

**Commercial Building Electrical Systems – Power System**

**Building Wire and Cable**

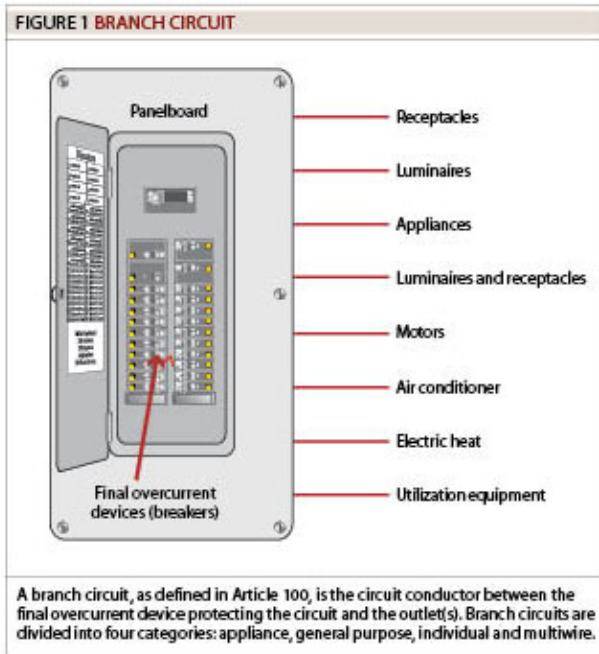
Most commonly known as branch circuit wiring

Supplies electrical current to all external uses of power in a building or dwelling

**Branch Circuits**

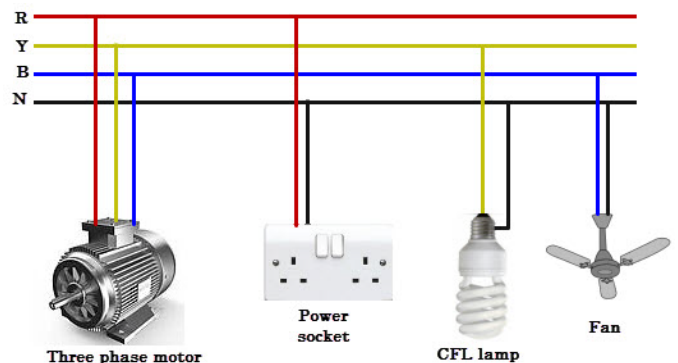
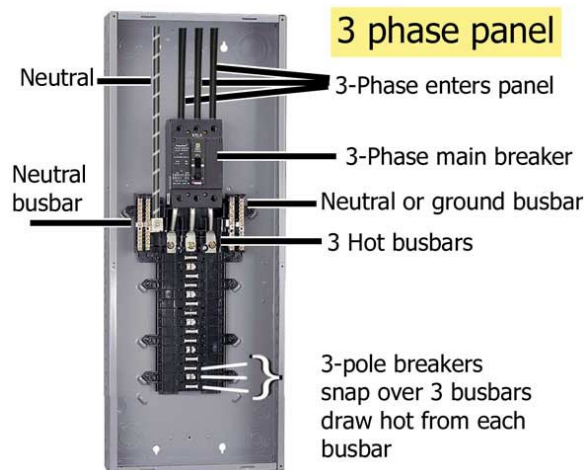
The circuits that deliver electricity to the various areas of a building or home are referred to as branch circuits.

The National Electrical Code (NEC) defines a branch circuit as “the conductors between the branch circuit final overcurrent device protecting the circuit and the outlet(s)” (such as receptacles or lights). [Article 100 Definition]

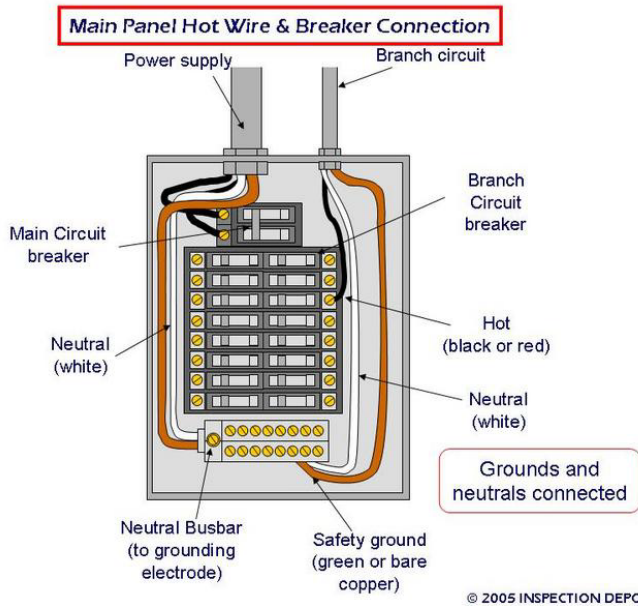


Branch circuits originate at a service distribution panel which provides either single-phase (1Ø) or 3-phase (3Ø) power at the required voltage value.

