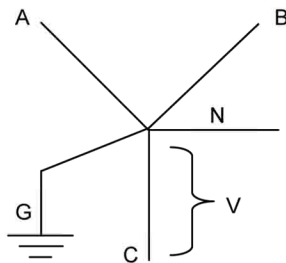




## What Electrical System Is It?

- Based on secondary side of upstream transformer, NOT by how load is connected
- Most SPD/TVSS miss-orders are misunderstandings related to grounding or neutrals
- Grounded system means that the system is referenced to ground, NOT that there is a safety ground
- By convention, ground wires are not 'counted' as one of the wires (3-wire, 4-wire, etc.)



### 3-phase 4-wire Grounded Wye

Neutral bonded to ground

Neutral pulled into facility

Common system configuration

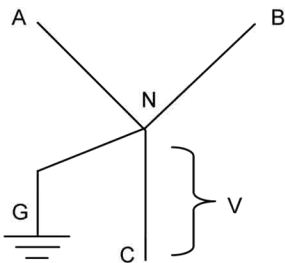
V = 120V (208Y/120V) APT '2'

V = 277V (480Y/277V) APT '4'

V = 347V (600Y/347V) APT '8'

V = 127V (220Y/127V) APT '21' (non-USA)

V = 220V (380Y/220V) APT '7' (non-USA)



### 3-phase 4-wire Grounded Wye

Neutral bonded to ground

Neutral NOT pulled into facility

Common system configuration at MCC, pumping and water treatment

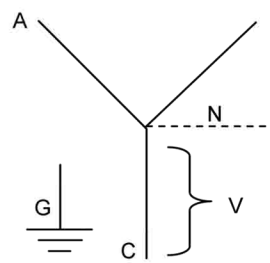
V = 120V (208Y/120V) APT '2'

V = 277V (480Y/277V) APT '4'

V = 347V (600Y/347V) APT '8'

V = 127V (220Y/127V) APT '21' (non-USA)

V = 220V (380Y/220V) APT '7' (non-USA)



### 3-phase 4-wire Ungrounded Wye

Neutral NOT bonded to ground

Neutral may or may not be pulled into facility

Rare system configuration; Error/miss-wire?

Note NEC 285.3(2),

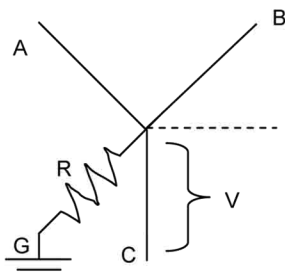
V = 120V (208Y/120V) Rare - Call

V = 277V (480Y/277V) APT '5'

V = 347V (600Y/347V) APT '9'

V = 127V (220Y/127V) Call (non-USA)

V = 220V (380Y/220V) Call (non-USA)



### Resistive or Impedance Grounded Wye

Neutral bonded to ground via grounding resistor

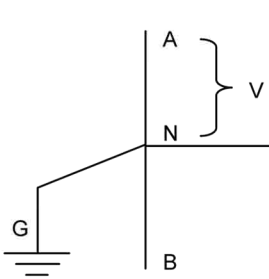
Neutral may, or may not, be pulled into facility

Becoming popular system on high-tech

V = 120V (208Y/120V) Rare - Call

V = 277V (480Y/277V) APT '5'

V = 347V (600Y/347V) APT '9'



### Split-Phase 'Single-Phase'

Neutral bonded to ground

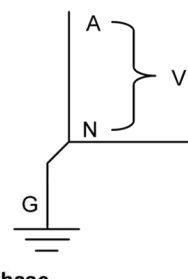
Neutral usually pulled into facility

Very, very Common

V = 120V (120/240V) APT '1'

V = 240V (240/480V) Rare - Call

V = 127V (127/254V) APT '15' (non-USA)



### Single-Phase

Verify where Neutral and Ground are!

Often for one leg or one piece of equip.

Neutral bonded to ground

Less common than perceived!

V = 120V APT '11'

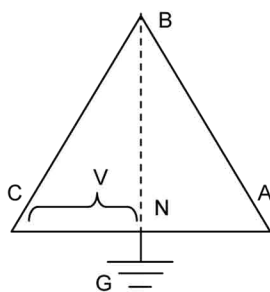
V = 240V APT '12'

V = 277V APT '16'

V = 480V APT '17' Call - almost always different

V = 127V APT '13' (non-USA)

V = 220V APT '12' (non-USA)



### Hi-Leg Grounded Delta

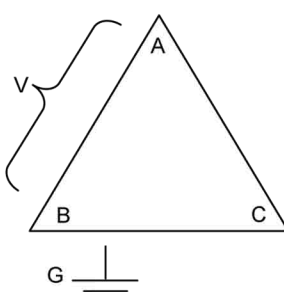
Neutral bonded to ground

Neutral often pulled into facility

Common system configuration

V = 120/240V APT '3'

V = 240/480V Call



### 3-phase 3-wire Ungrounded Delta

System has no reference to ground

L-L voltages fixed by transformer, but L-G voltages can vary; Known to become unstable.

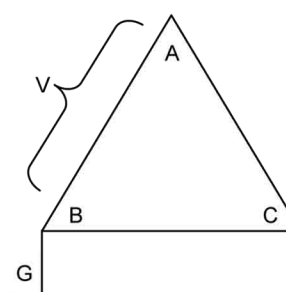
V = 240V APT '6'

V = 480V APT '5'

V = 600V APT '9'

Note NEC 285.3(2)

Common system configuration at older industrial facilities, normally not used on new construction



### 3-phase 3-wire Corner Grounded Delta

System has reference to ground because B phase is grounded

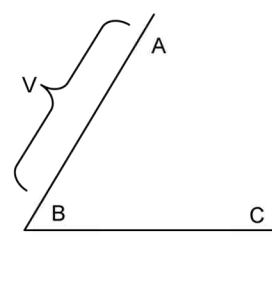
V = 240V APT '61'

V = 480V APT '51'

V = 600V APT '91'

Note NEC 285.3(2)

Occasionally seen at industrial facilities, normally not used on new construction



### Open Delta

3-phase 3 or 4-wire

Could be ungrounded, corner grounded or Hi-leg

Very rare, tend to be rural

Various solutions, Call for info



Since 1910

Presented by:

**THOMPSON LIGHTNING PROTECTION, INC.**

901 Sibley Highway • Saint Paul, MN 55118-1792 • 651-455-7661

1-800-777-1230 • Fax 651-455-2545 • Email: tlp@tlpinc.com

Rev Date: 3/16/09