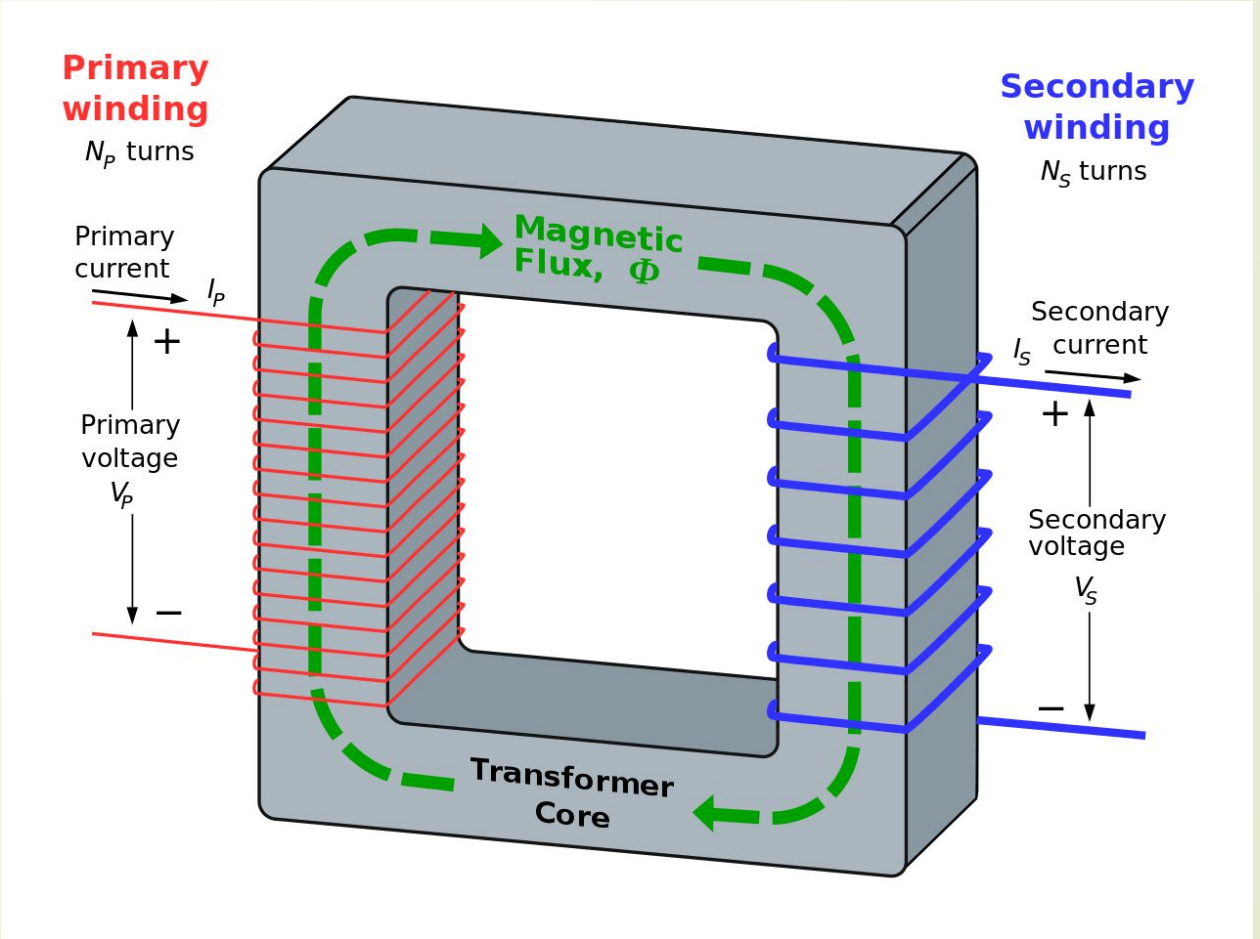
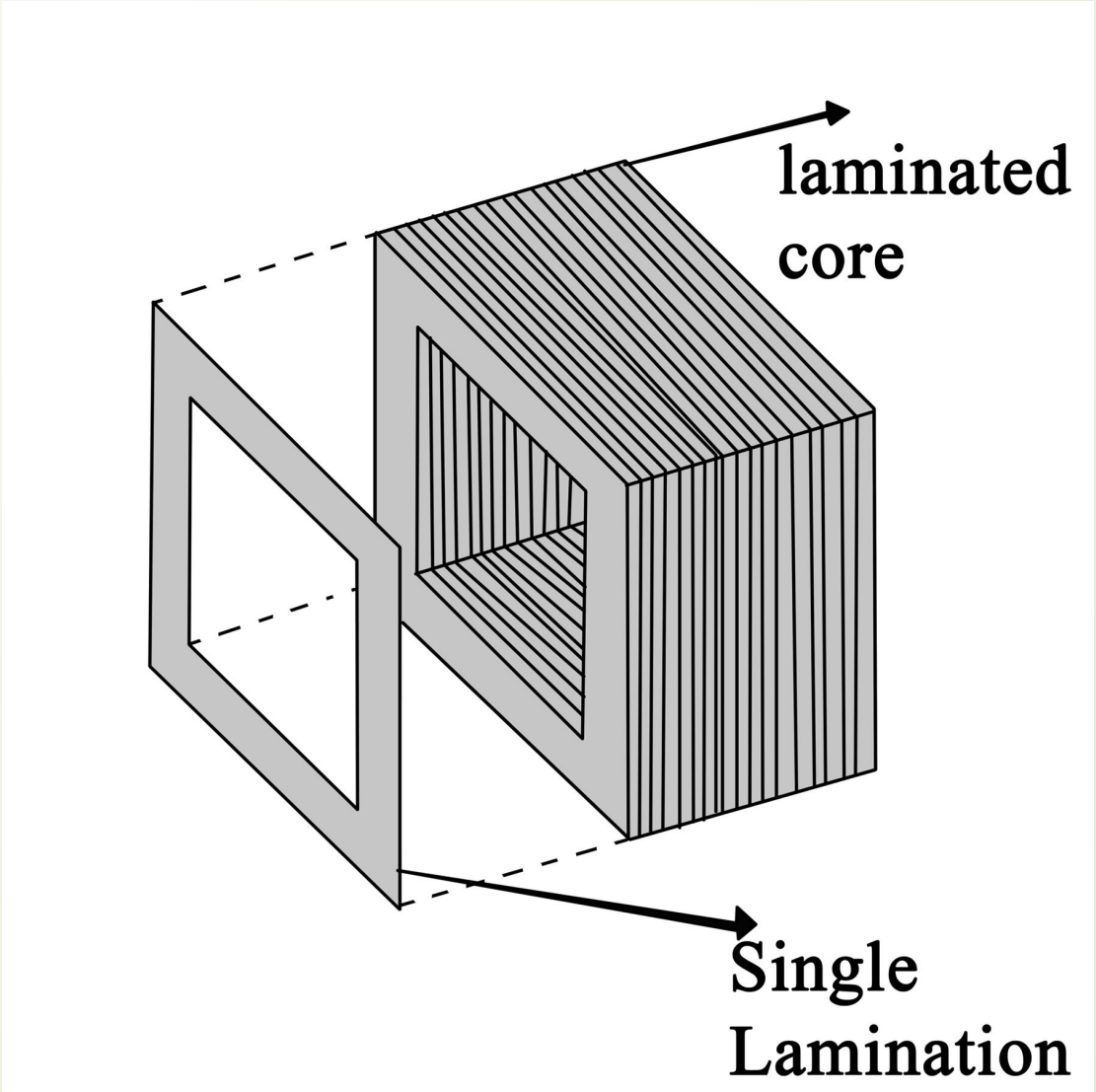
Construction of Single-Phase Transformers

