

E5	<div>Synchronous motor (wound rotor)</div> <div> Functions <ul style="list-style-type: none"> To transform electrical power into mechanical power (motor) To transform mechanical power into electrical power (generator) To compensate reactive power (synchronous condenser) </div> <div> Operational limits <ul style="list-style-type: none"> Transient (rapid degradation): Continuous (gradual degradation): </div> <div> Model <ul style="list-style-type: none"> Perfect (main function): </div>	E5
E3	<div>Induction Motor (squirrel cage)</div> <div> Functions <ul style="list-style-type: none"> To transform electrical power into mechanical power (motor) To transform mechanical power into electrical power (generator) </div> <div> Operational limits <ul style="list-style-type: none"> Transient (rapid degradation): Continuous (gradual degradation): </div> <div> Model <ul style="list-style-type: none"> Perfect (main function): Main imperfections: </div>	E3
E1	<div>Brushed or brushless DC Motor (permanent magnet)</div> <div> Functions <ul style="list-style-type: none"> To transform electrical power into mechanical power (motor) To transform mechanical power into electrical power (generator) </div> <div> Operational limits <ul style="list-style-type: none"> Transient (rapid degradation): Continuous (gradual degradation): </div> <div> Model <ul style="list-style-type: none"> Perfect (main function): Main imperfections: </div>	E1
E5	Main imperfections:	E5
E6		E6
E3	<div>Induction motor (wound rotor)</div> <div> Functions <ul style="list-style-type: none"> To transform electrical power into mechanical power (motor) & transform mechanical power into electrical power (generator) To split mechanical power fluxes between stator and rotor </div> <div> Operational limits <ul style="list-style-type: none"> Transient (rapid degradation): Continuous (gradual degradation): </div> <div> Model <ul style="list-style-type: none"> Perfect (main function): Main imperfections: </div>	E3
E4		E4
E1	<div>DC motor (with field coil)</div> <div> Functions <ul style="list-style-type: none"> To transform electrical power into mechanical power (motor) To transform mechanical power into electrical power (generator) </div> <div> Operational limits <ul style="list-style-type: none"> Transient (rapid degradation): Continuous (gradual degradation): </div> <div> Model <ul style="list-style-type: none"> Perfect (main function): Main imperfections: </div>	E1
E2		E2
E5	<div>Synchronous motor (permanent magnet)</div> <div> Functions <ul style="list-style-type: none"> To transform electrical power into mechanical power (motor) To transform mechanical power into electrical power (generator) </div> <div> Operational limits <ul style="list-style-type: none"> Transient (rapid degradation): Continuous (gradual degradation): </div> <div> Model <ul style="list-style-type: none"> Perfect (main function): Main imperfections: </div>	E5
E6		E6
E3	<div>Induction motor (wound rotor)</div> <div> Functions <ul style="list-style-type: none"> To transform electrical power into mechanical power (motor) & transform mechanical power into electrical power (generator) To split mechanical power fluxes between stator and rotor </div> <div> Operational limits <ul style="list-style-type: none"> Transient (rapid degradation): Continuous (gradual degradation): </div> <div> Model <ul style="list-style-type: none"> Perfect (main function): Main imperfections: </div>	E3
E4		E4
E1	<div>DC motor (with field coil)</div> <div> Functions <ul style="list-style-type: none"> To transform electrical power into mechanical power (motor) To transform mechanical power into electrical power (generator) </div> <div> Operational limits <ul style="list-style-type: none"> Transient (rapid degradation): Continuous (gradual degradation): </div> <div> Model <ul style="list-style-type: none"> Perfect (main function): Main imperfections: </div>	E1
E2		E2

E11

E11

Inverter3 ϕ **Functions**

- To modulate voltage or current
- To transform DC voltages into AC voltages (variable amplitude and frequency)
- To transform AC voltages into DC voltage

E9

DC/DC converter - H bridgeChopper 4Q, Inverter 1 ϕ **Functions**

- To modulate voltage or current
- To transform fixed DC voltages into variable DC voltages \rightarrow Chopper
- To transform a DC voltage into AC voltage (variable amplitude and frequency) \rightarrow Inverter
- To transform AC voltage into DC voltage \rightarrow Rectifier

E9

E7

E7

DC/DC converter – Buck chopper

1Q and 2Q

Functions

- To modulate voltage or current
- To transform fixed DC voltages into positive variable DC voltages

E11

E11

Dimmer1 ϕ or 3 ϕ **Functions :**

- To switch or not AC or DC current \rightarrow Static relay (switch)
- To modulate power, RMS voltage or RMS current \rightarrow Dimmer 1 ϕ or 3 ϕ

