

National Dock and Marina Conference

**Electrical Factors to Consider
in
Marina Design**



Forster Electrical Engineering, Inc.

550 N. Burr Oak Ave, Oregon, WI 53575

(608) 835-9009

(608) 835-9039 fax

Electrical Terminology 110, 115 or 120 volts?

**Most appliances are
designed for and rated at
a nominal 120 volt rating**

208, 220, 230 or 240 volts?

208 volts is the power provided from a 120/208 volt supply, it is intended to operate a 200 volt rated motor

What's the difference?

208 volts

220 volts

230 volts

240 volts

120/208 Volts - (3 phase)

- 120 volt loads are fine...
- 208 volt supply is intended to operate a 200 volt rated motor

220 Volt Rating

Most equipment nameplate rated 220 volts can operate on 208 to 240 volt systems

230/240 Volts - (1 phase)

- 120 volt loads are fine
- 240 volt supply is intended to operate a 230 volt rated motor

230/240 Volts - (3 phase)

Avoid 240 volt three phase, three or four wire systems!

120/240 Volts - (1 phase)

- This is OK..
- 120 volt loads are fine
- 230/240 volt loads fine

277/480 Volts - (3 phase)

480 volt supply is intended to operate 460 volt rated equipment or a step-down transformer

What does “VA” mean?

Volt-amperes

For most situations (1)
VA can be considered
equal to (1)Watt

What is “NEC”?

National Electrical Code

-

Don't forget State and
Local Codes

What is “Div.”?

Diversity

An allowance for the fact that not all outlets are being used at a single point in time

What Voltage is Best?

Small marina or large?

What is the layout?

Small Marina

Use 120/240 volt single
phase

Large Marina

120/208 volt three phase
277/480 volt three phase

OK, which one?

Can you get the power to
the pier at 208 volts?
(Yes/No)

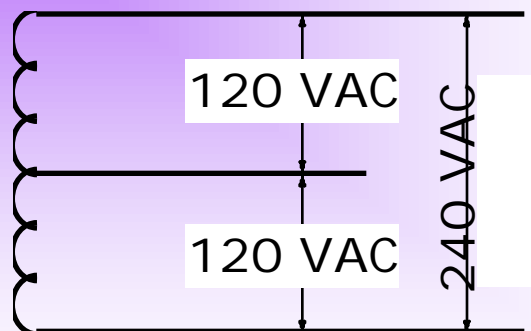
Yes: 208 is Adequate

Consider this system for
economy

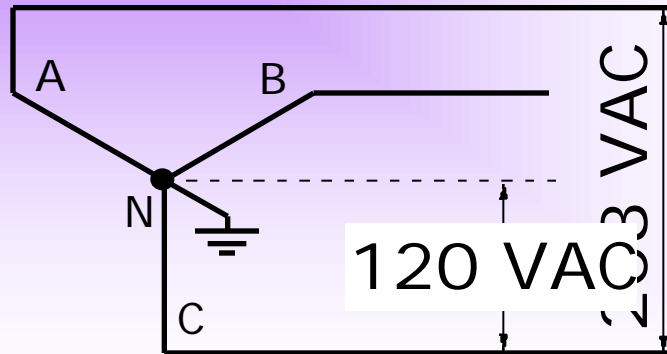
208 is NOT Adequate

Better look at 480
volt with step-
down transformers
(480-120/240)

What is Single Phase?



What is Three Phase?



How Do I Connect Ped's

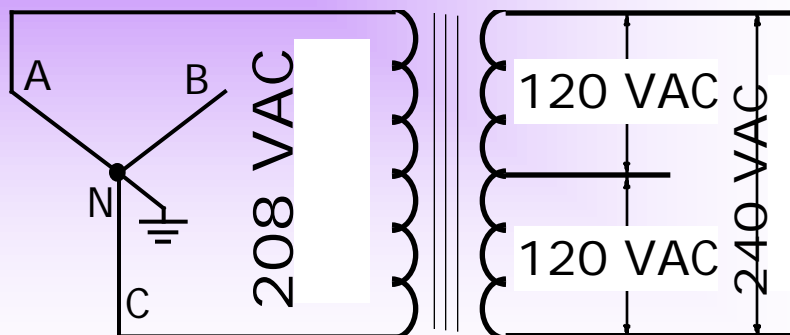
Radial Loop Feed?
Radial Tapped Feeder?

What do I do?