TRANSFORMER CORE & WINDINGS



- Image Courtesy: http://large.stanford.edu/courses/2016/ph240/swafford1/

Core Construction



Core Construction

- Types of core cross-sections

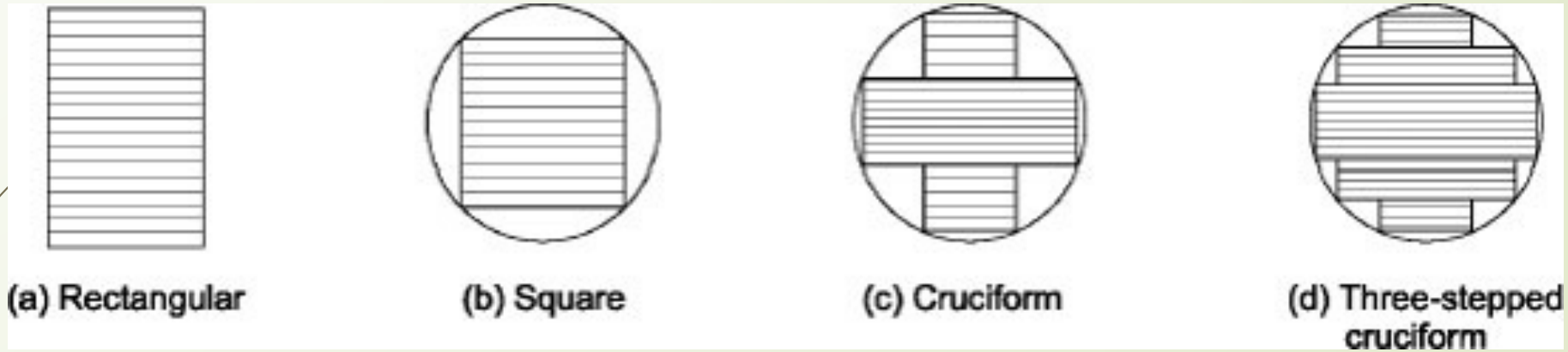
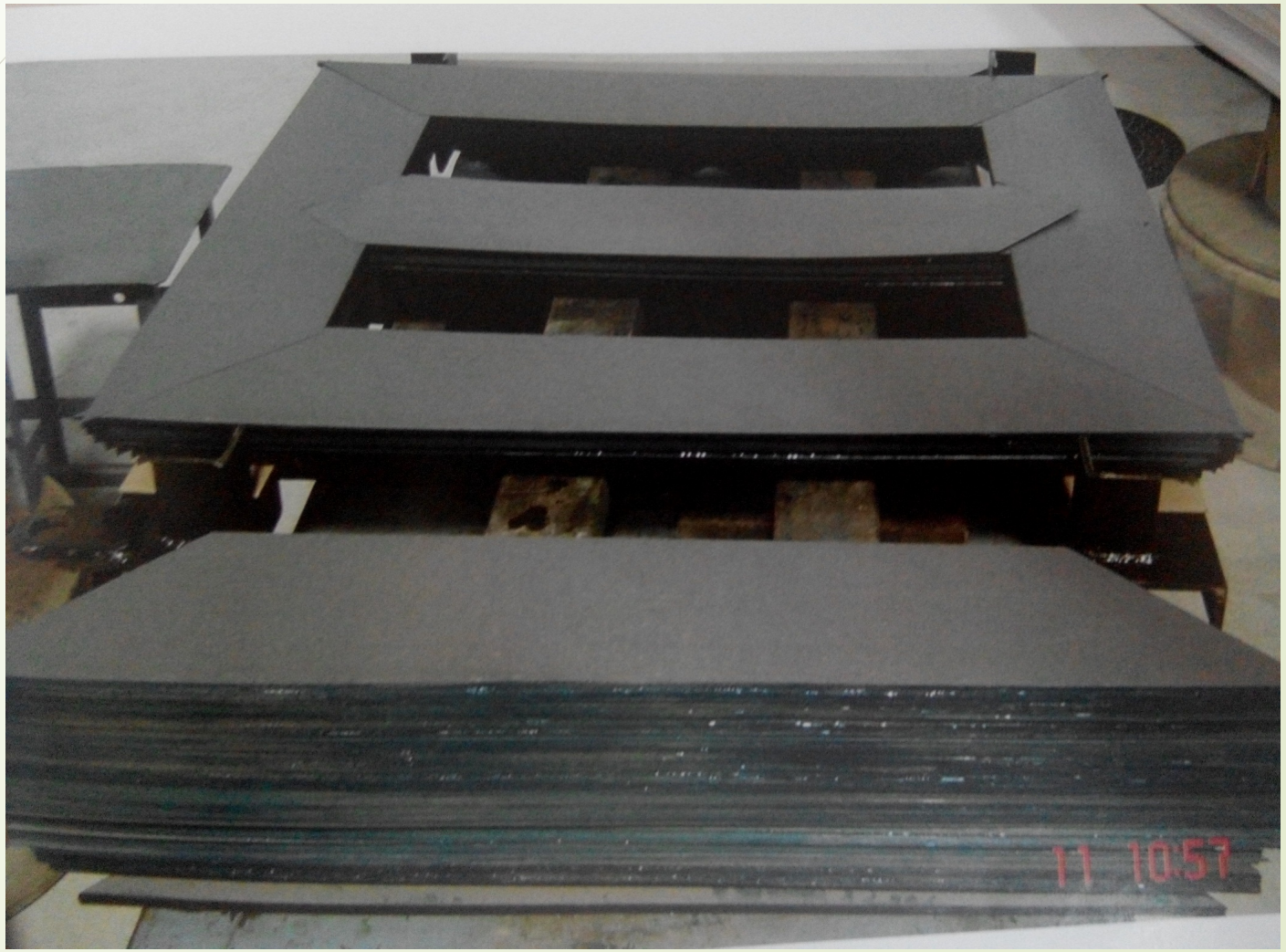


Image Courtesy: https://www.quora.com/What-is-cruciform-core-in-a-transformer-and-what-are-its-advantages

