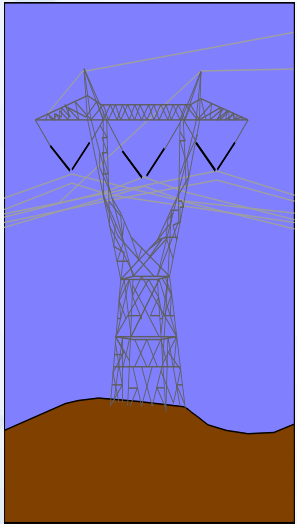


Transformer Seminar



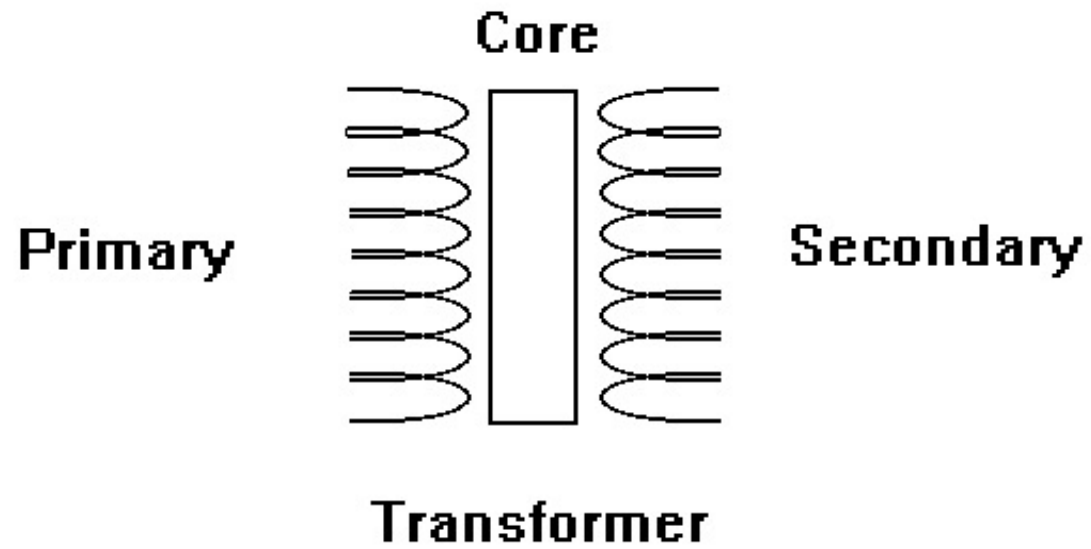
BASIC THEORY
SIZING & SELECTION
GENERAL PURPOSE TRANSFORMERS



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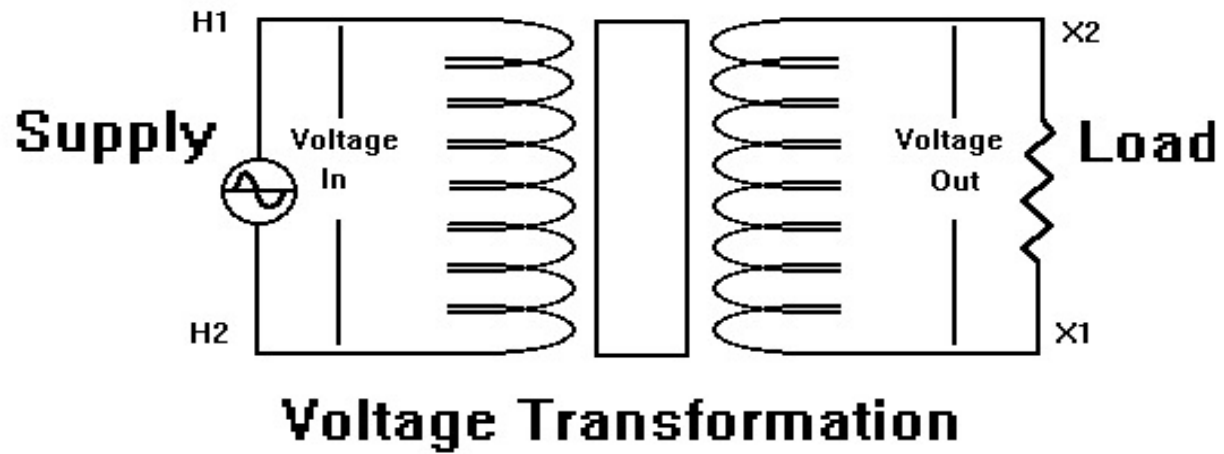
Basic Transformer



