Sizing the Generator

Three Phase Power

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Power Generator Formulas

Standard Electrical Formulas Used for Power Consumption Calculations

TO DETERMINE:	SINGLE-PHASE	THREE-PHASE	DIRECT CURRENT
KVA	$\frac{I \times E}{1000}$	$\frac{I \times E \times 1.73}{1000}$	--------
Kilowatts	$\frac{I \times E \times PF}{1000}$	$\frac{I \times E \times 1.73 \times PF}{1000}$	$\frac{I \times E}{1000}$
Horsepower	$\frac{I \times E \times \%EFF \times PF}{746}$	$\frac{I \times E \times 1.732 \times \%EFF \times PF}{746}$	$\frac{I \times E \times \%EFF}{746}$
Amperes (when HP is known)	$\frac{HP \times 746}{E \times \%EFF \times PF}$	$\frac{HP \times 746}{1.73 \times E \times \%EFF \times PF}$	$\frac{HP \times 746}{E \times \%EFF}$
Amperes (when kW is known)	$\frac{KW \times 1000}{E \times PF}$	$\frac{KW \times 1000}{1.73 \times E \times PF}$	$\frac{KW \times 1000}{E}$
Amperes (when KVA is known)	$\frac{KVA \times 1000}{E}$	$\frac{KVA \times 1000}{1.73 \times E}$	--------

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Amperage of 3 Ph Generators

Amperage (120/208 3-Ph, 80% PF)

$$\frac{KW \times 1000}{E \times PF \times 1.73}$$

30 KW Generator = AMPS

$$\frac{30{,}000}{208 \times .8 \times 1.73} = 104$$

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Amperage of 3 Ph Generators 80% Power Factor

kVa	kW	208V	220V	240V	380V	400V	440V	450V	480V
6.3	8	17.5	16.5	15.2	9.6	9.1	8.3	8.1	7.6
9.4	7.5	26.1	24.7	22.6	14.3	13.6	12.3	12	11.3
12.5	10	34.7	33	30.1	19.2	18.2	16.6	16.2	15.1
18.7	15	52	49.5	45	28.8	27.3	24.9	24.4	22.5
25	20	69.5	66	60.2	38.4	36.4	33.2	30.1	24
31.3	25	87	82.5	75.5	48	45.5	41.5	40.5	37.8
37.5	30	104	99	90.3	57.6	54.6	49.8	48.7	45.2
50	40	139	132	120	77	73	66.5	65	60
62.5	50	173	165	152	96	91	83	81	76
75	60	208	198	181	115	109	99.6	97.5	91
93.8	75	261	247	226	143	136	123	120	113
100	80	278	264	240	154	146	133	130	120

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Amperage of 1 Ph Generators

Amperage (120V- 1-Ph, 80% PF)

$$\frac{KW \times 1000}{E \times PF}$$

30 KW Generator = AMPS

$$\frac{30{,}000}{120 \times .8} = 312$$

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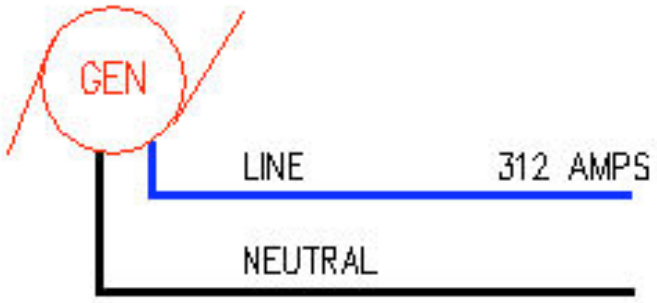
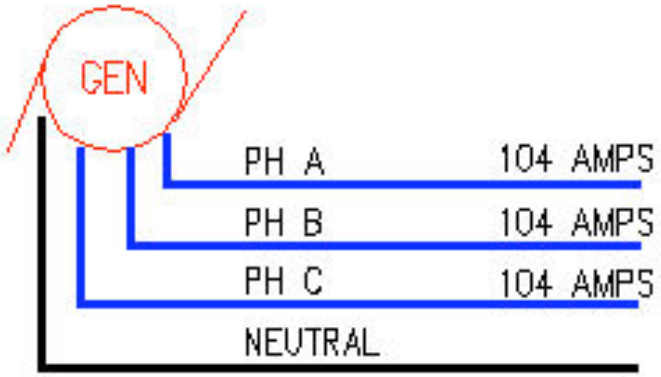
Compare 3 PH to 1 PH