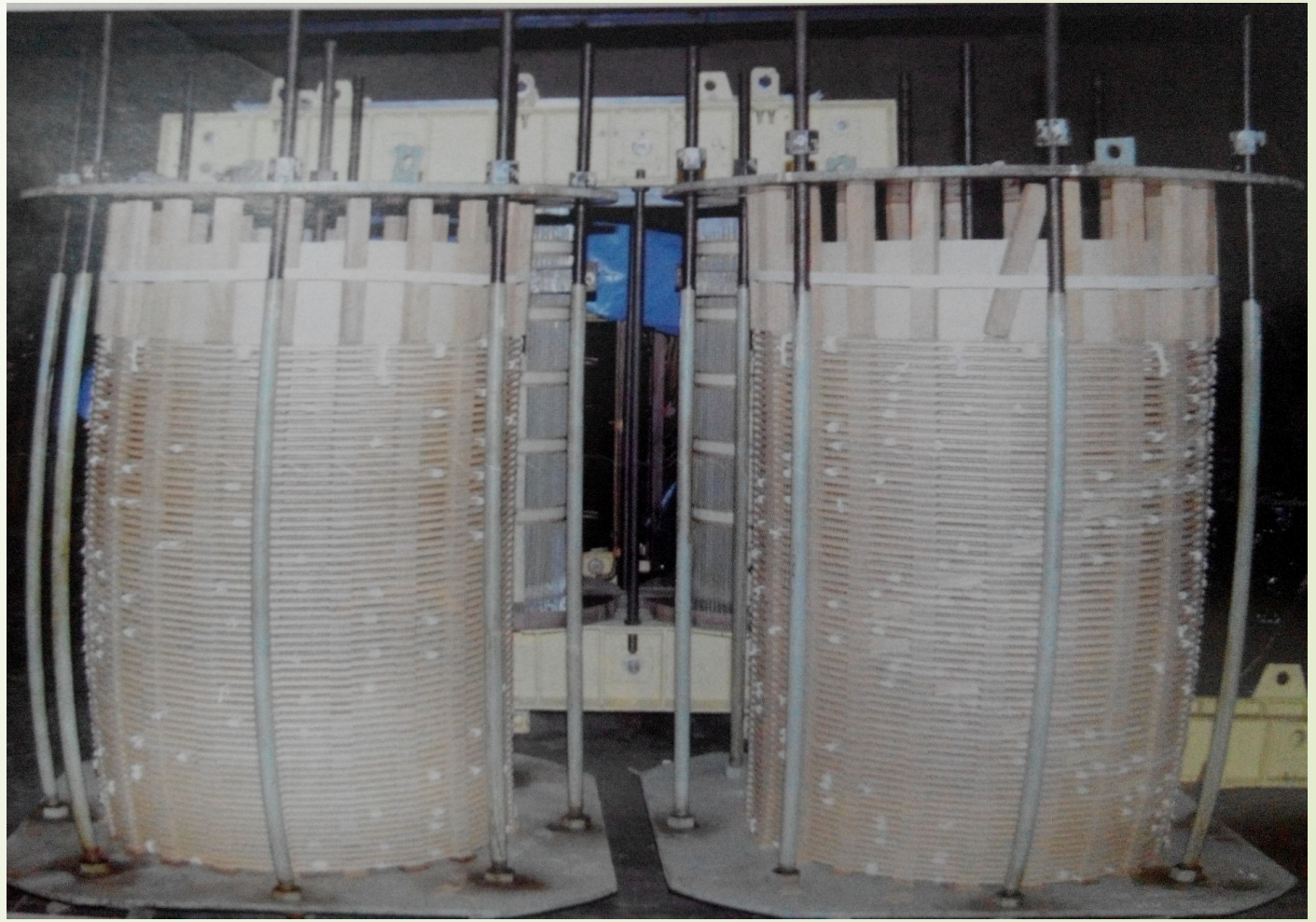
Core Construction



Windings

Air conditioned & Dust proof Winding Shop
(Up to160 MVA,220 kV class Transformers)

10MVA, 33kV Transformer LV Winding



250kVA, 11kV/433V Transformer LV &HV Winding

Transformer Classification

- **Based on Construction**
  - Core-Type
  - Shell-Type

- **Based on service**
  - Power Transformer
  - Distribution Transformer

- **Based on cooling system**
  - Self-Cooled
  - Air-Cooled
  - Oil-Cooled

Core-Type Transformer

- Basic Construction

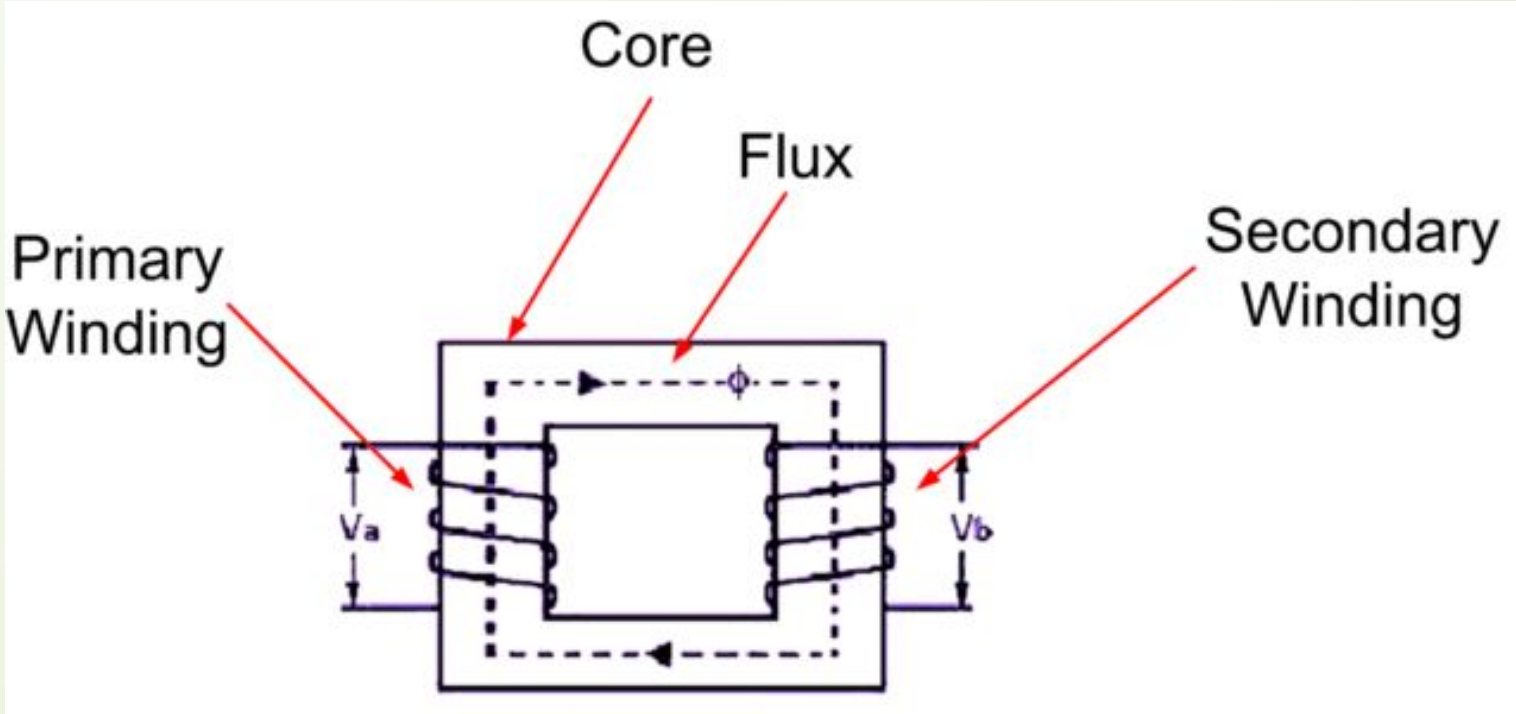


Image Courtesy: http://electricalacademia.com/electrical-comparisons/difference-between-core-type-and-shell-type-transformer/