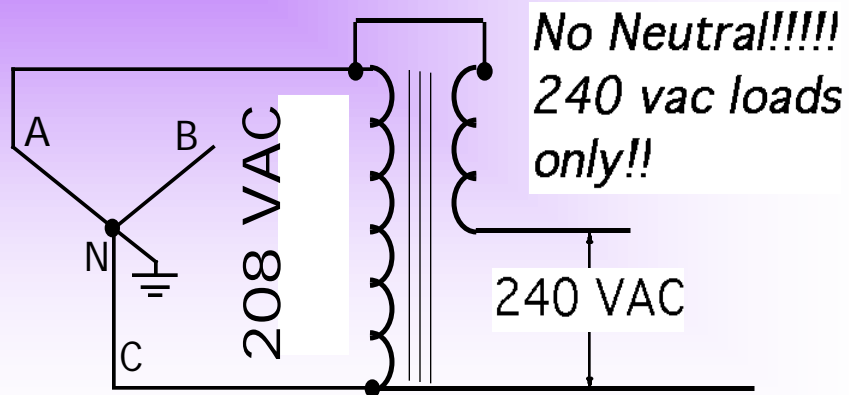
I'm on 208...

**I MUST
have 240 volts!**

**Use an isolation step-up
transformer**



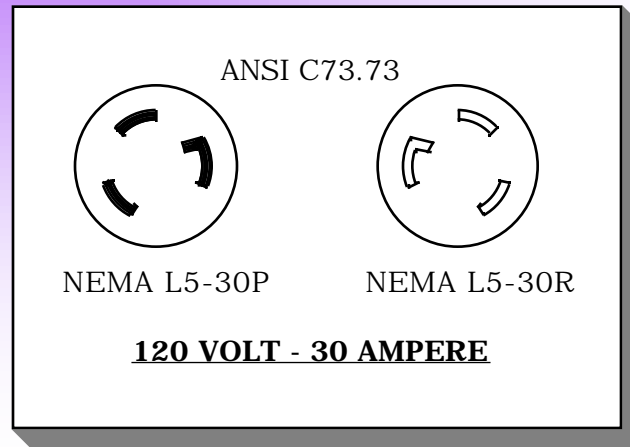
Do NOT do this!!!



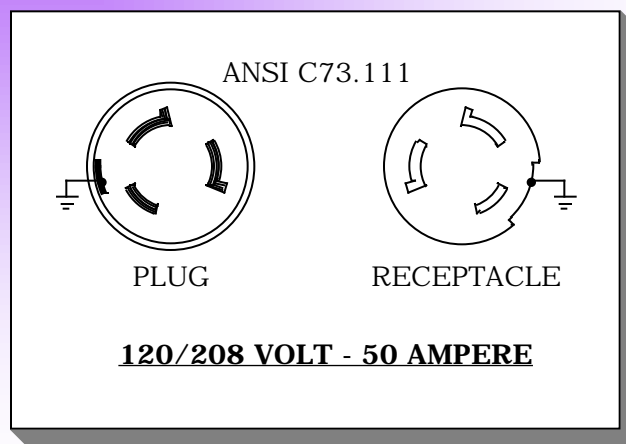
**My Voltage Varies Too
Much**

**What do I
do?**

Is this how you provide 120 volts?



120/208 or 120/240



Tell the people....

*This pedestal offers only
120 volt ac power*

Tell the people..

*This pedestal offers 120
or 208 volt ac power*
***Do not connect 230 or
240 volt equipment***

Tell the people

*This pedestal offers 120
or 240 volt ac power*

*Do not connect 208 volt
equipment*

How much power is needed?

Lights = 660 VA = 3 A @ 120

Refrig = 660 VA = 3 A @ 120

Micro = 960 VA = 8 A @ 120

Coffee = 960 VA = 8 A @ 120

How much power is needed?

Coffee = 960 VA = 8 A @ 120

A/C _{7,500BTU} = 1,200 VA = 10 A

D.W. = 1200 VA = 10 A @ 120

Heater = 1920 VA = 16 A @ 120

How much is a 1P-30A outlet good for?

The total load must be equal to or less than **24** amperes @ **120** volts

**How much is a 2P-50A
outlet good for?**

The total load must be
equal to or less than **80**
amperes @ **120** volts

**How much is a 2P-50A
outlet good for?**

The total load must be =
to or less than **40**
amperes @ **208** or
240 volts

What is Diversity?

If we did not use
diversity:

**System Load = # of
outlets * VA per outlet**

NEC Section 555 says...

