		
	NOTE #3	NOTE #1		NOTE #2				NOTE #2				

### 60° C TEMPERATURE RATING

60	4	8	1 1/4"	1 1/4"	1"	1"	1 1/4"	1 1/2"	1 1/4"	1 1/4"	60	60
100	1	6	1 1/2"	2"	1 1/2"	1 1/2"	2"	2"	1 1/2"	1 1/2"	100	100
125	1/0	6	2"	2"	1 1/2"	1 1/2"	2"	2 1/2"	2"	2"	125	200
150	3/0	6	2"	2 1/2"	2"	2"	2 1/2"	2 1/2"	2"	2"	150	200
200	250	4	2 1/2"	3"	2 1/2"	2 1/2"	3"	3"	2 1/2"	2 1/2"	200	200
225	300	4	3"	3"	2 1/2"	2 1/2"	3"	3 1/2"	3"	3"	225	400
300	500	3	3 1/2"	3 1/2"	3"	3"	3 1/2"	4"	3 1/2"	3 1/2"	300	400
400	750	3	4"	5"	4"	4"	4"	5"	4"	4"	400	400
600	2-500	2-1/0	2-3 1/2"	2-3 1/2"	2-3"	2-3"	2-3 1/2"	2-4"	2-3 1/2"	2-3 1/2"	600	600
800	2-750	2-1/0	2-4"	2-5"	2-4"	2-4"	2-4"	2-5"	2-4"	2-4"	800	800
1000	3-600	3-3/0	3-3 1/2"	3-4"	3-3 1/2"	3-3 1/2"	3-4"	3-5"	3-3 1/2"	3-3 1/2"	1000	1000
1200	3-750	3-3/0	3-4"	3-5"	3-4"	3-4"	3-4"	3-5"	3-4"	3-4"	1200	1200
1600	4-750	4-4/0	4-4"	4-5"	4-4"	4-4"	4-5"	4-5"	4-4"	4-4"	1600	1600
2000	5-750	5-250	5-4"	5-5"	5-4"	5-4"	5-5"	5-5"	5-4"	5-4"	2000	2000

NOTES:

1. Ground wire sizes are based on conductor ampacity.
2. RHW and RHH conductor fill with outer covering.
3. Multiple conductors are per phase, neutral, and ground wire (1-each ) per raceway.



## Transformer Ampacity Single Phase

KVA	AMPS 120 V	AMPS 240 V	AMPS 480 V	AMPS 600 V	AMPS 2,400 V	AMPS 4,160 V	AMPS 4,800 V	AMPS 7,200 V	AMPS 7,620 V	AMPS 12,000 V	AMPS 14,400 V
1	8.3	4.2	2.1	1.7	0.42	0.24	0.21	0.14	0.13	0.08	0.07
1.5	12.5	6.3	3.1	2.5	0.63	0.36	0.31	0.21	0.20	0.13	0.10
2	16.7	8.3	4.2	3.3	0.83	0.48	0.42	0.28	0.26	0.17	0.14
3	25.0	12.5	6.3	5.0	1.25	0.72	0.63	0.42	0.39	0.25	0.21
5	41.7	20.8	10.4	8.3	2.08	1.20	1.04	0.69	0.66	0.42	0.35
7.5	62.5	31.3	15.6	12.5	3.13	1.80	1.56	1.04	0.98	0.63	0.52
10	83.3	41.7	20.8	16.7	4.17	2.40	2.08	1.39	1.31	0.83	0.69
15	125	62.5	31.3	25.0	6.25	3.61	3.13	2.08	1.97	1.25	1.04
20	167	83.3	41.7	33.3	8.33	4.81	4.17	2.78	2.62	1.67	1.39
25	208	104	52.1	41.7	10.4	6.01	5.21	3.47	3.28	2.08	1.74
30	250	125	62.5	50.0	12.5	7.21	6.25	4.17	3.94	2.50	2.08
37.5	313	156	78.1	62.5	15.6	9.01	7.81	5.21	4.92	3.13	2.60
50	417	208	104	83.3	20.8	12.0	10.4	6.94	6.56	4.17	3.47
100	833	417	208	167	41.7	24.0	20.8	13.9	13.1	8.33	6.94
150	1,250	625	313	250	62.5	36.1	31.3	20.8	19.7	12.5	10.4
167	1,392	696	348	278	69.6	40.1	34.8	23.2	21.9	13.9	11.6
200	1,667	833	417	333	83.3	48.1	41.7	27.8	26.2	16.7	13.9
250	2,083	1,042	521	417	104	60.1	52.1	34.7	32.8	20.8	17.4
333	2,775	1,388	694	555	139	80.0	69.4	46.3	43.7	27.8	23.1
500	4,167	2,083	1,042	833	208	120	104	69.4	65.6	41.7	34.7

# Single Phase Transformer Schedule

## Primary Side - 480 Volts

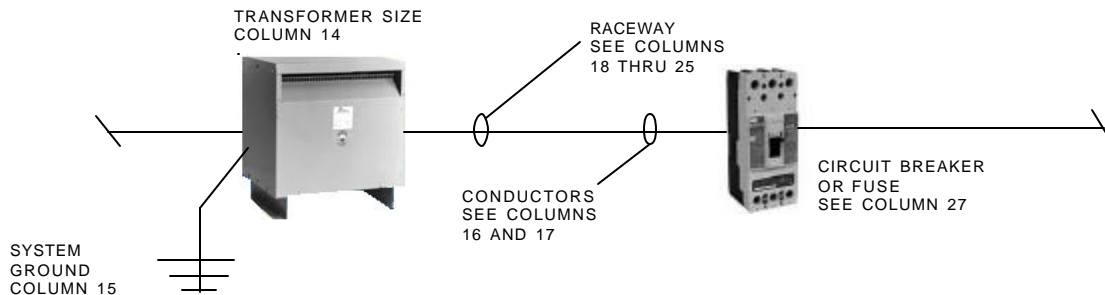
### 60° C Copper Conductors

14	15	16	17	18	19	20	21	22	23	24	25	26	27
PRIMARY SIDE - 480 VOLT - SINGLE PHASE													
TRANSFORMER		CONDUCTORS		RACEWAYS								PRIMARY	
40° C RISE XMFR KVA	SYS. GND WIRE AWG	WIRE SIZE AWG	EQUIP. GND WIRE AWG	2-WIRE (31% FILL)				2-WIRE WITH GROUND (40% FILL)				MAX. LOAD AMPS	BREAKER FUSE SIZE AMPS
				THW	RHH RHW	THWN THHN	XHHW	THW	RHH RHW	THWN THHN	XHHW		
		NOTE #3	NOTE #1		NOTE #2				NOTE #2				