A 3Ø panel has three hot busbars and one neutral busbar.



A 1Ø panel has two hot busbars and one neutral busbar.

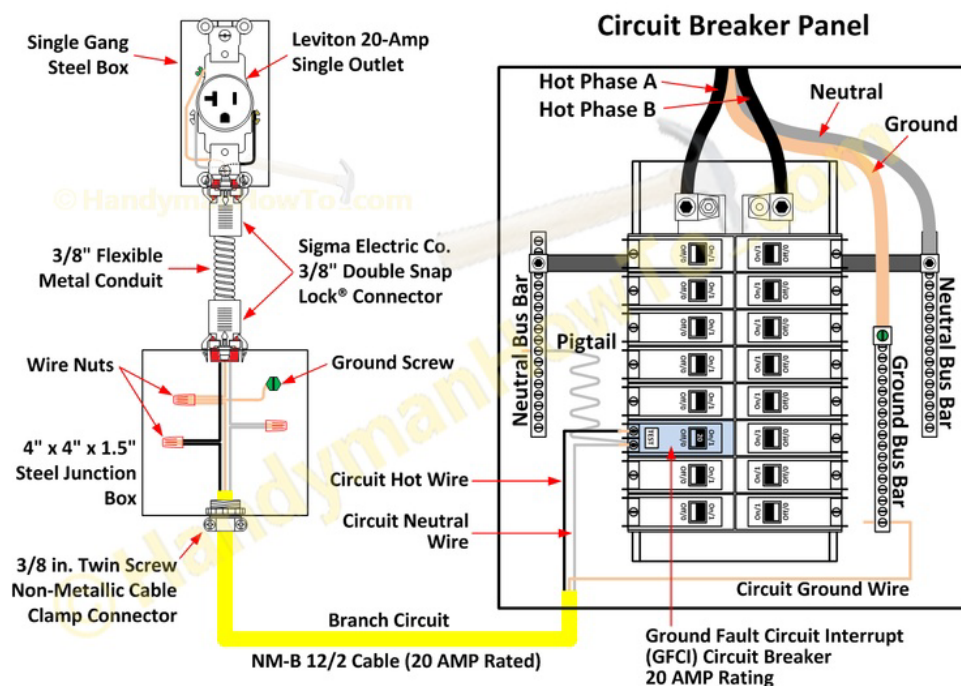


Depending on the amount of electricity a given circuit needs to deliver, it may attach to only one hot busbar and the neutral busbar or to two or three hot busbars.

In a residential load center (120/240 VAC, 1Ø Panel), a circuit that delivers 120 volts connects to one hot busbar and the neutral busbar, and a circuit that delivers 240 volts connects to both hot busbars.

The means for attachment is commonly known as a fuse or circuit breaker, and it protects the circuit from sudden surges in current.

Neutral conductors are all grounded through direct contact with the soil. Unlike the hot busbars, a neutral busbar does not have an over-current protection device so it can maintain 0 volts at all times.



## Panel Board Schedule

Panel board schedules are generally found on electrical drawings and are used mainly to indicate relevant information on the service-panel boards within the building.

A panel-board schedule should provide sufficient data to identify the panel number (as indicated on the drawings) and the type of cabinet (whether surface-mounted or flush). It should also provide relevant data regarding the panel main busbars and/or circuit breakers as well as the number and type of circuit breakers contained in the panel board and the components fed by each.