1-4 outlets - All on...

5-8 outlets - 90% on...

9-14 outlets - 80% on...

15-30 outlets - 70% on...

there is more...

**My ampere loads are
within NEC 555 for the
feeder and breaker
sizes. That means my
design is adequate.
Wrong!**

**Do not forget
about voltage
drop**

Telephone Service

- Just provide raceways...
- Customize the Telco peds
- Install your own...
- **U Sell** - Cellular & PCS

CATV Service

- Just provide raceways...
- Install your own...

Electric Metering

- OK with authorities?...
- Include power limits
- If free, they **abuse** it!

Design/Cost Review

Marina Size:

257 Slips (Bid)

464 Slips (Future)

Benefits of Bidding Multiple Designs

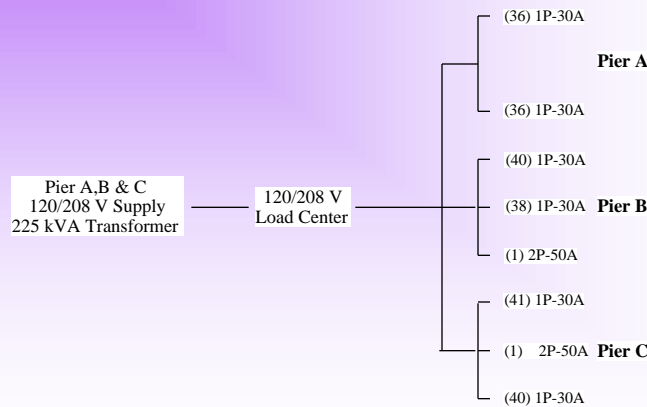
Base Bid - 120/208 with loop feeder

Alt #1 - 120/240 with loop feeder

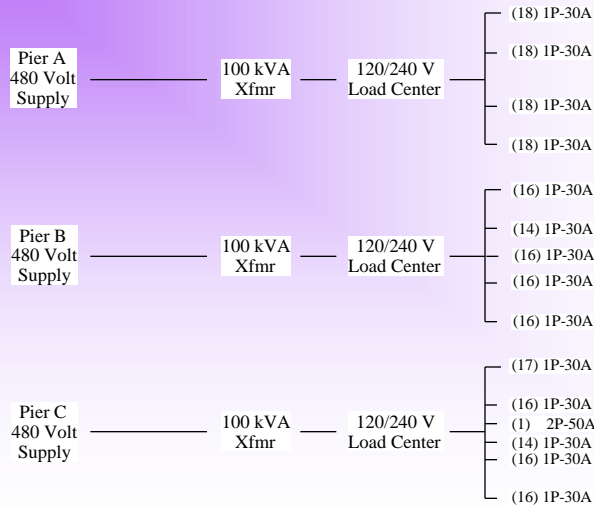
Alt #2 - 120/208 with tapped feeder

Alt #3 - 120/240 with tapped feeder

120/208 Volt



480 to 120/240 Volt



Bid Results

- Base Bid - \$431,932
- Alt #1 - \$533,138
- Alt #2 - \$482,332
- Alt #3 - \$557,932

Cost Per Slip

- Base Bid - \$1,681
- Alt #1 - \$2,074
- Alt #2 - \$1,877
- Alt #3 - \$2,171

Cost As A Percentage -

- Pedestals - 12%
- Load centers - 8%
- J-Boxes & terminals - 4%
- Type G cable - 27%
- Xfmrs - Not included
- Labor & misc. - 49%

Bid Comparisons

Low to High Bid Difference -
\$126,000

Low to Next Lowest Bid Diff. -
\$50,400

Bid Comparisons

All Electrical Engineering costs did not exceed the difference in Bids. Unless the Owner guessed correctly on best design, the engineering required to provide multiple designs for bidding was at no cost to the Owner.

Is one method of wiring best for all marinas?

Here are some items to consider

Check with the Utility

- What sources are avail?
- Contribution-in-Aid of construction?
- Single or three phase?

Layout of Marina

- Voltage drop
- Feeder length
- Xfmr sites

Power at Slip

- Loads at end of piers=\$\$
- Cost = $(\text{pwr}/\text{slip})^2$

Pier Type

- Floating
- Fixed
- Combination
- Room below deck

Other Important Items..

- Budget
- Month's of activity
- Maintenance personnel
- Salt or fresh water

Pier Type

- Floating
- Fixed
- Combination
- Room below deck