## 60° C COPPER CONDUCTORS

3	8	14	14	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	6.3	10
5	8	14	14	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	10.4	10
7.5	8	14	14	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	15.6	15
10	8	10	10	1/2"	1/2"	1/2"	1/2"	1/2"	3/4"	1/2"	1/2"	20.8	25
15	8	8	10	1/2"	3/4"	1/2"	1/2"	1/2"	1"	1/2"	1/2"	31.3	35
25	6	4	8	1"	1"	3/4"	3/4"	1"	1 1/4"	3/4"	1"	52.1	60
37.5	2	2	8	1"	1 1/4"	1"	1"	1"	1 1/4"	1"	1"	78.1	90
50	2	1/0	6	1 1/2"	1 1/2"	1 1/4"	1 1/4"	1 1/2"	1 1/2"	1 1/4"	1 1/4"	104	125
75	2/0	4/0	6	2"	2"	® 2"	1 1/2"	2"	2"	® 1 1/2"	1 1/2"	156	175
100	3/0	350	4	® 2 1/2"	2 1/2"	2"	2"	® 2"	2 1/2"	2"	2"	208	250
167	3/0	3-2/0	3-2	1 1/2"	2"	1 1/2"	1 1/4"	1 1/2"	2"	1 1/2"	1 1/2"	348	400

- NOTES:
1. Equipment Ground wire sizes are based on conductor ampacity.
  2. RHW and RHH conductor fill with outer covering.
  3. Multiple conductors are per phase, neutral, and ground wire (1-each ) per raceway.
- ® 2-wire with ground results in a smaller conduit size than 2-wire with no ground.



# Motor Schedules - 60° C Conductors

1	2	3	4	5	6	7	8	9	10
HP	FLA	KW	WIRE SIZE AWG	GND WIRE SIZE AWG	MAX WIRE LENGTH FEET	CONDUIT SIZE 3-WIRE (40% FILL)			
						THW	RHH RHW	THWN THHN	XHHW
						NOTE #1	NOTE #2		

## 115 Volt Three Phase

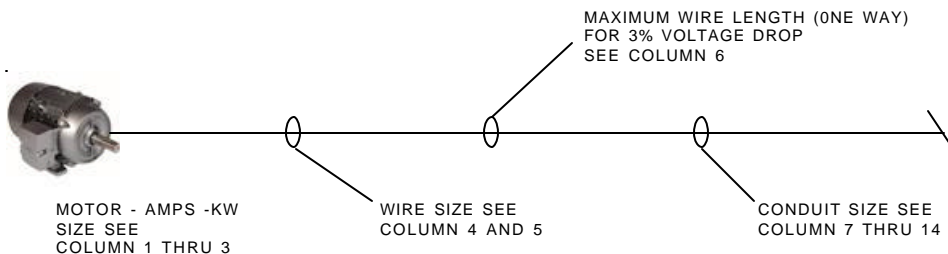
1/2	4.4	0.9	14	14	146'	1/2"	1/2"	1/2"	1/2"
3/4	6.4	1.3	14	14	100'	1/2"	1/2"	1/2"	1/2"
1	8.4	1.7	14	14	76'	1/2"	1/2"	1/2"	1/2"
1 1/2	12	2.4	14	14	54'	1/2"	1/2"	1/2"	1/2"
2	13.6	2.7	12	12	73'	1/2"	1/2"	1/2"	1/2"

## 200 Volt Three Phase

1/2	2.5	0.9	14	14	447'	1/2"	1/2"	1/2"	1/2"
3/4	3.7	1.3	14	14	302'	1/2"	1/2"	1/2"	1/2"
1	4.8	1.7	14	14	233'	1/2"	1/2"	1/2"	1/2"
1 1/2	6.9	2.4	14	14	162'	1/2"	1/2"	1/2"	1/2"
2	7.8	2.7	14	14	143'	1/2"	1/2"	1/2"	1/2"
3	11	3.8	14	14	102'	1/2"	1/2"	1/2"	1/2"
5	17.5	6.1	10	10	165'	1/2"	3/4"	1/2"	1/2"
7 1/2	25.3	8.8	8	10	176'	3/4"	1"	1/2"	3/4"
10	32.2	11.1	6	10	220'	1"	1"	3/4"	3/4"
15	48.3	16.7	4	8	231'	1"	1 1/4"	1"	1"
20	62.1	21.5	3	8	223'	1"	1 1/4"	1"	1"
25	78.2	27.1	1	6	277'	1 1/2"	2"	1 1/4"	1 1/4"
30	92	32	1/0	6	314'	1 1/2"	2"	1 1/2"	1 1/2"
40	120	42	3/0	6	365'	2"	2"	2"	1 1/2"
50	150	52	4/0	4	367'	2"	2 1/2"	2"	2"
60	177	61	300	4	435'	2 1/2"	3"	2"	2"
75	221	76	400	3	448'	2 1/2"	3"	2 1/2"	2 1/2"
100	285	99	700	2	579'	3 1/2"	3 1/2"	3"	3"
125	359	124	2-300	2-1	429'	2-2 1/2"	2-3"	2-2"	2-2"
150	414	143	2-350	2-1/0	429'	2-2 1/2"	2-3"	2-2 1/2"	2-2 1/2"
200	552	191	2-600	2-1/0	502'	2-3"	2-3 1/2"	2-3"	2-3"

**NOTES:**

1. Maximum wire length (one-way) for 3% voltage drop.
2. RHW and RHH conductor fill with outer covering.
3. Disconnects must be horsepower rated.
4. @ May require larger size if fused switch is used.



# Motor Schedules - 75° C Conductors

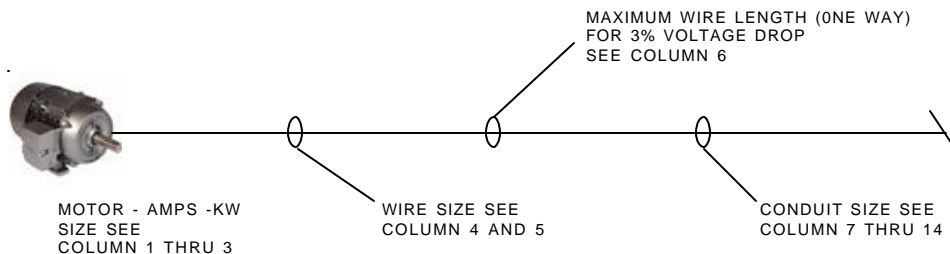
1	2	3	4	5	6	7	8	9	10
HP	FLA	KW	WIRE SIZE AWG	GND WIRE SIZE AWG	MAX WIRE LENGTH FEET	CONDUIT SIZE 3-WIRE (40% FILL)			
						THW	RHH RHW	THWN THHN	XHHW
						NOTE #1	NOTE #2		