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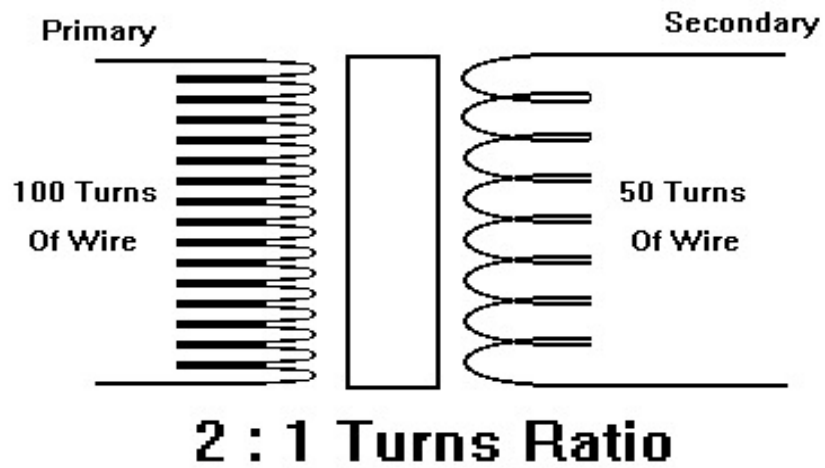
Voltage Transformation



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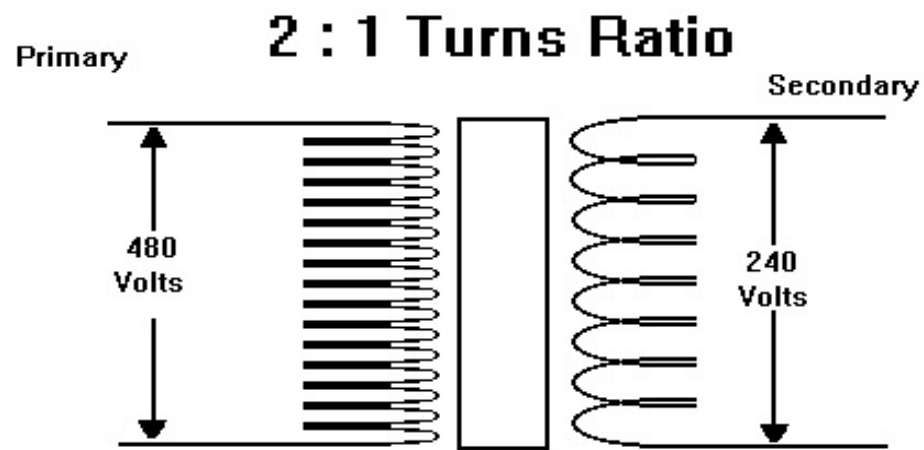
Turns Ratio



