Topics for Today:

- Announcements
  - Office hrs: 2:05-2:55pm M,W,F
  - Office: EERC 614. Phone: 906.487.2857
  - XFMR exercises posted on web page, due Mon Sept 22, 9am
  - CKTS problems collected by 9am Mon Sept 15th.
  - Recommended problems from Ch.2, solutions posted

- Followup questions on circuits basics
- XFMR, Chapter 2 - Transformers and circuits w/transformers
  - 3-ph transformer banks and phase shifts (ANSI/IEEE vs. IEC)
  - Standard 30° shift transformers, non-standard connections
  - Pos/neg sequence phase shifts, sequence networks
  - Autotransformers
  - Load Tap Changing (LTC) transformers
How many possibilities are there for Δ-Y or Y-Δ phase shifts?

\[ \pm 30^\circ, \pm 90^\circ, \pm 150^\circ \] 6 each

\[ \Rightarrow \text{12 total.} \]

Auto- Δ

Zig - Zig

Extended Δ.
Balanced 3-ph Voltages:

$|\vec{V}_{AG}| = |\vec{V}_{BG}| = |\vec{V}_{CG}|$
Extend Delta
Transformer Phase Shifts

- See Δ-Y transformer nameplate

Diagram:

- H3
- H2
- H1
- X3
- X2
- X1

Pos seq voltage phase shift
3-PHASE XFMR BANK

Ex: Δ-Y

From: Review Lecture 5
\[ I_N = 3I_{AO} \] 

\[ V_{DROP} = 3I_{AO}Z_n \]

\[ = V_{NG} \]
SEQUENCE NETWORKS FOR TRANSFORMERS