Core-Type Transformer

- 3D view of Basic Construction

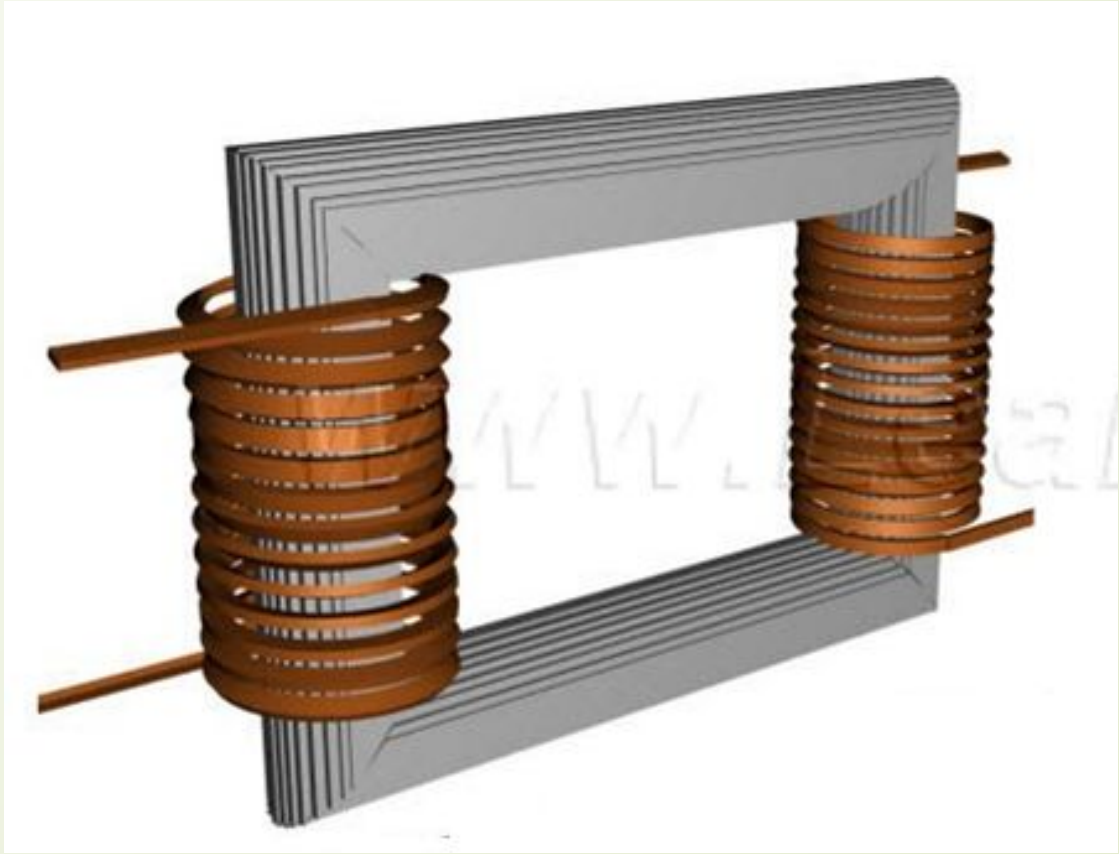


Image Courtesy: https://www.youtube.com/watch?v=XrIXioEn3yQ

Core-Type Transformer

- Actual Construction

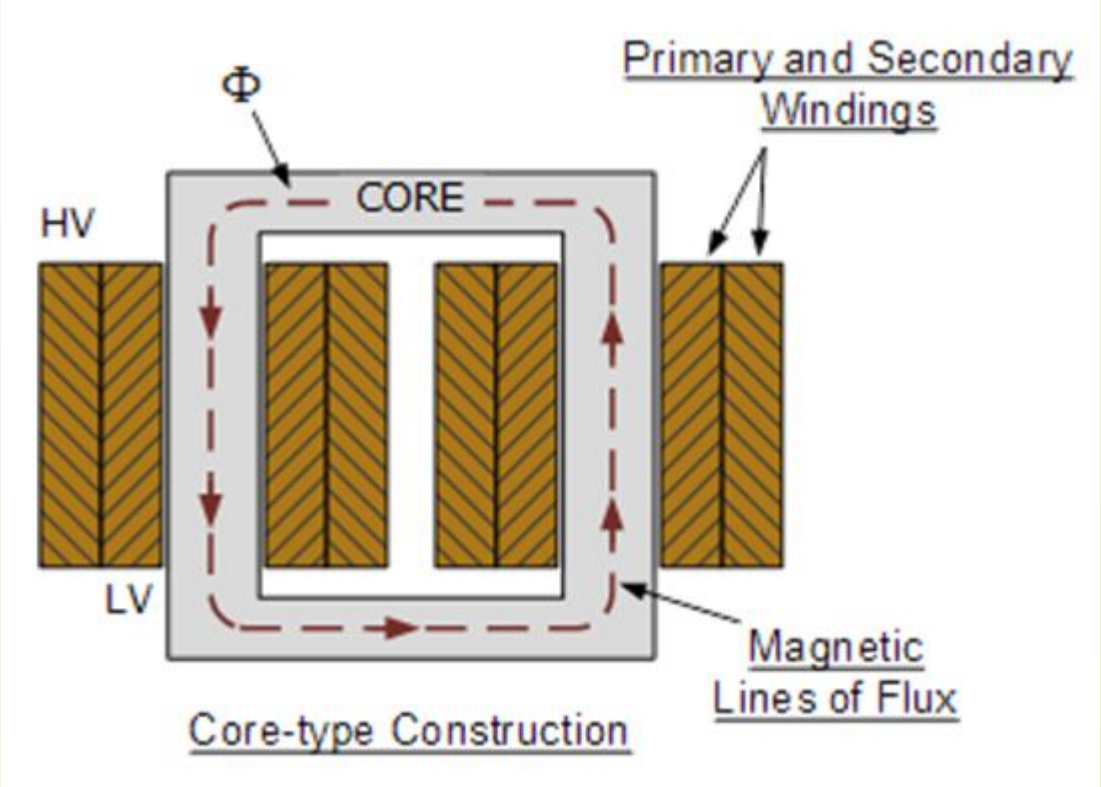
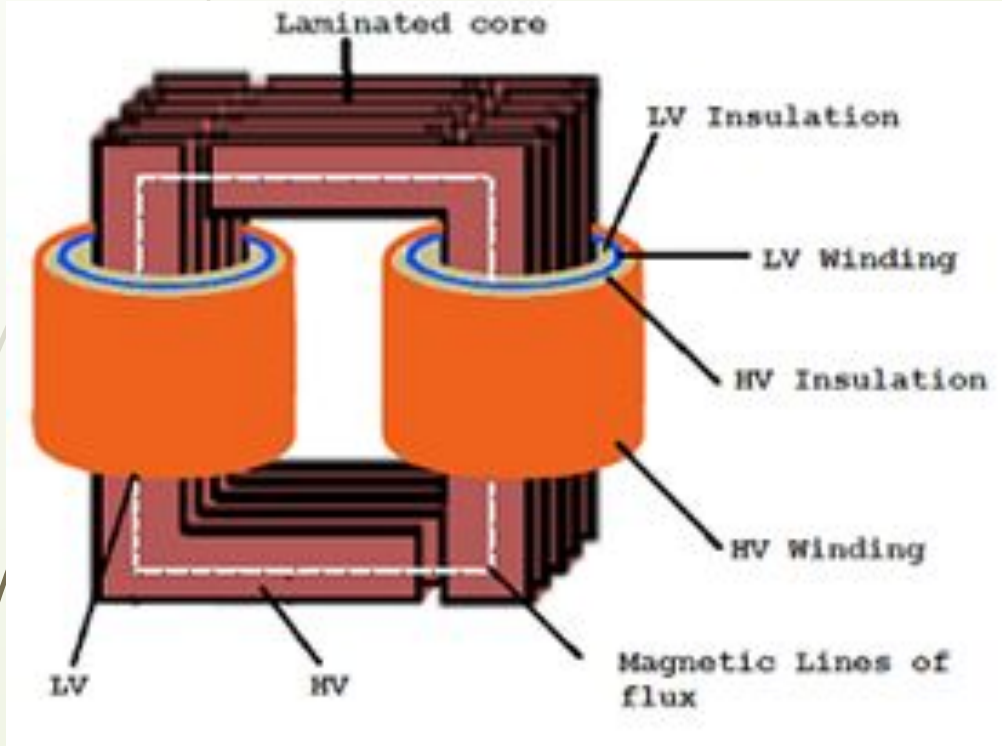


Image Courtesy: https://www.electronics-tutorials.ws/transformer/transformer-construction.html