30KW – 1 Phase – 80% PF 120V



30KW – 3 Phase – 80% PF 120/208v



Both Generators produce the same amount of total **POWER – WATTS** – but in completely different methods of delivery.

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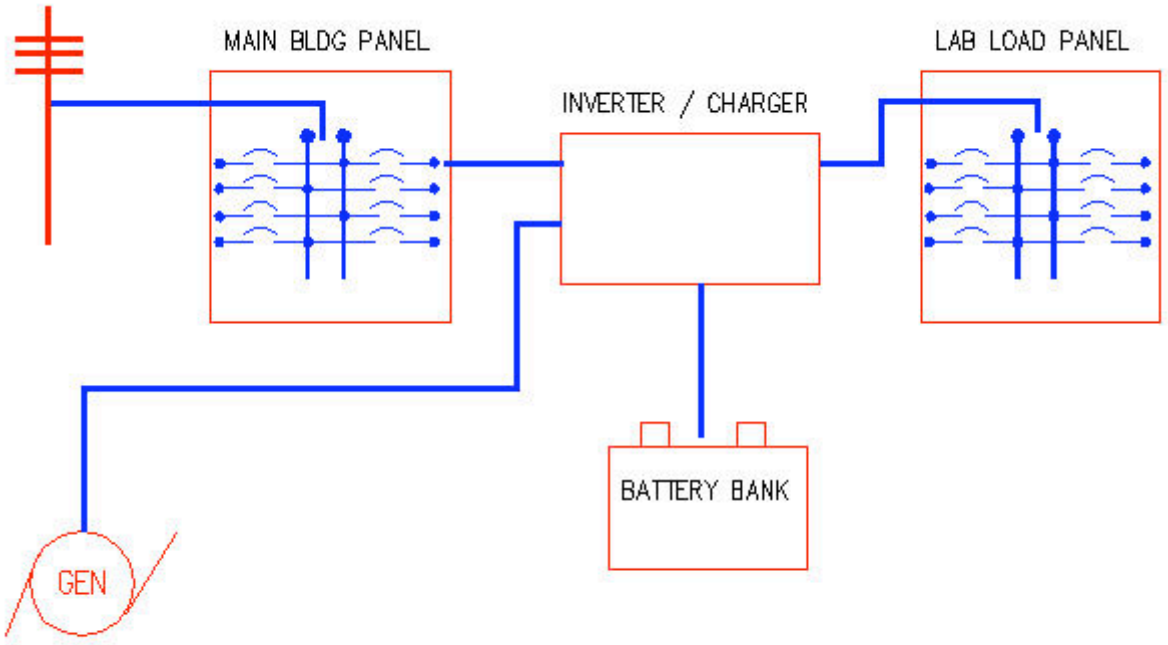
Example



Assume:

- Charger is set at 30 amps.
- Lab Loads will be 15 amps
- Total expected amp draw – 45 amps
- Everything here is single phase.

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Example

- We need to supply 45 amps to the Inverter / Battery / Lab Load system from a generator.
- We would probably select a minimum 15 KW three phase generator, producing 52 amps (per phase).
- (single phase generators over 5 kw are often hard to find.)
- Most often the difference between three phase and single phase is not considered.