E9

E10

Rectifier – Thyristor bridge1 ϕ or 3 ϕ **Functions**

- To modulate voltage or current
- To transform AC voltages into DC variable voltages \rightarrow Controlled rectifier
- To transform DC current into AC current \rightarrow thyristor inverter (connected to a network)

E9

E10

E7

E8

E7

E8

Rectifier – Diode bridge1 ϕ or 3 ϕ **Functions**

- To transform AC voltage into DC voltage \rightarrow Rectifier

E12

E12

E10

E10

E8

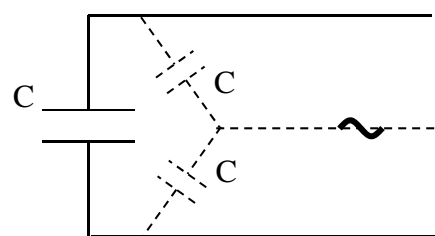
E8

E13

Capacitor

$$P \sim 0 \Rightarrow U \begin{array}{|c|} \hline + \\ \hline \end{array}$$

$$\underbrace{Q}_{\text{AC}} \begin{array}{|c|} \hline - \\ \hline \end{array} \quad \underbrace{\leftarrow I}_{\text{DC}} \begin{array}{|c|} \hline + \\ \hline \end{array}$$



E13 E15

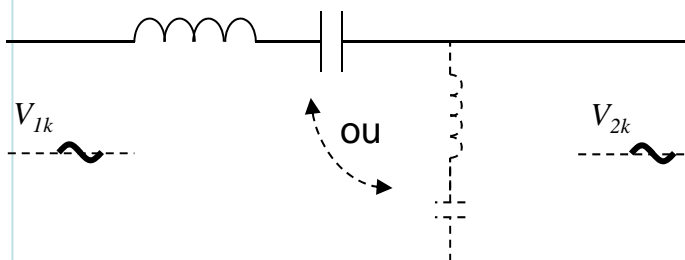
Notch

$$\begin{array}{|c|} \hline + \\ \hline \end{array} P \quad V_{Ik} \Rightarrow$$

$$V_{2k} \Leftarrow \begin{array}{|c|} \hline + \\ \hline \end{array} P$$

$$\begin{array}{|c|} \hline + \\ \hline \end{array} Q \quad I_{Ik} \Leftarrow$$

$$I_{2k} \Rightarrow \begin{array}{|c|} \hline + \\ \hline \end{array} Q$$



E17

Autotransformer

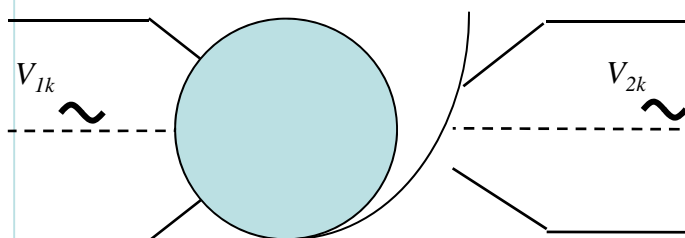
1φ or 3φ

$$\begin{array}{|c|} \hline + \\ \hline \end{array} P \quad V_{Ik} \Rightarrow$$

$$V_{2k} \Rightarrow \begin{array}{|c|} \hline + \\ \hline \end{array} P$$

$$\begin{array}{|c|} \hline + \\ \hline \end{array} Q \quad I_{Ik} \Leftarrow$$

$$I_{2k} \Leftarrow \begin{array}{|c|} \hline + \\ \hline \end{array} Q$$



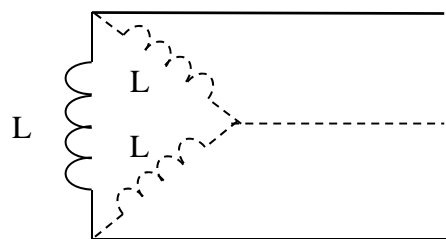
E13

E14

Inductor

$$P \sim 0 \quad \Leftarrow U \begin{array}{|c|} \hline + \\ \hline \end{array}$$

$$\underbrace{Q}_{\text{AC}} \begin{array}{|c|} \hline - \\ \hline \end{array} \Rightarrow \underbrace{I}_{\text{DC}} \begin{array}{|c|} \hline + \\ \hline \end{array}$$