## 460 Volt Three Phase

1/2	1.1	0.9	14	14	2337'	1/2"	1/2"	1/2"	1/2"
3/4	1.6	1.3	14	14	1606'	1/2"	1/2"	1/2"	1/2"
1	2.1	1.7	14	14	1224'	1/2"	1/2"	1/2"	1/2"
1 1/2	3	2.4	14	14	857'	1/2"	1/2"	1/2"	1/2"
2	3.4	2.7	14	14	756'	1/2"	1/2"	1/2"	1/2"
3	4.8	3.8	14	14	535'	1/2"	1/2"	1/2"	1/2"
5	7.6	6.1	14	14	338'	1/2"	1/2"	1/2"	1/2"
7 1/2	11	8.8	14	14	234'	1/2"	1/2"	1/2"	1/2"
10	14	11.2	12	12	285'	1/2"	1/2"	1/2"	1/2"
15	21	16.7	10	10	316'	1/2"	3/4"	1/2"	1/2"
20	27	21.5	8	10	378'	3/4"	1"	1/2"	3/4"
25	34	27.1	8	10	300'	3/4"	1"	1/2"	3/4"
30	40	32	8	8	255'	3/4"	1"	1/2"	3/4"
40	52	41	6	8	313'	1"	1"	3/4"	3/4"
50	65	52	4	6	395'	1"	1 1/4"	1"	1"
60	77	61	3	6	414'	1"	1 1/4"	1"	1"
75	96	76	1	6	519'	1 1/2"	2"	1 1/4"	1 1/4"
100	124	99	2/0	6	643'	1 1/2"	2"	1 1/2"	1 1/2"
125	156	124	3/0	4	647'	2"	2"	2"	1 1/2"
150	180	143	4/0	4	703'	2"	2 1/2"	2"	2"
200	240	191	350	3	851'	2 1/2"	3"	2 1/2"	2 1/2"
250	302	241	500	2	910'	3"	3"	3"	3"
300	361	288	700	1	1051'	3 1/2"	3 1/2"	3"	3"
350	414	330	2-300	2-1/0	428'	2-2 1/2"	2-3"	2-2"	2-2"
400	477	380	2-350	2-1/0	857'	2-2 1/2"	2-3"	2-2 1/2"	2-2 1/2"
450	515	410	2-400	2-1/0	884'	2-2 1/2"	2-3"	2-2 1/2"	2-2 1/2"
500	590	470	2-500	2-2/0	931'	2-3"	2-3"	2-3"	2-3"

**NOTES:**

1. Maximum wire length (one-way) for 3% voltage drop.
2. RHW and RHH conductor fill with outer covering.
3. Disconnects must be horsepower rated.
4. @ May require larger size if fused switch is used.





# Motor Schedules - 90° C Conductors

1	2	3	4	5	6	7	8	9	10
HP	FLA	KW	WIRE SIZE AWG	GND WIRE SIZE AWG	MAX WIRE LENGTH FEET	CONDUIT SIZE 2-WIRE (31% FILL)			
						THW-2	RHH RHW-2	THWN-2 THHN	XHHW
						NOTE #1	NOTE #2		

## 208 Volt Single Phase

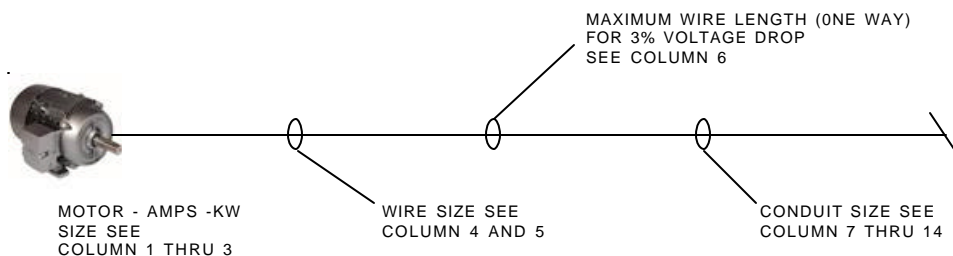
1/6	2.4	0.5	14	14	419'	1/2"	1/2"	1/2"	1/2"
1/4	3.2	0.7	14	14	315'	1/2"	1/2"	1/2"	1/2"
1/3	4	0.8	14	14	252'	1/2"	1/2"	1/2"	1/2"
1/2	5.4	1.1	14	14	186'	1/2"	1/2"	1/2"	1/2"
3/4	7.6	1.6	14	14	132'	1/2"	1/2"	1/2"	1/2"
1	8.8	1.8	14	14	114'	1/2"	1/2"	1/2"	1/2"
1 1/2	11	2.3	14	14	91'	1/2"	1/2"	1/2"	1/2"
2	13.2	2.7	12	12	118'	1/2"	1/2"	1/2"	1/2"
3	18.7	3.9	10	10	139'	1/2"	1/2"	1/2"	1/2"
5	30.8	6.4	8	10	130'	1/2"	3/4"	1/2"	1/2"
7 1/2	44	9.2	8	8	91'	3/4"	3/4"	1/2"	1/2"
10	55	11.4	6	8	116'	3/4"	1"	3/4"	3/4"

## 230 Volt Single Phase

1/6	2.2	0.5	14	14	506'	1/2"	1/2"	1/2"	1/2"
1/4	2.9	0.7	14	14	384'	1/2"	1/2"	1/2"	1/2"
1/3	3.6	0.8	14	14	309'	1/2"	1/2"	1/2"	1/2"
1/2	4.9	1.1	14	14	227'	1/2"	1/2"	1/2"	1/2"
3/4	6.9	1.6	14	14	161'	1/2"	1/2"	1/2"	1/2"
1	8	1.8	14	14	139'	1/2"	1/2"	1/2"	1/2"
1 1/2	10	2.3	14	14	111'	1/2"	1/2"	1/2"	1/2"
2	12	2.8	14	14	93'	1/2"	1/2"	1/2"	1/2"
3	17	3.9	10	10	169'	1/2"	1/2"	1/2"	1/2"
5	28	6.4	8	10	158'	1/2"	3/4"	1/2"	1/2"
7 1/2	40	9.2	8	8	111'	3/4"	3/4"	1/2"	1/2"
10	50	11.5	6	8	141'	3/4"	1"	3/4"	3/4"

### NOTES:

1. Maximum wire length (one-way) for 3% voltage drop.
2. RHW and RHH conductor fill with outer covering.
3. Disconnects must be horsepower rated.
4. @ May require larger size if fused switch is used.



