Panel Boards and Load Centers

Load Centers

Light duty residential use,' plug-on breakers 15" wide, 3-1/2" deep, restricted wiring gutter space. USE Copper Buss only.

Capacities available 60, 100, 150, 200 Amp.

Should be used only-for light duty, application, residences comfort stations, etc.

Main breaker or main lugs, only GFI breakers available.

Panel Boards

Heavy duty commercial and industrial use, shops, warehouses, offices, 20 inches wide, 5-3/4" deep bolt-on breakers, wider wiring gutters than load centers.

Use Copper Buss only.

Capacities available 60, 100A, 225, 400, 600, 800 Amp.

Use in any application.

Available in main breaker or main lugs only. GFI breakers available.

Panel Sizing

Panels must not be loaded up more than 80% of the main breaker rating.

Example: (225 A panel)(.8) = 180A maximum load.

Given Load: 33.41 KVA actual connected load, size panel, 1 phase, 120/240V. Balanced Panel

$$I = \frac{KVA}{KV} = \frac{33.41\ KVA}{.23\ KV} = 145.26A$$

(Use .23KV for 240V system) (for calculations)

145A + 25% Future Growth = 145A + 36A = 181A

$$\frac{181A}{.8} = 226A$$ use 225A panel

If panel is not balanced, use highest connected leg. This highest current in one phase then determines panel size.

Example: Given: 240V, 3 phase, 4 W

Ll = 150A

L2 = 195A Calculated Connected Load

L3 = 175A

Use L2, 195A, to size panel

195A + 25% future = 195A + 49A = 243 Amp

$\frac{243A}{.8} = 304A$ USE 4OOA panel. derating

Example Given: 50 KVA load, 120/208V, 3 phase, 4 W balanced.

$I = \frac{50\ KVA}{.2\ RV} = 144A$ (Use .2 KV for 208V systems)

144A + 25% future = 144A + 79A = 223A

$\frac{223A}{.8} = 278A$ USE 400A panel derating

Note: WYE systems must have full size neutral. No derating neutral.

Panel Balancing

Panel balancing is the process of arranging loads so that the main buss currents are about equal + 5% variation in currents.

Procedure 115/230V, 1 phase:

1. Make panel directory, and arbitrarily assign the 115 volt circuits to Ll and L2. 230 volt loads 1 phase are automatically balanced. USE actual line currents calculated from KVA
2. Add up line currents in each phase, that is, the current from the 115 volt loads, and the current from each 230 volt load. The 230 volt loads have the same current in Ll as L2 and must be counted twice.

Single Phase Panel

	L1, Amp	L2, Amp		
1 Outlets 115V	3	6	115V Outlets	5
2 Lights 115V	6	4	115V Lights	6
3 Motor 115V	6	12	115V Lights	7
4 Heater 230V	14 same	14		
	29 Amp	36 Amp		

Unbalanced

Loads 1, 2, 3, 5, 6, 7 can be switched. Load 4 (Heater) is already balanced.

Load		Ll Amp		L2 Amp	Load
1	Outlets	3		6	Outlets 5
2	Lights	6			
3	Motor	6		12	Lights 7
4	Heater	14	same	14	
6	Lights	4		0	
		33 A		32 A	Better Balance

Same procedure for 3 phase; but, phase loads contribute same current to all three phases, single phase line to line` loads contribute their current to only 2 lines. Single phase line to neutral contributes current to 1 line only.

3 Phase Panel 120/208V

		Ll Amp	L2 Amp	L3 Amp	
1	Outlets	5			
2	Lights		6		
3	Outlets	16			
4	Lights		14		
5	Heater 208V 1 phase	10		10	
6	Motor 3 phase 208V	12	12	12	
7	Heater 3 phase 208V	15	15	15	
8	Lights			8	
9	Outlets		6		
10	Outlets	6			
		67	53	42	Unbalanced

Balanced 3 phase, 120/208V

		Ll Amp	L2 Amp	L3 Amp	
1	Outlets	5			
2	Lights	6			
3	Outlets			16	
4	Lights			14	
5	Heater 208V 1 phase	10		10	
6	Motor 3 phase	12	12	12	
7	Heater 3 phase	15	15	15	
8	Lights		8		
9	Outlets		6		
10	Outlets			6	
		53A	58A	56A	Better Balanced

Try to balance phases for + 5% variation between phases. This will minimize voltage drop because neutral current approaches zero. On 120/240V, 3 phase Delta systems, watch out for phase 2, the wild leg. Cannot put 120 volt loads on this phase, because voltage is 208 volts to neutral.