Core-Type Transformer

- 3D View of Actual Construction



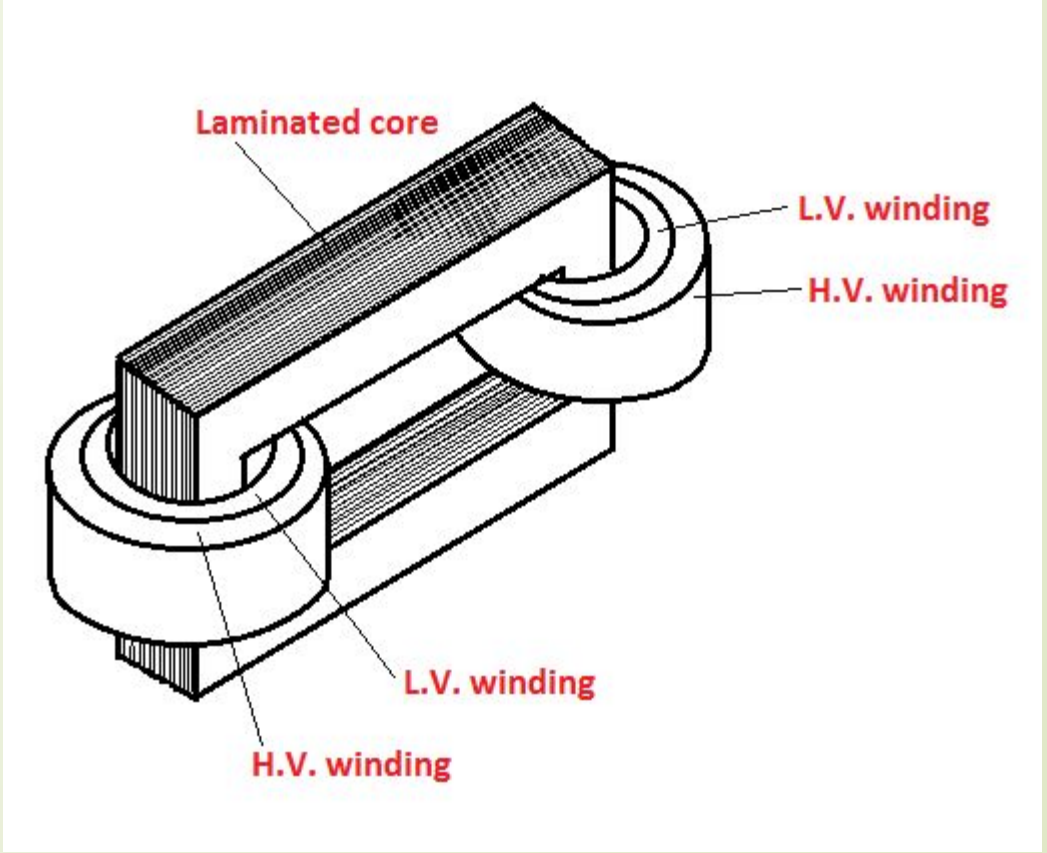


Image Courtesy: http://www.mytech-info.com/2014/08/core-type-transformer.html

https://electricalg4u.blogspot.com/2015/12/construction-of-transformer.html

Core-Type Transformer

- Cut-section view and top-view of Actual Construction

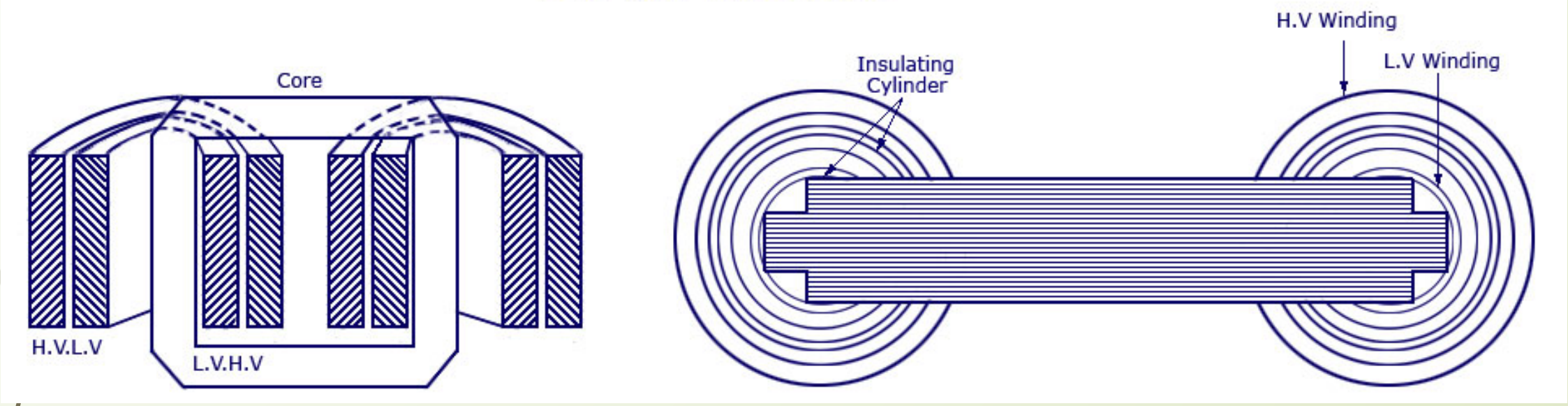
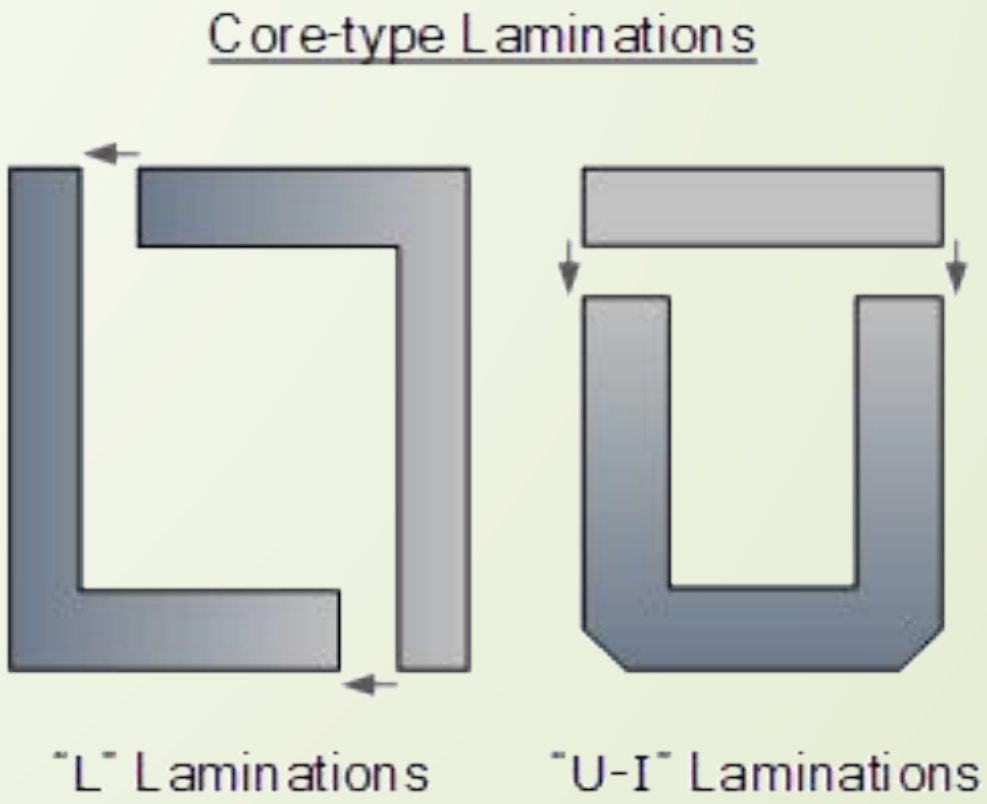


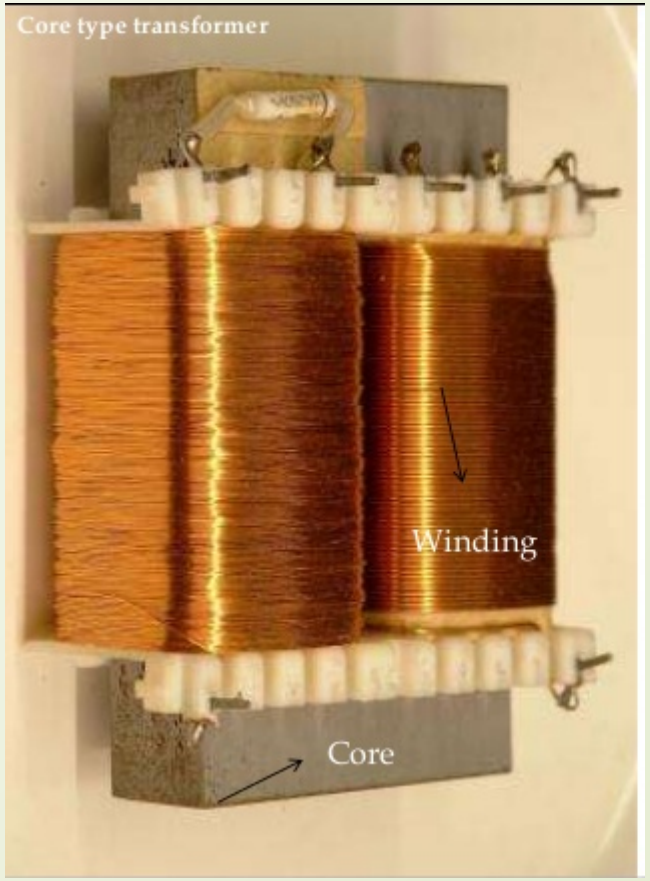
Image Courtesy: http://www.circuitstoday.com/transformer