**Voltage Drop**  
**200 Volt - Single Phase (24-120 Amps)**  
**Maximum Conductor Length (One Way)**

1	2	3	4	5	6	7	8	9	10	11
LOAD	MAXIMUM LENGTH AT 3% VOLTAGE DROP					MAXIMUM LENGTH AT 2% VOLTAGE DROP				
AMPS	#4	#3	#2	#1	1/0	#4	#3	#2	#1	1/0
24	403'	500'	625'	781'	962'	269'	333'	417'	521'	641'
28	346'	429'	536'	670'	824'	230'	286'	357'	446'	549'
32	302'	375'	469'	586'	721'	202'	250'	313'	391'	481'
36	269'	333'	417'	521'	641'	179'	222'	278'	347'	427'
40	242'	300'	375'	469'	577'	161'	200'	250'	313'	385'
44	220'	273'	341'	426'	524'	147'	182'	227'	284'	350'
48	202'	250'	313'	391'	481'	134'	167'	208'	260'	321'
52	186'	231'	288'	361'	444'	124'	154'	192'	240'	296'
56	173'	214'	268'	335'	412'	115'	143'	179'	223'	275'
60	161'	200'	250'	313'	385'	108'	133'	167'	208'	256'
64	151'	188'	234'	293'	361'	101'	125'	156'	195'	240'
68	142'	176'	221'	276'	339'	95'	118'	147'	184'	226'
72		167'	208'	260'	321'		111'	139'	174'	214'
76		158'	197'	247'	304'		105'	132'	164'	202'
80		150'	188'	234'	288'		100'	125'	156'	192'
84			179'	223'	275'			119'	149'	183'
88			170'	213'	262'			114'	142'	175'
92			163'	204'	251'			109'	136'	167'
96				195'	240'				130'	160'
100				188'	231'				125'	154'
104				180'	222'				120'	148'
108					214'					142'
112					206'					137'
116					199'					133'
120					192'					128'






















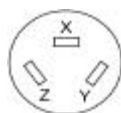











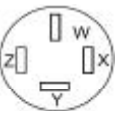

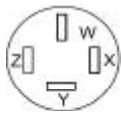

- NOTES:
1. Columns 2-6 indicated the maximum one-way conductor length at 3% voltage drop.
  2. Columns 7-11 indicated the maximum one-way conductor length at 2% voltage drop.

**Voltage Drop**  
**230 Volt - Three Phase (4-52 Amps)**  
**Maximum Conductor Length (One Way)**

1	2	3	4	5	6	7	8	9	10	11
LOAD	MAXIMUM LENGTH AT 3% VOLTAGE DROP					MAXIMUM LENGTH AT 2% VOLTAGE DROP				
AMPS	#14	#12	#10	#8	#6	#14	#12	#10	#8	#6
4	321'	498'	830'	1277'	2033'	214'	332'	553'	851'	1355'
6	214'	332'	553'	851'	1355'	143'	221'	369'	567'	903'
8	161'	249'	415'	638'	1016'	107'	166'	277'	426'	678'
10	129'	199'	332'	511'	813'	86'	133'	221'	340'	542'
12	107'	166'	277'	426'	678'	71'	111'	184'	284'	452'
14		142'	237'	365'	581'		95'	158'	243'	387'
16		124'	207'	319'	508'		83'	138'	213'	339'
18			184'	284'	452'			123'	189'	301'
20			166'	255'	407'			111'	170'	271'
22			151'	232'	370'			101'	155'	246'
24			138'	213'	339'			92'	142'	226'
26				196'	313'				131'	208'
28				182'	290'				122'	194'
30				170'	271'				113'	181'
32				160'	254'				106'	169'
34				150'	239'				100'	159'
36				142'	226'				95'	151'
38				134'	214'				90'	143'
40				128'	203'				85'	136'
42					194'					129'
44					185'					123'
46					177'					118'
48					169'					113'
50					163'					108'
52					156'					104'

- NOTES:
1. Columns 2-6 indicated the maximum one-way conductor length at 3% voltage drop.
  2. Columns 7-11 indicated the maximum one-way conductor length at 2% voltage drop.

# Non-Locking Receptacle Configuration Reference Chart

		15 Amp	20 Amp	30 Amp	50 Amp	60 Amp
2 Pole 2 Wire	125V	 1-15R				
	250V		 2-20R	 2-30R		
2 Pole 3 Wire Grounding	125V	 5-15R	 5-20R	 5-30R	 5-50R	
	250V	 6-15R	 6-20R	 6-30R	 6-50R	
	277V	 7-15R	 7-20R	 7-30R	 7-50R	
3 Pole 3 Wire	125/250V		 10-20R	 10-30R	 10-50R	
	3-Phase 250V	 11-15R	 11-20R	 11-30R	 11-50R	
3 Pole 4 Wire Grounding	125/250V	 14-15R	 14-20R	 14-30R	 14-50R	 14-60R
	3-Phase 250V	 15-15R	 15-20R	 15-30R	 15-50R	 15-60R
4 Pole 4 Wire	3-Phase 120/208V	 18-15R	 18-20R	 18-30R	 18-50R	 18-60R

### 2-LAMP

2' X 4' Recessed  
Lighting Fixtures  
2-T8 32 Watt Lamps  
8' x 10' Spacing  
32 Foot-Candles Avg

Room Size 32' x 26' x 9'  
Task Height 2.5'  
Reflectance 80-50-20  
Lumens Per Lamp 2800  
Power Density 0.63 W/sq ft

	16		23	26			25	26			23				
	23		39	40			42	40			39				
	25		39	43			42	43			39				
	26		43	46			47	46			43				
	25		39	43			42	43			39				
	23		39	40			42	40			39				
	16		23	26			25	26			23				