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Voltage Ratio



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Three Basic Components

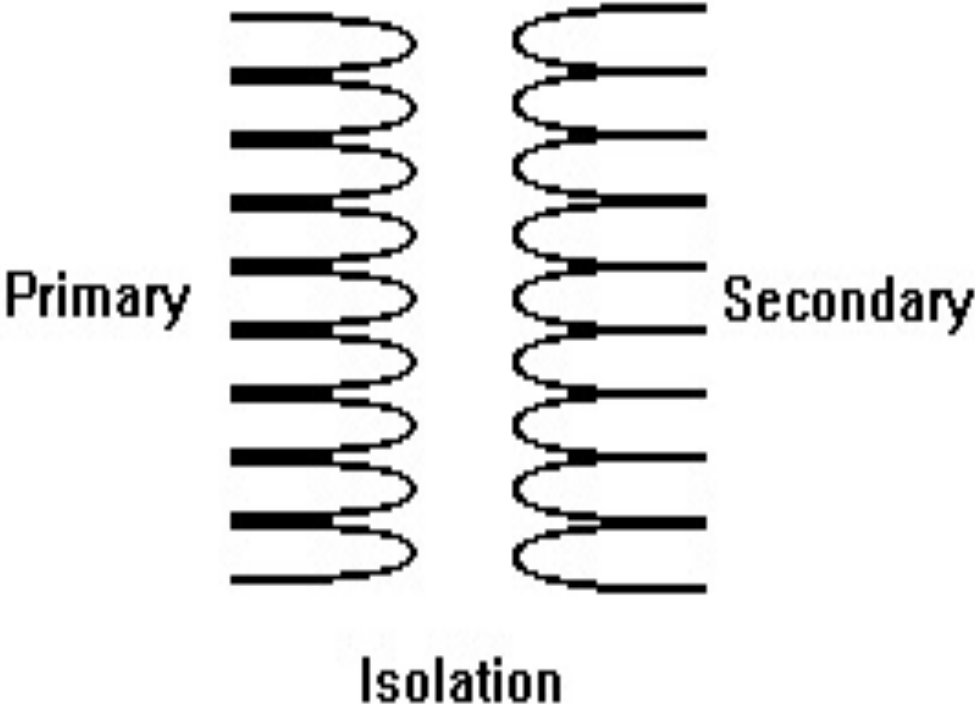
1. Core (magnetics)
2. Coils (conductors)
3. Insulation (paper, etc.)



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Electrical Types of Transformers

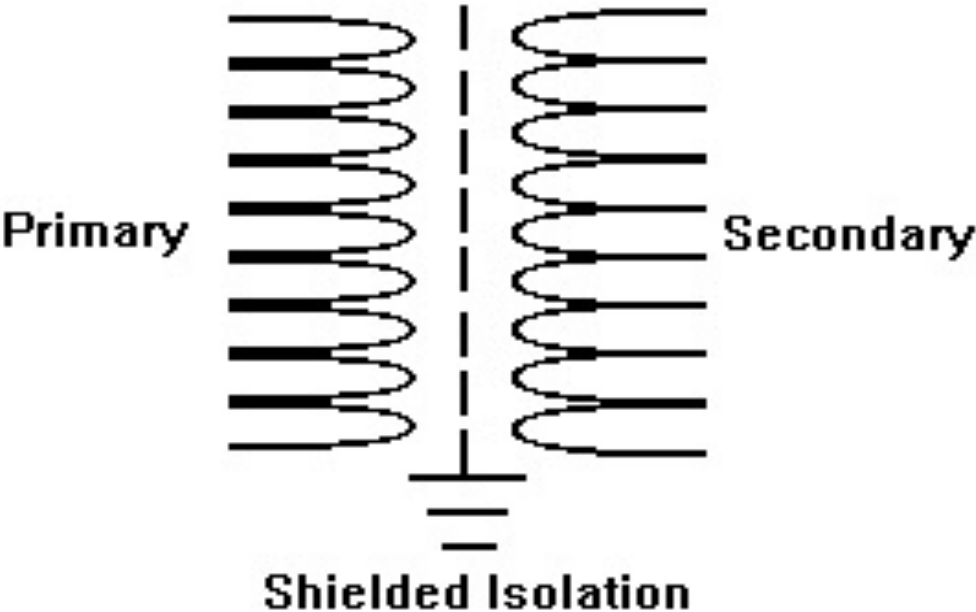


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Electrical Types, cont'd

"SHIELDED ISOLATION"