E13

E14

E15

E16

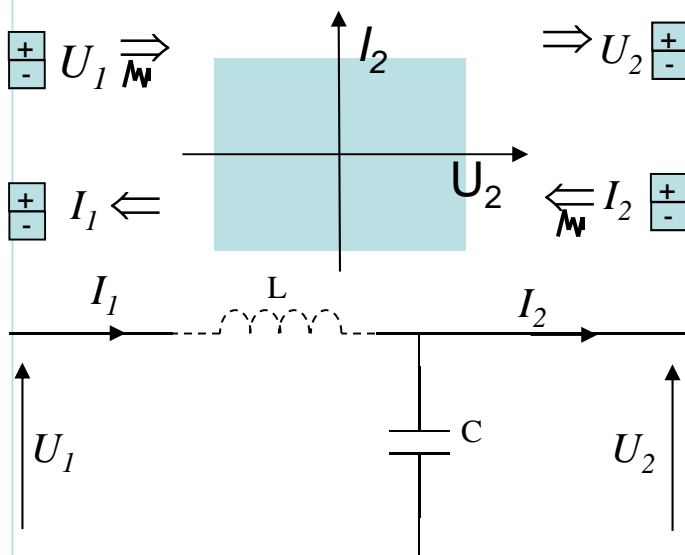
Low-pass band filter

$$\begin{array}{|c|} \hline + \\ \hline \end{array} U_1 \Rightarrow$$

$$\Rightarrow U_2 \begin{array}{|c|} \hline + \\ \hline \end{array}$$

$$\begin{array}{|c|} \hline + \\ \hline \end{array} I_1 \Leftarrow$$

$$\Leftarrow I_2 \begin{array}{|c|} \hline + \\ \hline \end{array}$$



E15

E16

E17

E18

Transformer

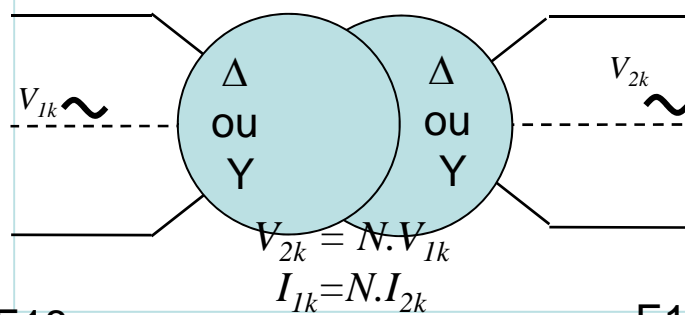
1φ or 3φ

$$\begin{array}{|c|} \hline + \\ \hline \end{array} P \quad V_{Ik} \Rightarrow$$

$$V_{2k} \Rightarrow \begin{array}{|c|} \hline + \\ \hline \end{array} P$$

$$\begin{array}{|c|} \hline + \\ \hline \end{array} Q \quad I_{Ik} \Leftarrow$$

$$I_{2k} \Leftarrow \begin{array}{|c|} \hline + \\ \hline \end{array} Q$$