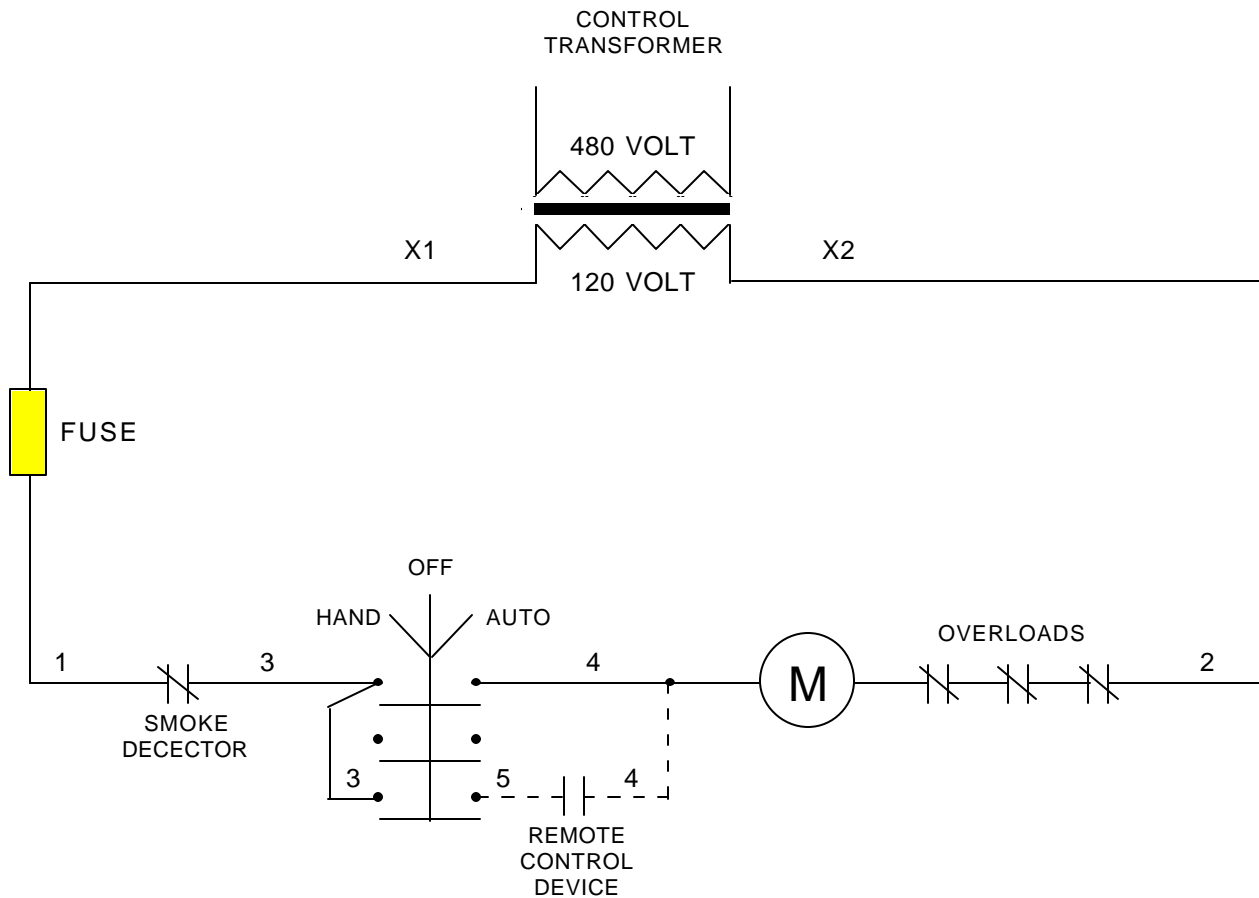
### 3-LAMP

2' X 4' Recessed  
Lighting Fixtures  
3-T8 32 Watt Lamps  
8' x 10' Spacing  
48 Foot-Candles Avg

Room Size 32' x 26' x 9'  
Task Height 2.5'  
Reflectance 80-50-20  
Lumens Per Lamp 2800  
Power Density 0.95 W/sq ft

	22		35	38			37	38			35				
	34		60	60			63	60			60				
	36		59	63			63	63			59				
	38		66	68			71	68			67				
	35		59	63			63	63			59				
	34		60	60			63	60			60				
	22		35	37			37	37			35				

# HVAC Control Diagram



## SEQUENCE OF OPERATION

Hand-Off-Auto switch will select either the hand or automatic operation. In the automatic position the remote control device will cycle the unit as required. Smoke Detector will automatically stop motor if smoke is detected.

## 4-Lamp (40 Watt) Fluorescent Fixture

### Branch Circuit Load Data

Wattage Based on Ballast Input Watts

Number of Fixtures	Wattage Each	Total Wattage	Amps 1-Phase 120 Volt	Amps 1-Phase 277 Volt	Amps 3-Phase 120/208 V	Amps 3-Phase 277/480 V
1	165	165	1.4	0.6	0.5	0.2
2	165	330	2.8	1.2	0.9	0.4
3	165	495	4.1	1.8	1.4	0.6
4	165	660	5.5	2.4	1.8	0.8
5	165	825	6.9	3.0	2.3	1.0
6	165	990	8.3	3.6	2.8	1.2
7	165	1,155	9.6	4.2	3.2	1.4
8	165	1,320	11.0	4.8	3.7	1.6
9	165	1,485	12.4	5.4	4.1	1.8
10	165	1,650	13.8	6.0	4.6	2.0
11	165	1,815	15.1	6.6	5.0	2.2
12	165	1,980	16.5	7.1	5.5	2.4
13	165	2,145	17.9	7.7	6.0	2.6
14	165	2,310	19.3	8.3	6.4	2.8
15	165	2,475	20.6	8.9	6.9	3.0
16	165	2,640	22.0	9.5	7.3	3.2
17	165	2,805	23.4	10.1	7.8	3.4
18	165	2,970	24.8	10.7	8.3	3.6
19	165	3,135	26.1	11.3	8.7	3.8
20	165	3,300	27.5	11.9	9.2	4.0
21	165	3,465	28.9	12.5	9.6	4.2
22	165	3,630	30.3	13.1	10.1	4.4
23	165	3,795	31.6	13.7	10.5	4.6
24	165	3,960	33.0	14.3	11.0	4.8
25	165	4,125	34.4	14.9	11.5	5.0
26	165	4,290	35.8	15.5	11.9	5.2
27	165	4,455	37.1	16.1	12.4	5.4
28	165	4,620	38.5	16.7	12.8	5.6
29	165	4,785	39.9	17.3	13.3	5.8
30	165	4,950	41.3	17.9	13.8	6.0
31	165	5,115	42.6	18.5	14.2	6.2
32	165	5,280	44.0	19.1	14.7	6.4
33	165	5,445	45.4	19.7	15.1	6.6
34	165	5,610	46.8	20.3	15.6	6.8
35	165	5,775	48.1	20.8	16.0	7.0
36	165	5,940	49.5	21.4	16.5	7.2
37	165	6,105	50.9	22.0	17.0	7.4
38	165	6,270	52.3	22.6	17.4	7.6
39	165	6,435	53.6	23.2	17.9	7.7
40	165	6,600	55.0	23.8	18.3	7.9
41	165	6,765	56.4	24.4	18.8	8.1
42	165	6,930	57.8	25.0	19.3	8.3
43	165	7,095	59.1	25.6	19.7	8.5
44	165	7,260	60.5	26.2	20.2	8.7
45	165	7,425	61.9	26.8	20.6	8.9
46	165	7,590	63.3	27.4	21.1	9.1
47	165	7,755	64.6	28.0	21.6	9.3
48	165	7,920	66.0	28.6	22.0	9.5
49	165	8,085	67.4	29.2	22.5	9.7
50	165	8,250	68.8	29.8	22.9	9.9

# Roof Top Air Conditioners With Gas Heat ( 3-25 Ton )



## 208/230V-1Ø-60HZ ( 3-5 Ton )

SIZE TONS	MIN VOLT	MAX VOLT	MIN CIR AMPS	MAX FUSE OR BKR	MIN SW SIZE	WIRE SIZE/LENGTH 75° C LIMITING 2% VOLTAGE DROP						
						#12 CU	#10 CU	#8 CU	#6 CU	#8 AL	#6 AL	#4 AL
3.0	208	230	27.1	40	60	---	95'	151'	234'	91'	142'	227'
4.0	208	230	36.3	60	60	---	---	113'	175'	68'	106'	169'
5.0	208	230	46.5	60	60	---	---	88'	137'	---	83'	132'