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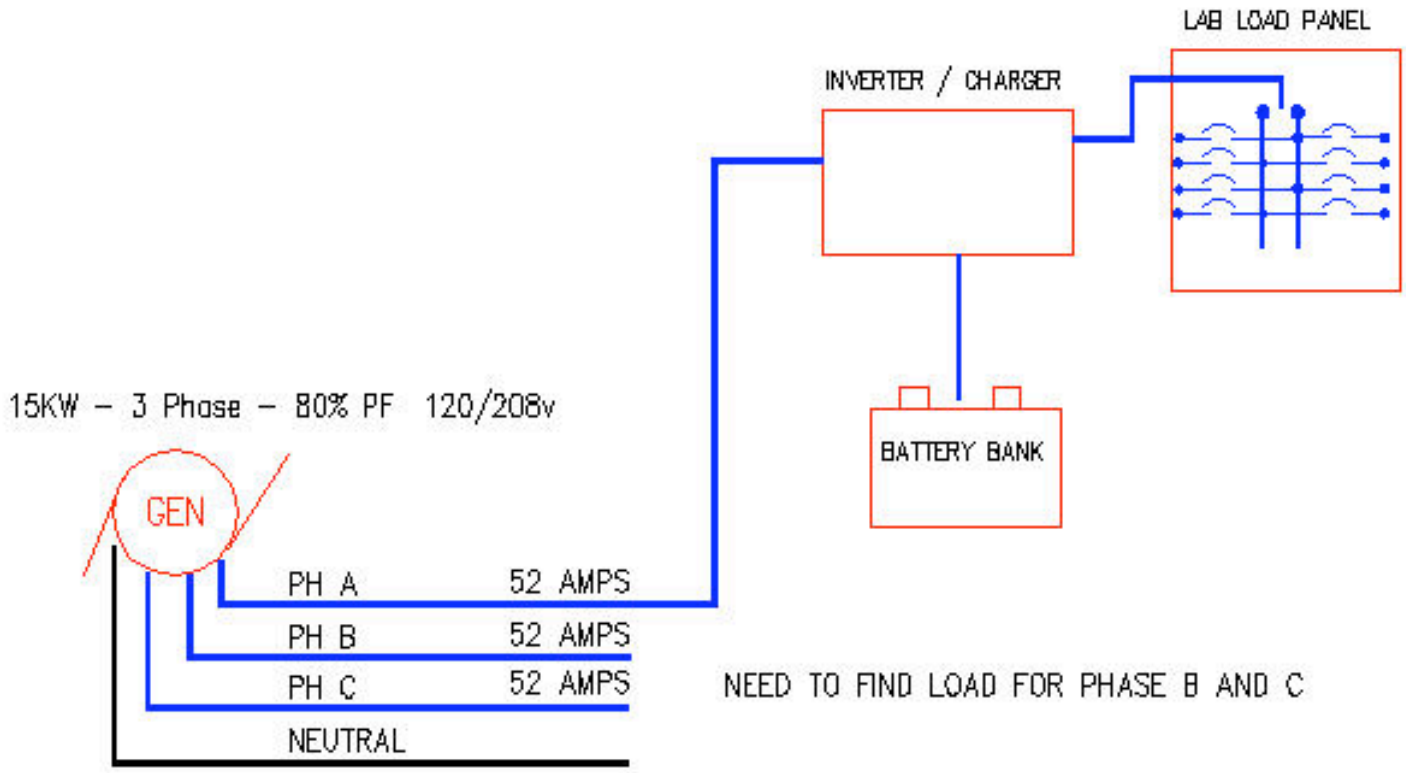
The result:



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Other likely Scenarios

- For expediency, a ministry purchases a trainload of 30KW, 3PH generators.
  - Good discount
  - 30 KW sounds plenty big enough
  - Not sure of the application (single phase, three phase, 240V, inverter, no inverter???
- Result: Much more fuel is burned, or health services are not provided because fuel can not be afforded.

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Discussion Topics

- Suggested Solutions?
- What does unbalancing do to a generator?
- Questions for Generator representative?

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