E14

E14

E16

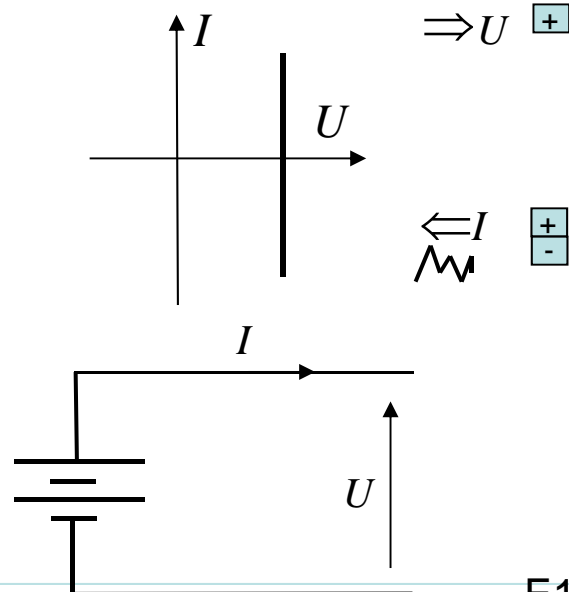
E16

E18

E18

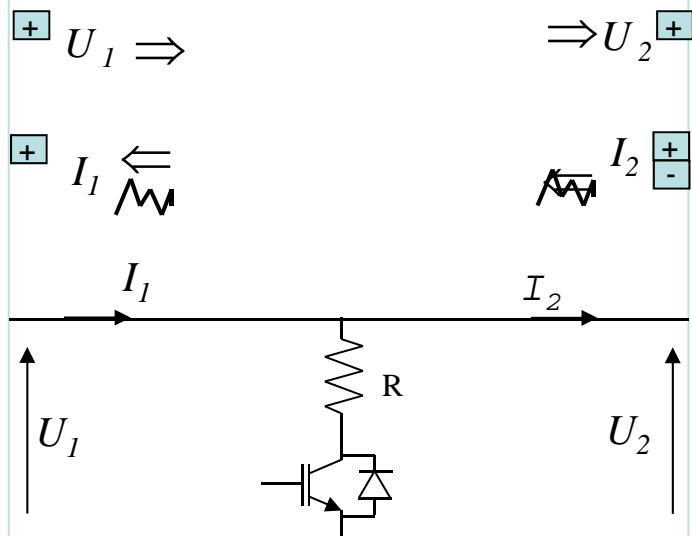
E19 E19

Battery

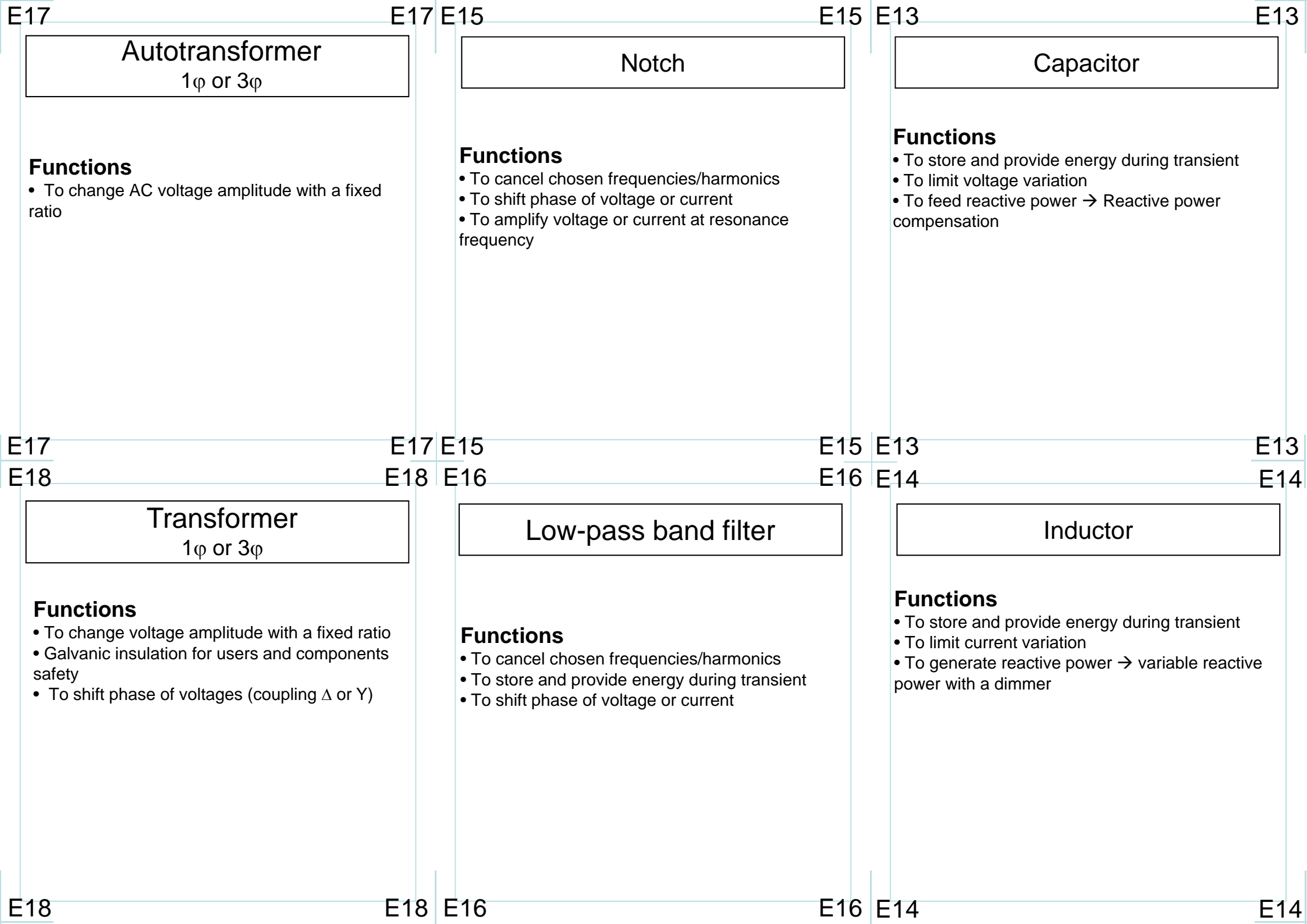


E19 E20

Rheostatic chopper



E20 E20



Fonctions :

-
-
-

Contraintes technologiques :

-
-
-
-

Fonctions :

-
-
-

Contraintes technologiques :

-
-
-
-

E19E19

Battery

Functions

- To provide steady state energy
- To store and provide energy during transient

E19E19

Fonctions :

-
-
-

Contraintes technologiques :

-
-
-
-

Fonctions :

-
-
-

Contraintes technologiques :

-
-
-
-

E20E20

Rheostatic chopper

Functions

- To dissipate energy
- To disable power reversibility
- To avoid overvoltage of DC bus capacitor

E20E20