## 208/230V-3Ø-60HZ ( 3-10 Ton )

SIZE TONS	MIN VOLT	MAX VOLT	MIN CIR AMPS	MAX FUSE OR BKR	MIN SW SIZE	WIRE SIZE/LENGTH 75° C LIMITING 2% VOLTAGE DROP						
						#12 CU	#10 CU	#8 CU	#6 CU	#8 AL	#6 AL	#4 AL
3.0	208	230	18.6	25	30	100'	160'	254'	394'	154'	240'	381'
4.0	208	230	24.8	35	60	---	120'	190'	296'	115'	180'	286'
5.0	208	230	31.3	45	60	---	---	151'	234'	91'	142'	227'
6.2	208	230	36.6	50	60	---	---	129'	200'	78'	122'	194'
7.5	208	230	41.7	60	60	---	---	113'	176'	---	107'	170'
8.5	208	230	49	60	60	---	---	96'	150'	---	91'	145'
10.0	208	230	56	70	100	---	---	---	131'	---	---	127'

## 208/230V-3Ø-60HZ ( 12-25 Ton )

SIZE TONS	MIN VOLT	MAX VOLT	MIN CIR AMPS	MAX FUSE OR BKR	MIN SW SIZE	WIRE SIZE/LENGTH 75° C LIMITING 2% VOLTAGE DROP						
						#4 CU	#2 CU	#1 CU	#1/0 CU	#2 AL	#1/0 AL	#2/0 AL
12.5	208	230	71	80	100	165'	262'	329'	416'	159'	252'	403'
15.0	208	230	82	90	100	143'	226'	285'	360'	138'	219'	349'
17.5	208	230	100	110	200	---	186'	234'	295'	---	179'	286'
20.0	208	230	123	150	200	---	---	190'	240'	---	---	232'
25.0	208	230	132	150	200	---	---	---	224'	---	---	217'

## 460V-3Ø-60HZ ( 3-25 Ton )

SIZE TONS	MIN VOLT	MAX VOLT	MIN CIR AMPS	MAX FUSE OR BKR	MIN SW SIZE	WIRE SIZE/LENGTH 75° C LIMITING 2% VOLTAGE DROP						
						#12 CU	#10 CU	#8 CU	#6 CU	#8 AL	#6 AL	#4 AL
3.0	460	460	9.4	15	30	439'	700'	1109'	1726'	673'	1049'	1669'
4.0	460	460	11.9	15	30	347'	553'	876'	1364'	531'	829'	1318'
5.0	460	460	16.3	25	30	253'	404'	640'	996'	388'	605'	962'
6.2	460	460	17.7	25	30	233'	372'	589'	917'	357'	557'	886'
7.5	460	460	20.9	30	30	---	315'	499'	776'	303'	472'	750'
8.5	460	460	29	35	60	---	227'	360'	560'	218'	340'	541'
10.0	460	460	31	40	60	---	---	336'	523'	204'	318'	506'
12.5	460	460	32	40	60	---	---	326'	507'	198'	308'	490'
15.0	460	460	37	45	60	---	---	282'	439'	171'	267'	424'
17.5	460	460	47	60	60	---	---	222'	345'	---	210'	334'
20.0	460	460	53	60	60	---	---	---	306'	---	---	296'
25.0	460	460	57	70	100	---	---	---	285'	---	---	275'



# Design Tools

Durand & Associates also offers many software programs that make designing electrical systems much easier. Listed below are some of the software programs available from Durand & Associates.

- 1-Line Software . . . . . Page 18-2
- Residential 1-Line Software . . . . . Page 18-3
- Panel Schedule Software . . . . . Page 18-4
- Short Circuit Software . . . . . Page 18-5
- Service Software . . . . . Page 18-6

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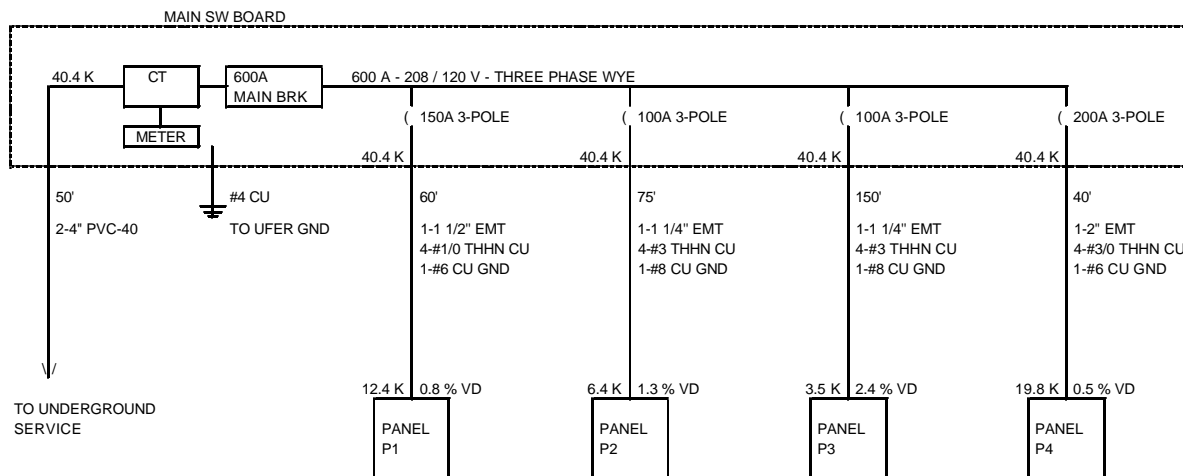
Durand & Associates  
176 Three Waters Road  
Priest Lake, ID 83856

Phone: (208) 443-6627  
Fax: (208) 443-6629  
[www.durandassociates.com](http://www.durandassociates.com)

# 1-Line Software ( for commercial & industrial applications )

This program will automatically create a 1-Line Drawing showing conduit and wire size, voltage drop, and fault current calculations. It will also create a load calculation for each panel and the main switchboard. This programs will also printout circuit directories for each panel.

## Sample 1-Line Drawing



## Features:

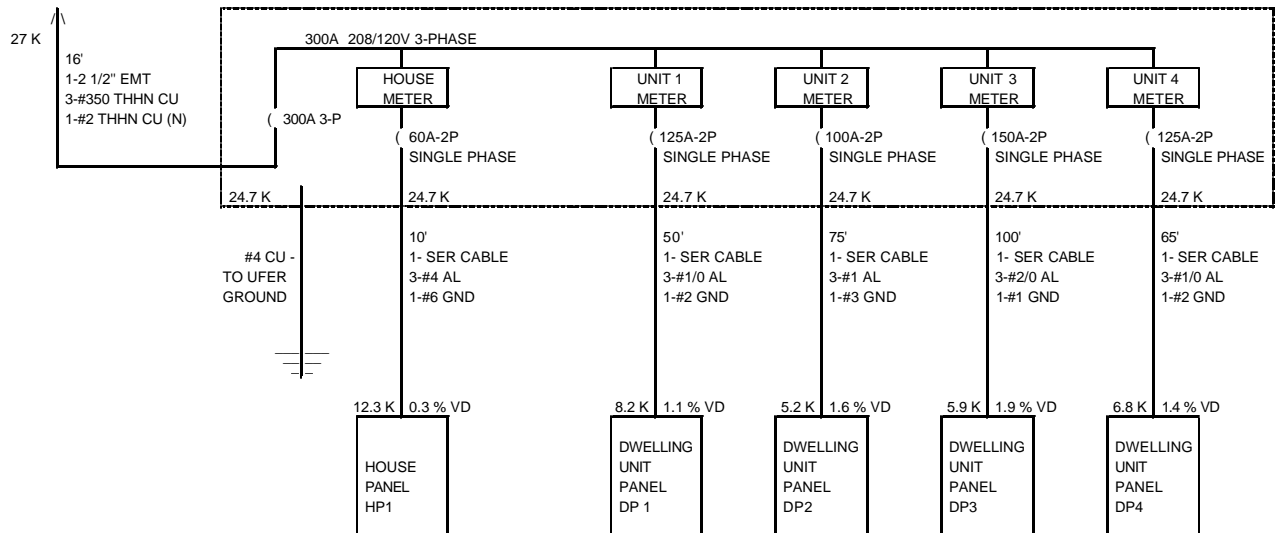
- Main switchboard up to 18 circuits
- Each panel can have 6-84 circuits
- Each panel can feed a subpanel or transformer and subpanel.
- Single Phase, 3-Phase WYE, or 3-Phase DELTA
- Fault current calculations
- Voltage drop calculations
- Load calculations
- Error checking for NEC Code compliance.