Sizing Feeders for Panels

1. Feeders to panels must be equal to or greater than ampacity of main breaker. This assumes short runs with less than 3% voltage drop, copper feeders. USE NEC 310-16 ampacity tables.
Example:

	100A USE #3 CU wire
Panel	200A USE 3/O CU wire
Size	225A USE 4/0 CU wire
	400A USE 2 parallel runs of 3/0 CU wire
	600A USE 3 parallel runs of 3/0 CU wire
	Neutral should be same size as phase conductors far all systems.

2. Rule of thumb: If distance from transformer to panel exceeds 100', then voltage. drop may require larger wire than ampacity tables 310-16 require.

3. The above rules assume this panel is service entrance with no other loads as feeders

4. Interrupting short circuit rating of main and branch breakers must be larger than available fault current. Fault current limiting main breakers will allow use of 10,000 AC breakers for branch breakers.
Fault current limiting breakers are available in 100A, 225A, and 400A.

COMPUTATION SHEET FOR PANEL DIRECTORY LAYOUT

4-5

PROJECT: ____________________

PANEL: __________ VOLTAGE & PHASE: __________

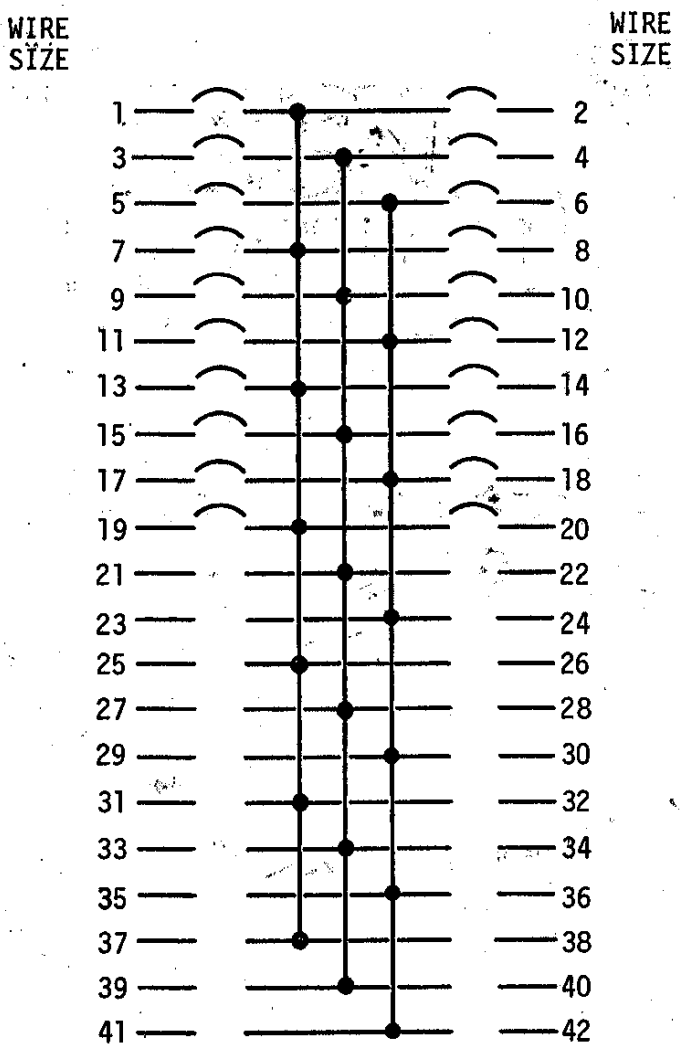
LOCATION OF PANEL: ____________________

CALCULATED BY: ____________________

LOAD	LINE	KV	AMPS/PHASE	$\sqrt{3}$	KVA	P.F.	KW	PHASE	C.B.	WIRE SIZE	H.P.

PANEL DIRECTORY

4-6



PANEL DIRECTORY

4-7