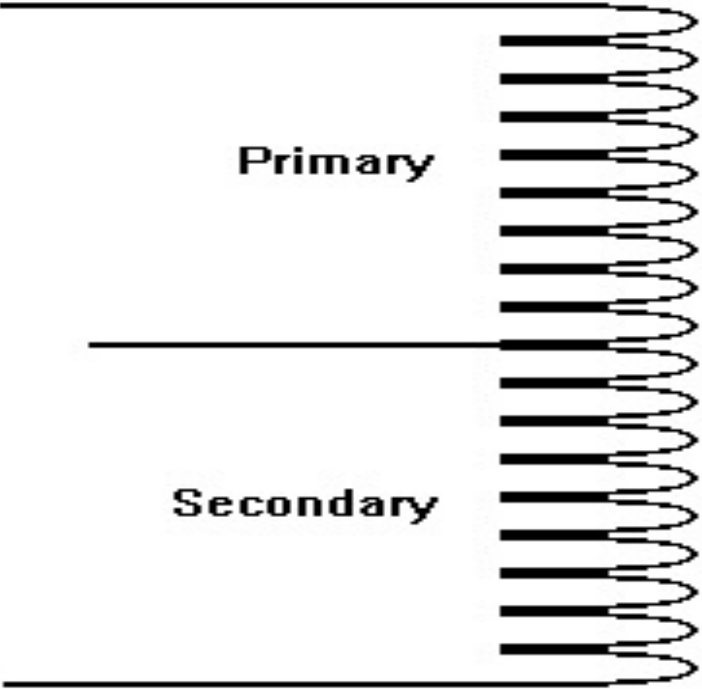


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Electrical Types, cont'd

“Auto-Transformer”



Autotransformer



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Transformer Taps

Taps are “typically” located on the Primary of the transformer.
The NEMA designation for taps is:

ANFC - Above Normal Full Capacity

BNFC - Below Normal Full Capacity

Spacing of taps is usually 2 1/2 % or 5 % of rated voltage



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Numerical Example of Taps

480 volt Primary with 2-2.5% ANFC and 4 2-2.5% BNFC Taps
(2.5% x 480v = 12v) Each tap will change by 12v.

- 504v (ANFC)
- 492v (ANFC)
- 480v (Nominal)
- 468v (BNFC)
- 456v (BNFC)
- 444v (BNFC)
- 432v (BNFC)



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Acme Standard Tap Chart

Cat numbers no longer contain dashes

(For reference only)

CATALOG NUMBER SUFFIX:

NO SUFFIX = NO TAPS

-S = SHIELDED BUT NO TAPS

-1S = 2 X 5% BNFC

-2S = 1 X 5% ANFC & 1 X 5% BNFC

-3S = 2 X 2.5% ANFC & 4 X 2.5% BNFC

-4S = 2 X 2.5% ANFC & 2 X 2.5% BNFC

-5S = 2 X 5% ANFC & 2 X 5% BNFC



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Agency Listings and Certifications

- UL
- CE
- CSA
- ANSI
- NEMA
- IEEE
- ISO 9001



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General Purpose Transformers

Single Phase

(Enclosure Ratings)

- .050 - .150 kva Totally Enclosed (3R)
- .250 - 25 kva Epoxy Encapsulated (3R)
- 37.5 - 250 kva Ventilated (NEMA 2)
- 37.5 - 100 kva Non-Ventilated (3R)

(NEMA 2 becomes 3R with addition of weather shield)



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General Purpose Transformers

Three Phase

(Enclosure Ratings)

3 - 15 kva Epoxy Encapsulated (3R)

15 - 1000 kva Ventilated (NEMA 3R)

30, 45, & 75 kva Epoxy Encapsulated (3R)



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Steps for Selecting the Proper Single Phase Transformer

Determine load data:

- Voltage required by load
- Amperes, horsepower, or kva required by load
- Frequency
- Verify load is designed for single phase

Determine supply data:

- Voltage of supply
- Frequency

(Supply can be single or three phase)



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Selecting Single Phase, cont'd

If the load nameplate expresses a rating in kva, a transformer can be selected directly from the charts in the ATD-01 catalog.

If motor horsepower is known, you must first select kva from the charts in the front of Section I or from the KVA Card.



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Sizing Single Phase Transformers

Always size based on load volts and load amps!

To determine kva when volts and amps are known:

$$\text{KVA} = \frac{\text{Volts} \times \text{Amps}}{1000}$$

To determine Amperes when kva and volts are known:

$$\text{AMPS} = \frac{\text{KVA} \times 1000}{\text{Volts}}$$



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Single Phase Selection

PROBLEM #1

Load: 1-phase, 60Hz, 240 v, @ 10 A.

Supply: 1-phase, 60Hz, 480 v

PROBLEM #2

Load: 1-phase, 60Hz, 120 v, @ 50 A.