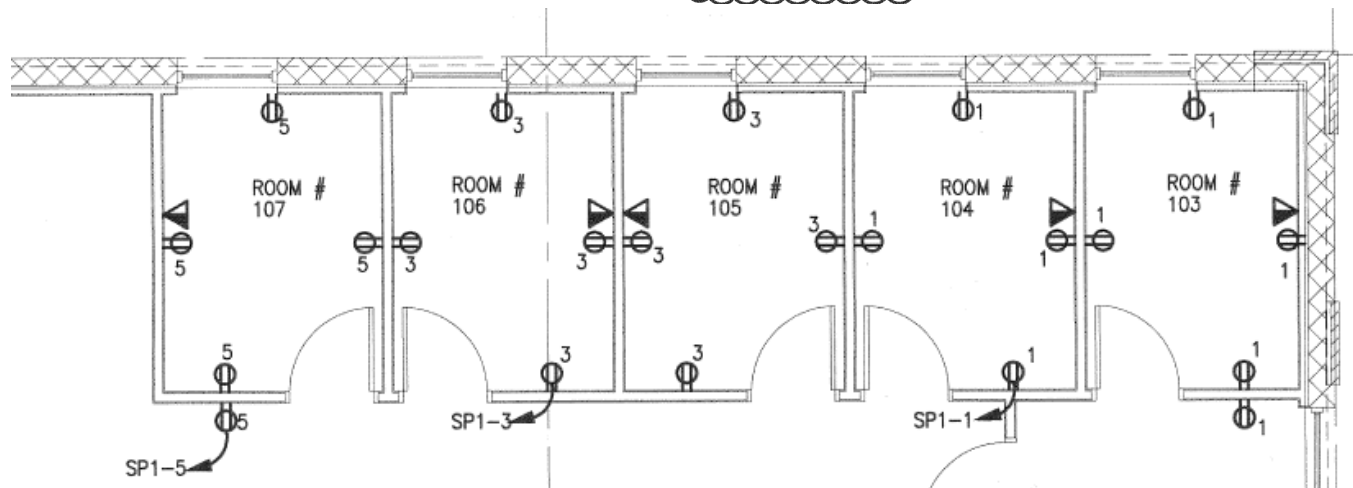
This type of schedule, however, does not furnish detailed information for the individual circuits (e.g., wire sizes or number of outlets on the circuit); this information needs to be shown elsewhere on the drawing, such as in the plan view or power-riser diagrams.

PANEL		'SP1'		MOUNTING:		SURFACE		ENCLOSURE:		NEMA 1			
VOLTAGE:		208Y/120V-3P-4W		FEEDER:		TOP		MAINS:		200A MCB			
AMPS TRIP	POLES	NOTES	BRANCH CIRCUIT		PHASE LOAD (VOLT-AMPS)			BRANCH CIRCUIT		NOTES	POLES	AMPS TRIP	
			DESIGNATION	VOLT AMPS	N.C.	ØA	ØB	ØC	N.C.				VOLT AMPS
20	1		RECEPTACLES ROOM 103, 104	1620	1	3060			2	1440	RECEPTACLES ROOM 101, 102	1	20
20	1		RECEPTACLES ROOM 105, 106	1440	3		2880		4	1440	RECEPTACLES ROOM 109, 110	1	20
20	1		RECEPTACLES ROOM 107, GYM	900	5			2520	6	1620	RECEPTACLES ROOM 111, 112	1	20
20	1		RECEPTACLES ROOM 113, 119	1080	7	1800			8	720	RECEPTACLES ROOM 117	1	20
20	1		RECEPTACLES ROOM 118, 120	1440	9		2140		10	700	REFRIGERATOR	1	20
20	1		RECEPTACLES ROOM 116, 121	1080	11			2080	12	1000	COUNTERTOP	1	20
20	1		SPARE		13	960			14	960	LIGHTING OFFICES	1	20
20	1		RECEPTACLES ROOM 202, 203	1260	15		2092		16	832	LIGHTING RECEPTION & OFFICES	1	20
20	1		RECEPTACLES ROOM 201, 204	1260	17			2188	18	928	LIGHTING 2ND FLOOR OFFICES	1	20
20	1		LIGHTING OFFICES	960	19	2416			20	1456	LIGHTING GYM	1	20
20	1		LIGHTING OFFICES	1152	21		1872		22	720	ROOF RECEPTACLES	1	20
20	1		LIGHTING 2ND FLOOR OFFICES	672	23			672	24	896	SPARE	1	20
20	1		SPARE		25				26		SPARE	1	20
45	3		RTU-3	4743	27		9691		28	4948		3	50
				4743	29			9691	30	4948	RTU-1		
				4743	31	9691			32	4948			
					33		8130		34	8130			
					35			8130	36	8130	RTU-2		3 80
					37	8130			38	8130			
30	2		WATER HEATER (WH-2)	2050	39		4300		40	2250	WATER HEATER (WH-1)	2	30
				2050	41			4300	42	2250			
INTEGRATED EQUIPMENT RATING: 10,000 AIC MINIMUM										TOTAL VA: 86743			
KVA TOTAL										TOTAL AMPS: 241A			
						26057	31105	29581					