Core-Type Transformer



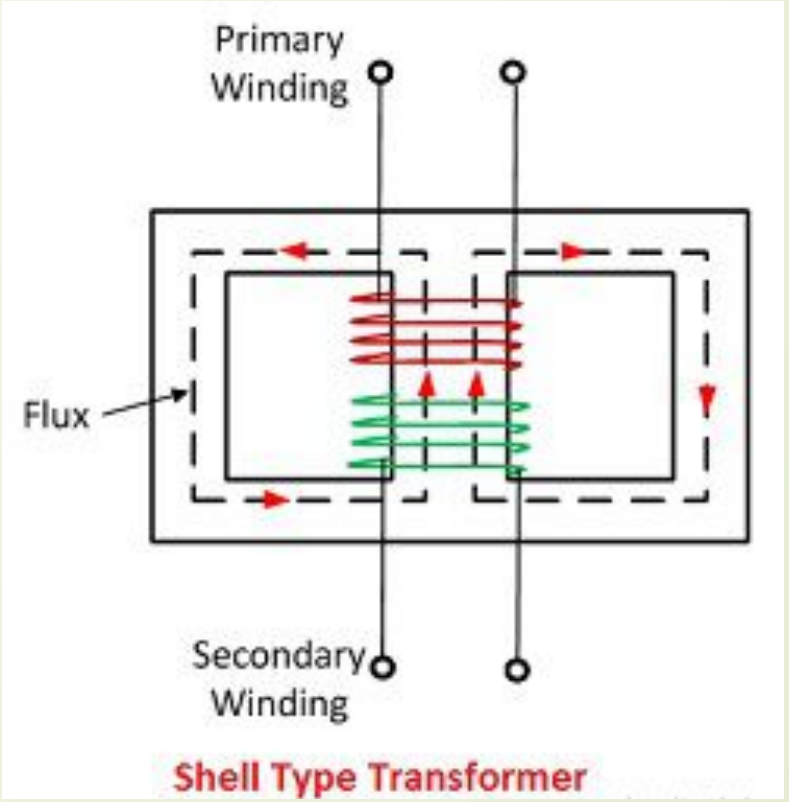
Core-Type Transformer

- Actual Core-Type Transformer



Shell-Type Transformer

- Basic Construction



https://circuitglobe.com/difference-between-core-type-and-shell-type-transformer.html

Shell-Type Transformer

- 3D view of basic construction

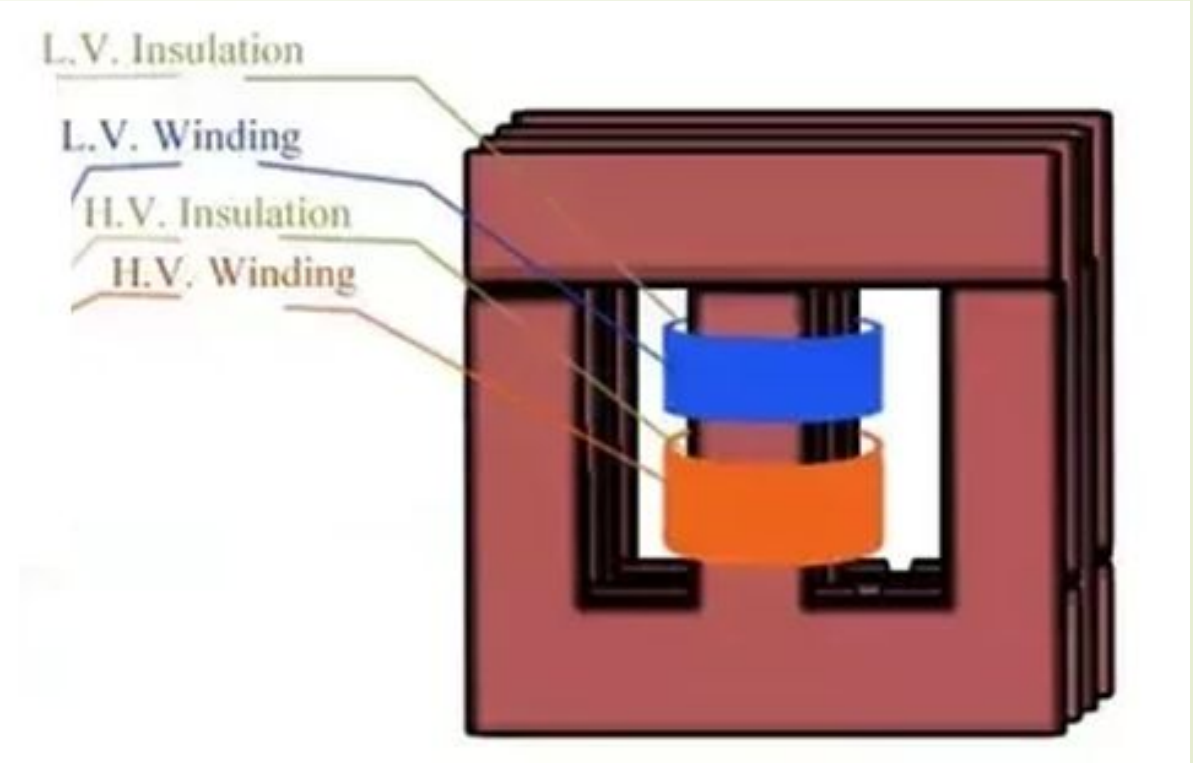


Image Courtesy: https://www.researchgate.net/figure/Single-phase-shell-type-wound-core-transformer_fig2_224244378

https://www.youtube.com/watch?v=lPNrzp9K4Lg

Shell-Type Transformer

- Actual construction

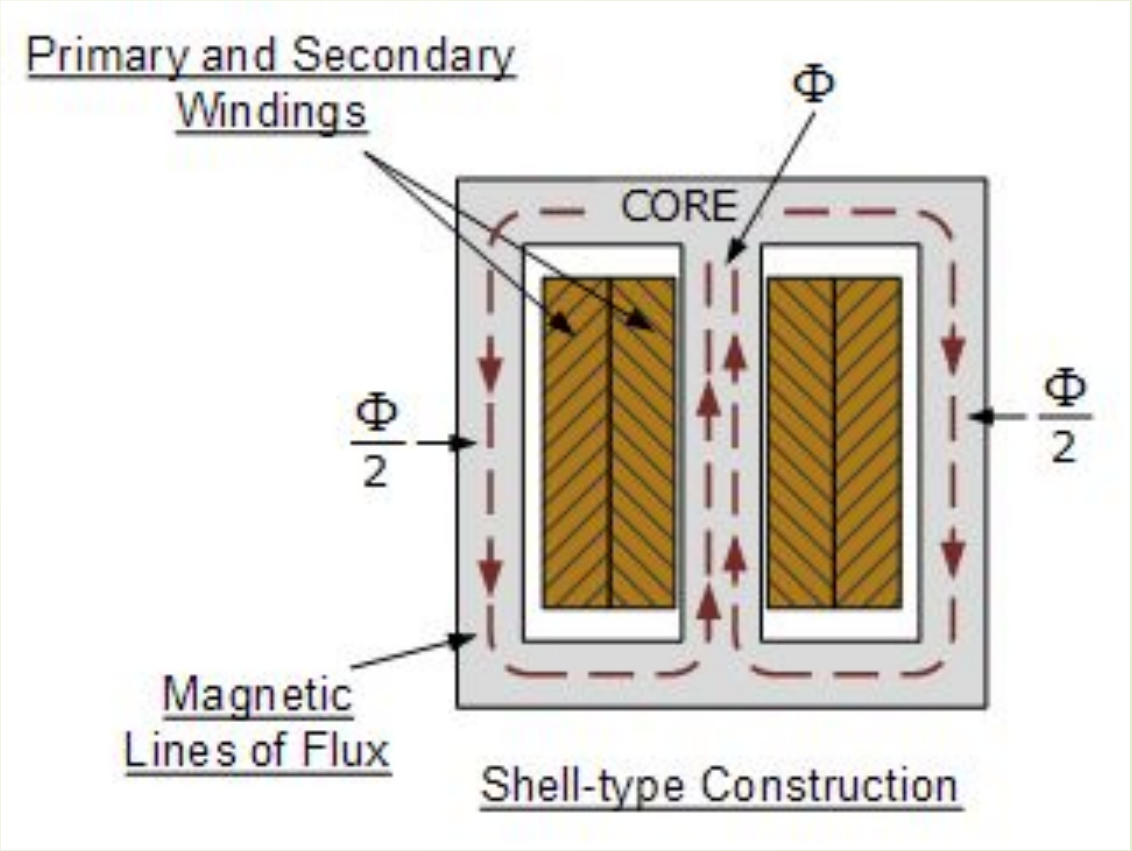
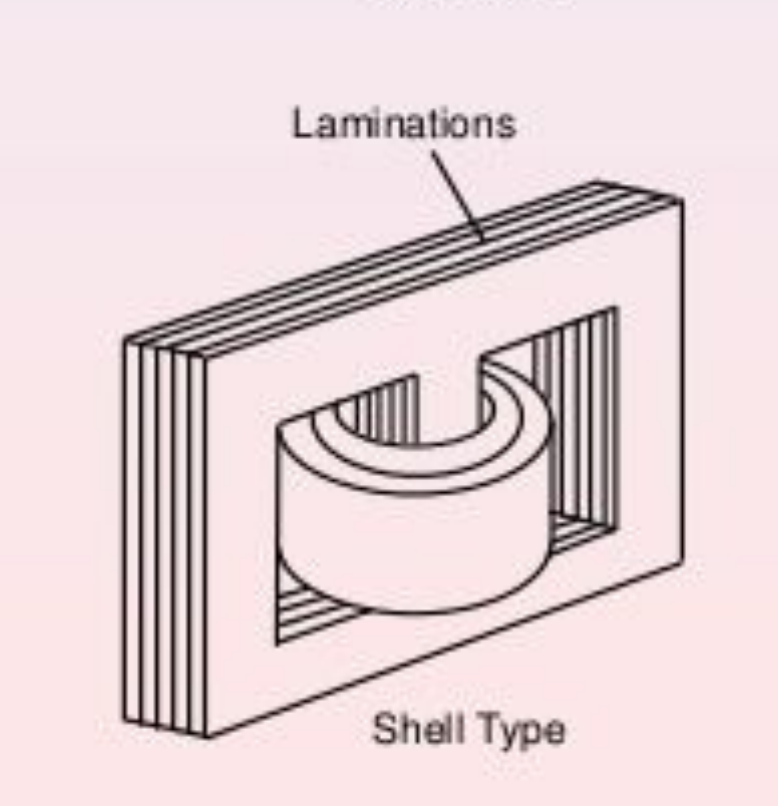