To obtain more information visit [www.durandassociates.com](http://www.durandassociates.com)

# Residential 1-Line Software ( for multifamily dwellings )

This program will automatically create a 1-Line Drawing showing conduit and wire size, voltage drop, and fault current calculations. It will also create a load calculation for each panel and the main switchboard.

## Sample Multifamily 1-Line Drawing



### Features:

- Main switchboard up to 30 dwelling units and 2 house panels.
- Automatic feeder sizing
- Single Phase or 3-Phase WYE
- Fault current calculations
- Voltage drop calculations
- Load calculations
- Error checking for NEC Code compliance.

To obtain more information visit [www.durandassociates.com](http://www.durandassociates.com)

# Panel Schedule Software ( for commercial & industrial applications )

This program will automatically create a panel schedule, load calculation, and circuit directory. It is designed for one (1) panel.

## Sample Load Calculation

PANEL		P1		FEEDER							
FED FROM	MAIN SWITCH BOARD	NUMBER OF CONDUITS	1								
# CIRCUITS	30	FEEDER CONDUIT	2"								
HI VOLTAGE	240	WIRE SIZE L1	#3/0								
LOW VOLTAGE	120	WIRE SIZE L2	#3/0								
PHASE	1	WIRE SIZE NEUTRAL	#3/0								
DESIGN LOAD AMPS	198	WIRE SIZE GROUND	#6								
NEUTRAL BUS	YES										
GROUND BUS	YES										
AVAILABLE FAULT CURRENT AT THIS PANEL	176										
MAIN BREAKER SIZE AMPS	200										
#	BKR	CIRCUIT DESCRIPTION	H	I	VA	VA	I	H	CIRCUIT DESCRIPTION	BKR	#
1	20A-1P	LIGHTS		C	1,600	L1 1,440	D		DUPLEX	20A-1P	2
3	20A-1P	LIGHTS		C	1,600	L2 1,440	D		DUPLEX	20A-1P	4
5	20A-1P	LIGHTS		C	1,600	L1 1,440	D		DUPLEX	20A-1P	6
7	20A-1P	LIGHTS		C	1,600	L2 1,440	D		DUPLEX	20A-1P	8
9	20A-1P	LIGHTS		C	1,600	L1 1,440	D		DUPLEX	20A-1P	10
11	20A-1P	LIGHTS		C	1,600	L2 1,440	D		DUPLEX	20A-1P	12
13	\ / \ /			M	3,500	L1 1,440	D		DUPLEX	20A-1P	14
15	40A-3P	PUMP		M	3,500	L2 1,440	D		DUPLEX	20A-1P	16
17	/ \ / \			M	3,500	L1 1,000	K		DISPOSAL	20A-1P	18
19				G		L2 4,000	K		OVEN	40A-2P	20
21				G		L1 4,000	K		/ \	/ \	22
23				G		L2 1,500	K		COFFE MAKER	20-1P	24
25				G		L1	G				26
27				G		L2	G				28
29				G		L1	G				30

## Features:

- Each panel can have 6-84 circuits
- Each panel can feed a subpanel or transformer and subpanel.
- Single Phase, 3-Phase WYE, or 3-Phase DELTA
- Fault current calculations
- Voltage drop calculations
- Load calculations
- Error checking for NEC Code compliance.

To obtain more information visit [www.durandassociates.com](http://www.durandassociates.com)

# Short Circuit Software

This program will automatically calculate the fault current for a cable run.

## Sample Fault Current Calculation

**Step 1**  
 Available Fault Current at Starting Point 39,425 AFC  
 Calculate TF ( 39,425 AFC x 4160 PV x 1.732 x 2.0 %Z ) ÷ ( 100,000 x 300 KVA ) = 18.937 TF  
 Calculate TM ( 1 ) / ( 1 + 18.937 TF ) = 0.050 TM  
 Calculate TLC ( ( ( ( 4,160 PV ÷ 208 SV ) ÷ ( 0.050 TM x 39,425 AFC ) ) x 1.0 UA ) + 0 MC ) = 39,425 TLC

**Step 2**  
 Conductor Factor CF - Formula ( 1.732 x 20 L x 39,425 TLC ) ÷ ( 22,185 C x 2 N x 208 SV ) = 0.148 CF  
 Conductor Multiplier CM - Formula ( 1 ) ÷ ( 1 + 0.148 CF ) = 0.871 CM  
 Conductor Let-Through Current CLC - Formula ( 39,425 TLC x 0.871 CM ) = 34,339 CLC

<p>Start &gt;   &lt; 39,425 AFC</p> <p style="padding-left: 20px;">Transformer</p> <p style="padding-left: 20px;">&lt; 300 KVA</p> <p style="padding-left: 20px;">  &lt; 39,425 TLC</p> <p style="padding-left: 20px;">&lt; Length 20'</p> <p style="padding-left: 20px;">Steel Conduit</p> <p style="padding-left: 20px;">2 Conductor(s) Per Phase</p> <p style="padding-left: 20px;">500 MCM Cable CU</p> <p>End &gt;   &lt; 34,339 CLC</p>	<p><b>KEY</b></p> <p>%Z - Transformer Impedance Value Nameplate %Z              AFC - Available Fault Current              C - Conductor Constant              CF - Conductor Factor              CLC - Conductor Let-Through Current              CM - Conductor Multiplier              KVA - Kilovolt Amps              L - Length of Conductor              MC - Motor Short-Circuit Contribution              N - Number of Conductors Per Phase              PV - Primary Voltage              SV - Secondary Voltage              TF - Transformer Factor              TLC - Transformer Let-Through Current              TM - Transformer Multiplier              UA - Utility Adjustment 1.1 ( Voltages May Vary 10% )</p>
---	---