Supply: 1-phase, 60Hz, 480 v



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Single Phase, cont'd

PROBLEM # 3

Load: 1-phase, 60 Hz, 3HP motor,
240 V, starts 2 times/hour

Supply: 1-phase, 60 Hz, 480 V

PROBLEM # 4

Load: (1) 3/4 HP, 1-phase, 240v motor
(2) 1/4 HP, 1-phase, 120v motors
(4) 50 watt lamps, 120 v

Supply: 1-phase, 60 Hz, 480 V



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Steps for Selecting the Proper Three Phase Transformer

Determine load data

- Voltage required by the load
- Amperes, horsepower, or kva required by load
- Frequency
- Verify load is designed for three phase

Determine supply data

- Voltage of supply
- Frequency

(Supply MUST be three phase)



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Selecting Three Phase, cont'd

If the load nameplate expresses a rating in KVA, a transformer can be selected directly from the charts in the catalog.

If motor horsepower is known, you must first select KVA from the charts in the front of Section I or from the KVA card.



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Sizing Three Phase Transformers

Always size based on load volts and load amps!

To determine kva when volts and amps are known:

$$\text{KVA} = \frac{\text{Volts} \times \text{Amps} \times 1.73}{1000}$$

(1.73 due to phase shift of 120 degrees between phases)

(1.73 = square root of 3)



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Sizing Three Phase Transformers, cont'd

To determine amperes when kva and volts are known:

$$\text{AMPS} = \frac{\text{KVA} \times 1000}{\text{Volts} \times 1.73}$$

Note: A 3-phase transformer can be seen as three 1-phase transformers.

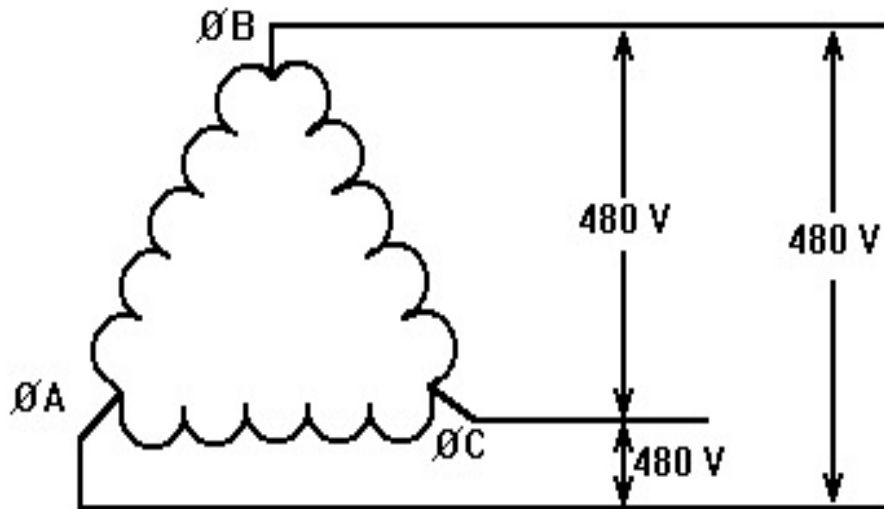
Example: 30 kva = 3 - 10 kva 1-phase units. (10 kva per coil)



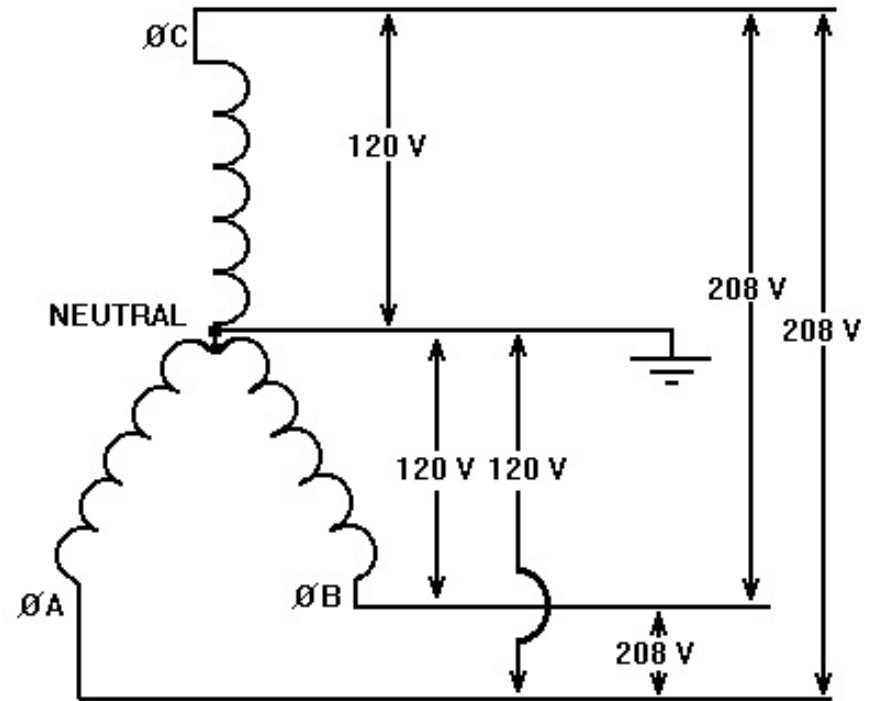
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Delta – WYE Connection