Image Courtesy: https://www.electronics-tutorials.ws/transformer/transformer-construction.html

Shell-Type Transformer

- 3D View of Actual construction



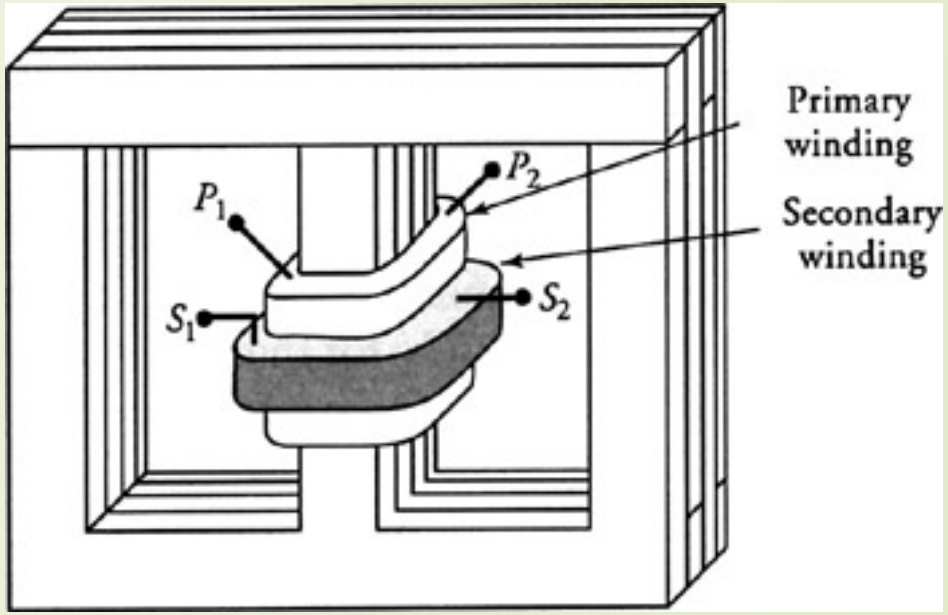
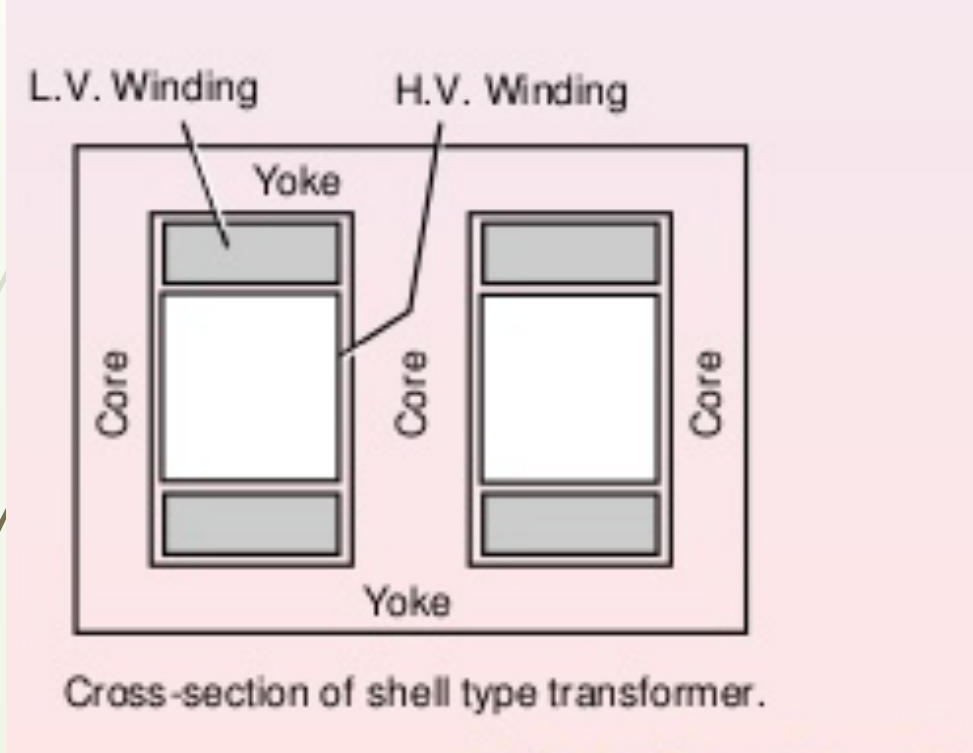