## Sample Input Screen

Project Name	Smith Ranch	
Starting Point	Main Service	
Ending Point	Main Switch Board	
Select Method	Transformer Known AFC	
Available Fault Current	39,425	
Transformer KVA	300	
Phase	Three Phase	
Primary Voltage	4160	
Transformer %Z Rating	2.0%	
Secondary Voltage	208	
Motor Short-Circuit Contribution	0	
Utility Voltage Adjustment	1.00	

Enter Conduit or Busway Length	20
Select One	
3-SINGLE CONDUCTORS (Copper) Steel Conduit	500 MCM
1-THREE CONDUCTOR CABLE (Copper) Steel Conduit	No
3-SINGLE CONDUCTORS (Copper) Nomagnetic Conduit	No
1-THREE CONDUCTOR CABLE (Copper) Nomagnetic Conduit	No
BUSWAY (Copper)	No
PLUG-IN BUSWAY (Copper)	No
3-SINGLE CONDUCTORS (Aluminum) Steel Conduit	No
1-THREE CONDUCTOR CABLE (Aluminum) Steel Conduit	No
3-SINGLE CONDUCTORS (Aluminum) Nomagnetic Conduit	No
1-THREE CONDUCTOR CABLE (Aluminum) Nomagnetic Conduit	No
BUSWAY (Aluminum)	No
Number of conductors Per Phase	2

To obtain more information visit [www.durandassociates.com](http://www.durandassociates.com)

# Service Software ( for single family dwellings )

This program will automatically calculate the service size for a single family dwelling.

## Sample Load Calculation

### SINGLE FAMILY SERVICE LOAD CALCULATIONS BASED ON THE 2005 NEC SECTION 220.82

#### GENERAL LOADS NEC 220.82(B)

TOTAL SQ FOOTAGE ( 1,500 SQ FT X 3 VA ) = 4,500 VA  
 APPLIANCE CIRCUITS ( 2 X 1,500 VA ) = 3,000 VA  
 LAUNDRY CIRCUITS ( 1 X 1,500 VA ) = 1,500 VA

RANGE ( 1 RANGE X 12,000 VA ) = 12,000 VA

DRYER ( 1 DRYER X 5,000 VA ) = 5,000 VA

WATER HEATERS ( 1 X 2,500 VA ) = 2,500 VA

#### MISC LOADS NEC 220.82(B)(4)

DISHWASHER ( 1 X 10A X 120 V ) = 1,200 VA

TOTAL GENERAL LOAD 29,700 VA  
 FIRST 10 KVA AT 100% 10,000 VA  
 REMAINDER OF LOAD AT 40% 7,880 VA  
 SUB TOTAL GENERAL LOAD 17,880 VA

#### HEATING & COOLING LOADS - NEC 220.82(C)

- (1) AC LOAD ( 0 VA X 100% ) = 0 VA
  - (2) HEAT PUMPS NO SUPP ( 0 VA X 100% ) = 0 VA
  - (3) ELECTRIC CONTINUOUS ( 0 VA X 100% ) = 0 VA
  - (4) HEAT PUMPS WITH SUPPL ( 0 VA X 100% ) = 0 VA
  - (5) SPACE HEATING ( 10,000 VA X 65% ) = 6500 VA
  - (6) SPACE HEATING ( 10,000 VA X 40% ) = 4000 VA
- LARGEST HEATING OR COOLING LOAD

TOTAL KVA 6,500 VA  
24,380 VA

TOTAL AMPS ( 24,380 VA ÷ 240 V ) = 102 A  
 FUTURE AMPS ( 0% ) 0 A  
**DESIGN AMPS** 102 A

### NEUTRAL LOAD NEC 220.61

TOTAL SQ FOOTAGE ( 1,500 SQ FT X 3 VA ) = 4,500 VA  
 APPLIANCE CIRCUITS ( 2 X 1,500 VA ) = 3,000 VA  
 LAUNDRY CIRCUITS ( 1 X 1,500 VA ) = 1,500 VA  
 TOTAL CONNECTED NEUTRAL LOAD 9,000 VA

FIRST 3,000 VA @ 100% ( 3,000 VA X 1.00 ) = 3,000 VA  
 3,000-120,000 VA @ 35% ( 6,000 VA X 0.35 ) = 2,100 VA  
 OVER 120,000 VA @ 25% ( 0 VA X 0.25 ) = 0 VA  
 SUBTOTAL 5,100 VA

#### RANGE DEMAND NEC 220.61

TABLE 220.55 COLUMN C  
 70% OF TABLE 220.55 ( 8,000 VA X 0.70 ) = 5,600 VA

#### DRYER DEMAND NEC 220.61

TABLE 220.54  
 70% OF TABLE 220.54 ( 5,000 VA 1.00 VA X 0.70 ) = 3,500 VA

UNBALANCED MISC LOADS 1,200 VA

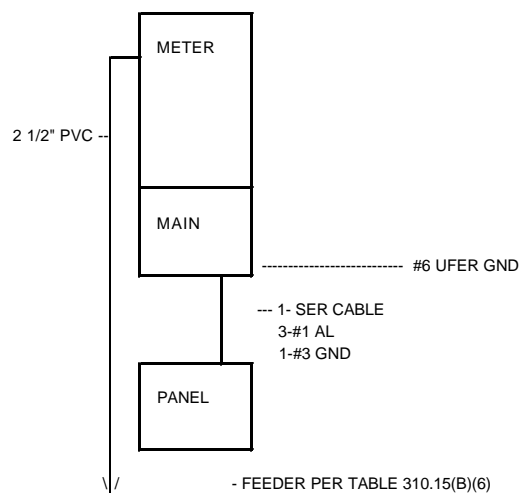
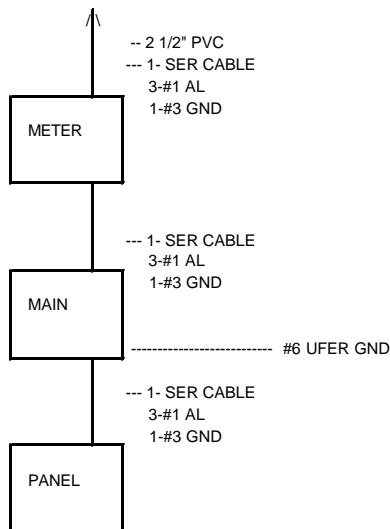
NEUTRAL LOAD VA 15,400 VA

NEUTRAL LOAD ( 15,400 VA ÷ 240 V ) = 64 A

#### FURTHER DEMAND FACTOR - 2005 NEC 220.61(B)(2)

FIRST 200 A @ 100% ( 64 A X 1.00 ) = 64 A  
 REMAINDER @ 70% ( 0 A X 0.70 ) = 0 A

MINIMUM NEUTRAL CONDUCTOR AMPACITY 64 A



To obtain more information visit [www.durandassociates.com](http://www.durandassociates.com)