- NOTES:  
 1. HACR RATED BREAKER  
 2. BREAKER TO BE SWITCHING DUTY RATED

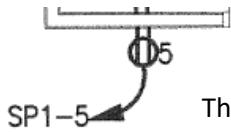
LOAD DESCRIPTION	DEMAND FACTOR	VOLT - AMPS	
		CONNECTED	DEMAND
LIGHTING	1.25	6960	8700
RECEPTACLES	N.E.C.	17720	13088
HVAC EQUIPMENT	1.00	53463	53463
MISC. EQUIPMENT	1.00		
WATER HEATER	1.25	8600	10750
KITCHEN EQUIPMENT	0.65		
TOTAL		86743	86001

DEMAND LOAD AMPS = 239 A



## Electrical Home Run

An electrical home run is a wiring run that connects directly to a building's electrical panel (source). It is usually shown on a plan using an arrow with the panel name and circuit number(s) it connects to.



The home run shown connects to Panel SP1 – Circuit No. 5

## Raceway Fill

Raceways must be large enough to avoid damaging the insulation when conductors are pulled into the raceway. Chapter 9 and Annex C of the NEC are the primary references for determining allowable conductor fill in raceways. For the most common condition, where multiple conductors of the same size are installed together in a raceway, the maximum number of conductors permitted can be determined from the tables in Annex C.

Table C.1 Continued

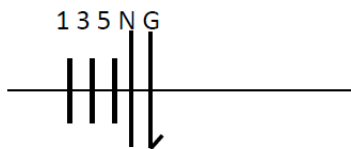
		CONDUCTORS									
Type	Conductor Size (AWG kcmil)	Metric Designator (Trade Size)									
		16 (½)	21 (¾)	27 (1)	35 (1¼)	41 (1½)	53 (2)	63 (2½)	78 (3)	91 (3½)	103 (4)
RHH*, RHW*, RHW-2*, TW, THW, THHW, THW-2	6	1	3	4	8	11	18	32	48	63	81
	4	1	1	3	6	8	13	24	36	47	60
	3	1	1	3	5	7	12	20	31	40	52
	2	1	1	2	4	6	10	17	26	34	44
	1	1	1	1	3	4	7	12	18	24	31
	1/0	0	1	1	2	3	6	10	16	20	26
	2/0	0	1	1	1	3	5	9	13	17	22
	3/0	0	1	1	1	2	4	7	11	15	19
	4/0	0	0	1	1	1	3	6	9	12	16
	250	0	0	1	1	1	3	5	7	10	13
	300	0	0	1	1	1	2	4	6	8	11
	350	0	0	0	1	1	1	4	6	7	10
	400	0	0	0	1	1	1	3	5	7	9
	500	0	0	0	1	1	1	3	4	6	7
	600	0	0	0	1	1	1	2	3	4	6
	700	0	0	0	0	1	1	1	3	4	5
	750	0	0	0	0	1	1	1	3	4	5
	800	0	0	0	0	1	1	1	3	3	5
	900	0	0	0	0	0	1	1	2	3	4
	1000	0	0	0	0	0	1	1	2	3	4
1250	0	0	0	0	0	1	1	1	2	3	
1500	0	0	0	0	0	1	1	1	1	2	
1750	0	0	0	0	0	0	1	1	1	2	
2000	0	0	0	0	0	0	1	1	1	1	
THHN, THWN, THWN-2	14	12	22	35	61	84	138	241	364	476	608
	12	9	16	26	45	61	101	176	266	347	443
	10	5	10	16	28	38	63	111	167	219	279
	8	3	6	9	16	22	36	64	96	126	161
	6	2	4	7	12	16	26	46	69	91	116
	4	1	2	4	7	10	16	28	43	56	71
	3	1	1	3	6	8	13	24	36	47	60
	2	1	1	3	5	7	11	20	30	40	51
	1	1	1	1	4	5	8	15	22	29	37
	1/0	1	1	1	3	4	7	12	19	25	32
	2/0	0	1	1	2	3	6	10	16	20	26
	3/0	0	1	1	1	3	5	8	13	17	22
	4/0	0	1	1	1	2	4	7	11	14	18
	250	0	0	1	1	1	3	6	9	11	15
	300	0	0	1	1	1	3	5	7	10	13
	350	0	0	1	1	1	2	4	6	9	11
	400	0	0	0	1	1	1	4	6	8	10
	500	0	0	0	1	1	1	3	5	6	8
	600	0	0	0	1	1	1	2	4	5	7
	700	0	0	0	1	1	1	2	3	4	6
750	0	0	0	0	1	1	1	3	4	5	
800	0	0	0	0	1	1	1	3	4	5	
900	0	0	0	0	1	1	1	3	3	4	
1000	0	0	0	0	1	1	1	2	3	4	