Image Courtesy: https://www.slideshare.net/rsamurti/transformers-61522610

https://www.electronicshub.org/introduction-to-transformers/

Shell-Type Transformer

- Cut-section view and top-view



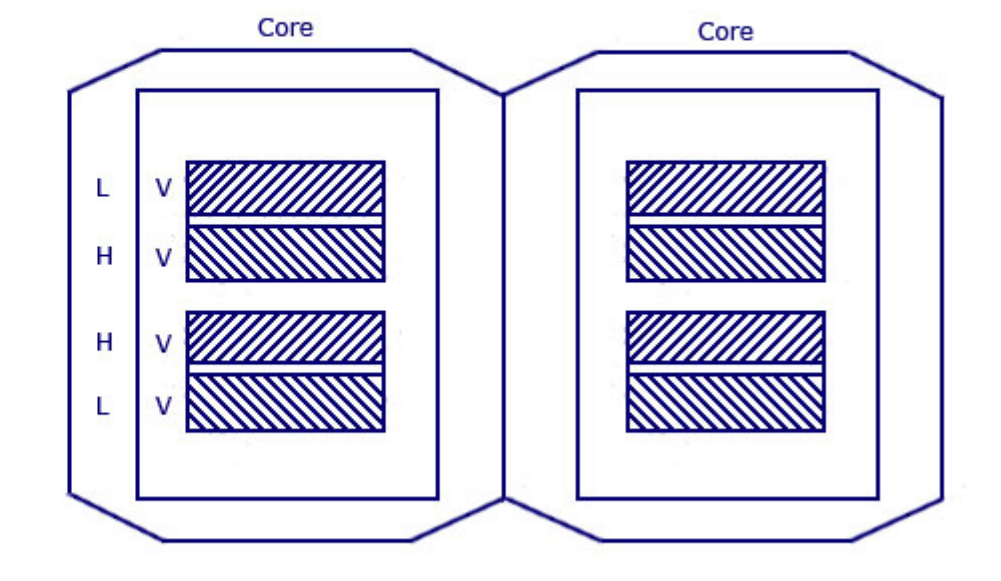
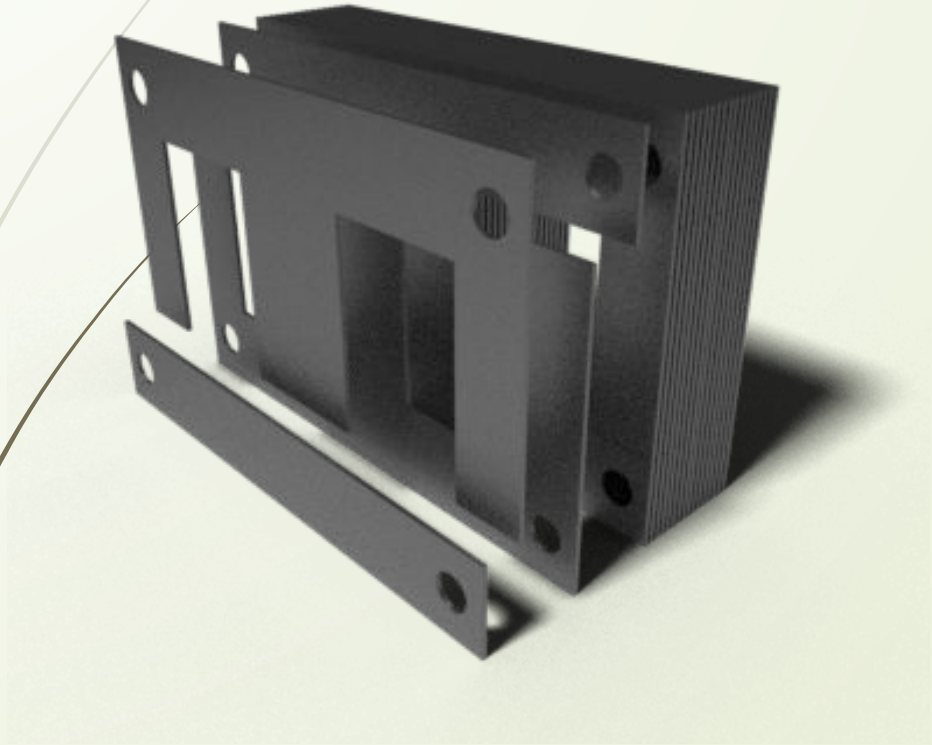


Image Courtesy: https://www.slideshare.net/rsamurti/transformers-61522610

http://www.circuitstoday.com/transformer

Shell-Type Transformer

- Laminations for Shell-Type Transformer



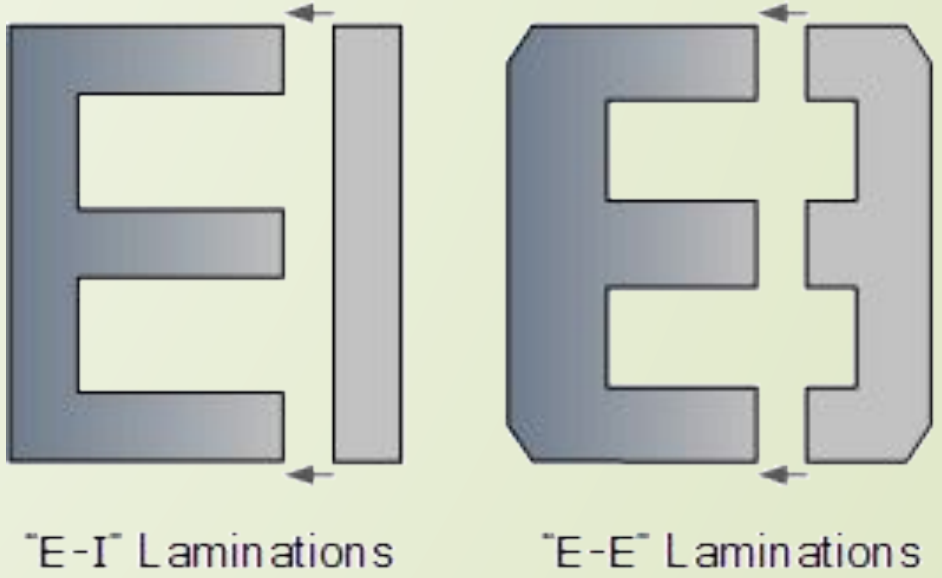


Image Courtesy: https://www.slideshare.net/rsamurti/transformers-61522610

https://www.electronics-tutorials.ws/transformer/transformer-construction.html

Shell-Type Transformer

- Actual Shell-Type Transformer

Image Courtesy: http://carbognin.it/portfolio-articoli/single-phase-shell-transformers/?lang=en

Shell-Type Transformer

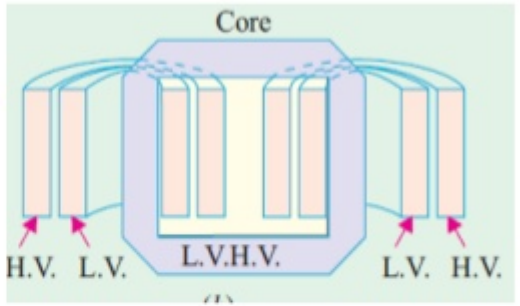
- Actual Shell-Type Transformer

Image Courtesy: https://vikiwat.com/product/18400/shell-type-transformer-220-220-42-vac-250-va.en.html

Types of Transformer Winding

windings

- Cylindrical type



- Sandwich type

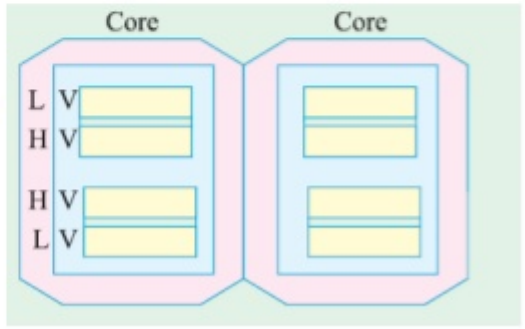


Image Courtesy: https://www.slideshare.net/saravanankaruppasamy1/transformers-57886787

Comparison of Core and Shell Type Transformers

Sr. No.	Core Type	Shell Type
1.	The winding encircles the core.	The core encircles most part of the windings.
2.	The cylindrical type of coils are used.	Generally, multilayer disc type or sandwich coils are used.
3.	As windings are distributed, the natural cooling is more effective.	As windings are surrounded by the core, the natural cooling does not exist.
4.	The coils can be easily removed from maintenance point of view.	For removing any winding for the maintenance, large number of laminations are required to be removed. This is difficult.
5.	The construction is preferred for low voltage transformers.	The construction is used for very high voltage transformers.
6.	It has a single magnetic circuit.	It has a double magnetic circuit.
7.	In a single phase type, the core has two limbs.	In a single phase type, the core has three limbs.

Comparison of Core and Shell Type Transformers

Criterion	Power transformer	Distribution transformer
Definition	Stepping up the voltage for efficient transmission	Stepping down the voltage in order to be consumed
Specifications	Higher voltages, and commonly rated above 200 MVA	Middle to lower voltage ranges, and commonly rated below 200 MVA
Efficiency	Operating at maximum efficiency (100 %)	Around 60 - 70 %
Size	Larger and heavier	Smaller compared to power transformer
Losses	More constant, optimal losses at full load operation	Fluctuating, optimal losses when operating around 75 % of full load
Winding connection	Primary winding connected in star, secondary in delta	Primary winding connected in delta, secondary in star