480 V Delta



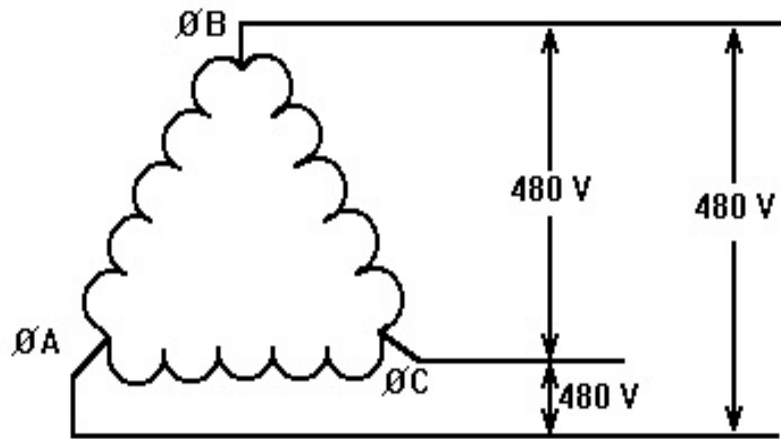
208Y/120 V



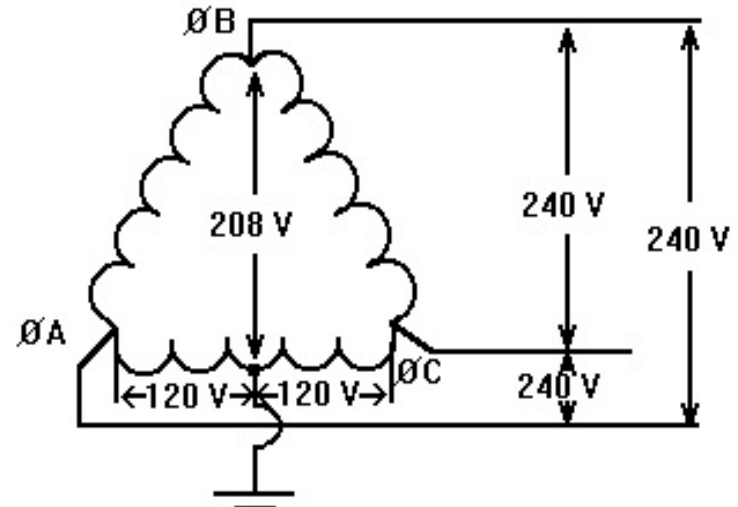
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Delta-Delta Connection



480 V Delta



**240 V DELTA /
120 V CENTER TAP**



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Acme Electric®

Three Phase Selection

Problem # 1

Load: 3-phase, 60 Hz, 208 v @ 30 A

Supply: 3-phase, 60 Hz, 480 v

Problem # 2

Load: 3-phase, 60 Hz, 240 v @ 50 A

Supply: 3-phase, 60 Hz, 480 v



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Three Phase, cont'd

Problem # 3

Load: (1) 3-phase, 240v, 30 HP motor
(1) 1-phase, 240v, 5 HP motor
(1) 1-phase, 120v, 2 KW heater

Supply: 480Y/277, 3-phase, 60 Hz



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Questions or Comments

Tech Service contact number:
800-334-5214 option 1



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