# Round House Combinations

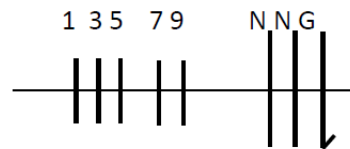
House	Hot	Hot	Hot	N	GND	Hot	Hot	Hot	N	GND
	1	3	5			2	4	6		
	7	9	11			8	10	12		
	13	15	17			14	16	18		
	19	21	23			20	22	24		
	25	27	29			26	28	30		
	31	33	35			32	34	36		
	37	39	41			38	40	42		
	43	45	47			44	46	48		
	49	51	53			50	52	54		
	55	57	59			56	58	60		
	61	63	65			62	64	66		
	67	69	71			68	70	72		
	73	75	77			74	76	78		
	79	81	83			80	82	84		
	85	87	89			86	88	90		
	91	93	95			92	94	96		
	97	99	101			98	100	102		
	103	105	107			104	106	108		
	109	111	113			110	112	114		
	115	117	119			116	118	120		
	121	123	125			122	124	126		

Examples:

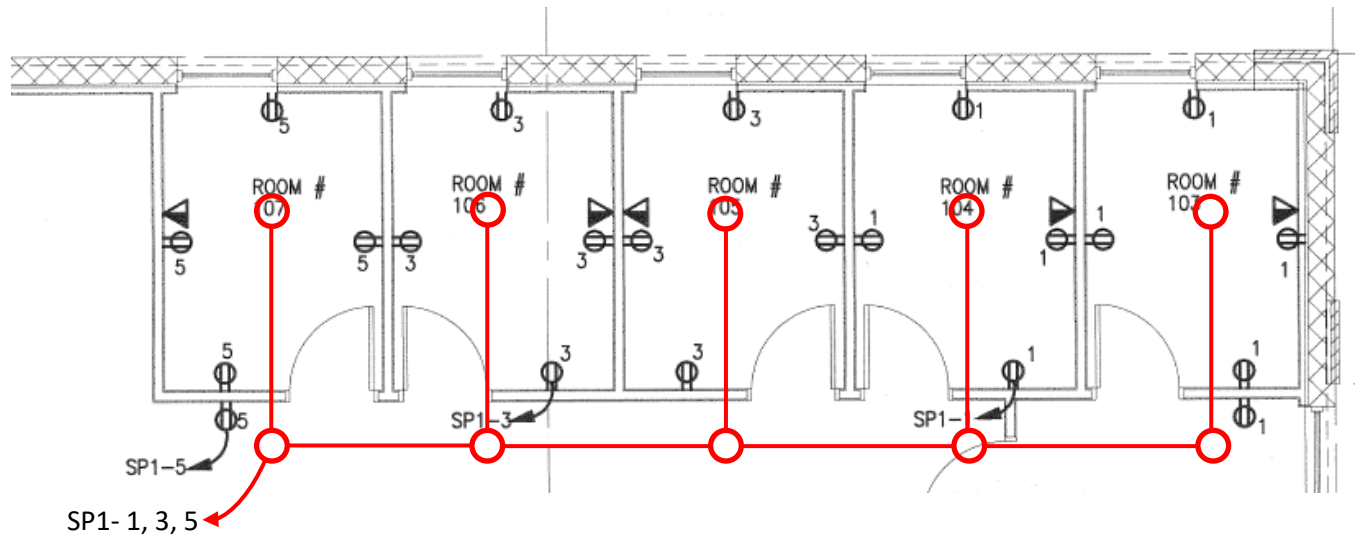
Round House



Round House + CKCT 7 & 9 - ADD N



### Branch Power Layout



### Branch Lighting Layout

