

Three Phase Inverter

Three Phase Inverter

THREE PHASE BRIDGE INVERTERS

For providing power to industrial applications, three phase inverters are more common than single-phase inverters.

A basic three phase inverter is a six step inverter. It uses a minimum of six thyristors.

In inverter terminology, a step is defined as a change in the firing from one thyristor to the next thyristor in proper sequence.

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For one cycle of 360° , each step would be of 60° interval for a six-step inverter. This means that thyristors would be gated at regular intervals of 60° in proper sequence so that a 3 phase ac voltage is synthesized at the o/p terminals of a six step inverter.

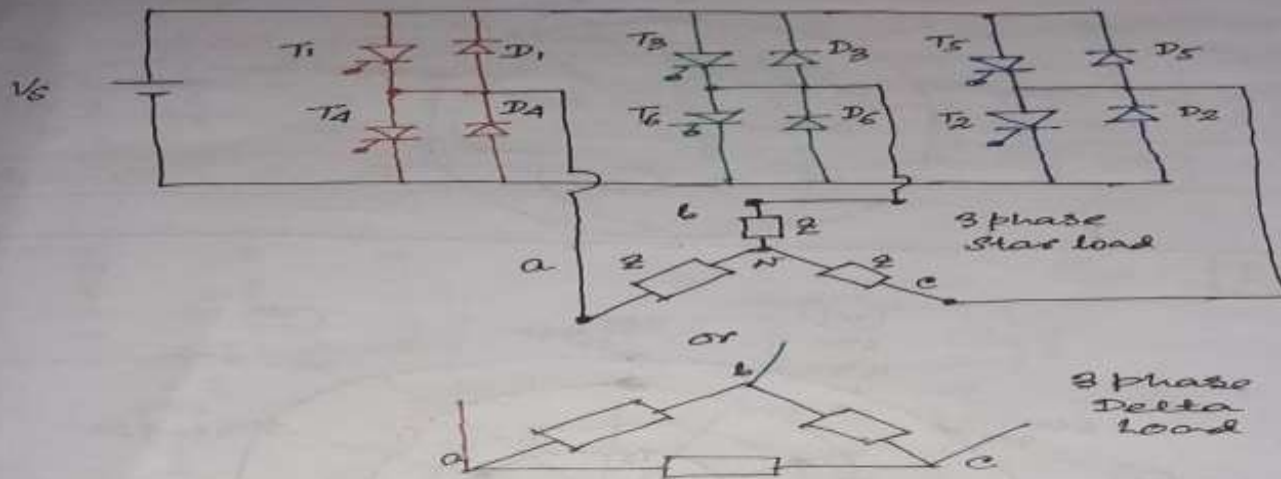
In low or medium power applications IGBT can be used in place of Thyristor.

→ Two Schemes

: 180° VSI - Each thyristor conducts for 180°

: 120° VSI - Each thyristor conducts for 120°

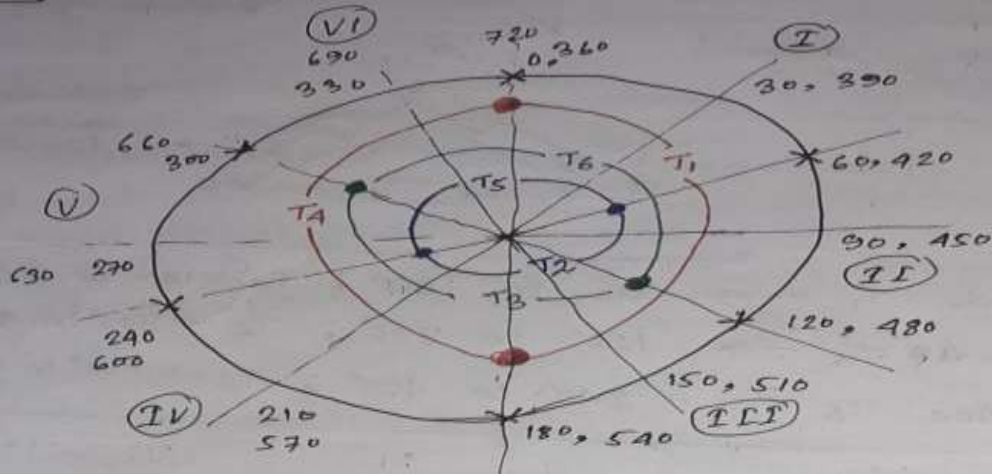
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phase a	$T_1 \rightarrow$	0° to 180°	$T_4 \rightarrow 180^\circ$ to 360°
phase b	$T_3 \rightarrow$	120° to 300°	$T_6 \rightarrow 300^\circ$ to 480°
phase c	$T_5 \rightarrow$	240° to 420°	$T_2 \rightarrow 420^\circ$ to 600°

$T_1, T_3, T_5 \Rightarrow +ve$ Group
 $T_4, T_6, T_2 \Rightarrow -ve$ Group.

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$0-60^\circ$	$60-120^\circ$	$120^\circ-180^\circ$	$180^\circ-240^\circ$	$240^\circ-300^\circ$	$300^\circ-360^\circ$
T_1, T_6, T_5	T_1, T_6, T_2	T_1, T_3, T_2	T_4, T_3, T_2	T_4, T_3, T_5	T_4, T_6, T_5
$360^\circ-420^\circ$	$420^\circ-480^\circ$	$480^\circ-540^\circ$	$540^\circ-600^\circ$	$600^\circ-660^\circ$	$660^\circ-720^\circ$

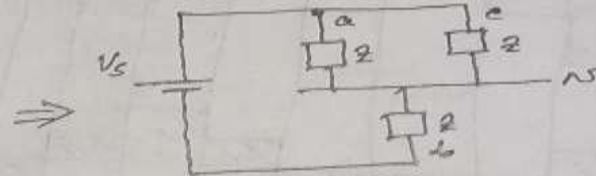
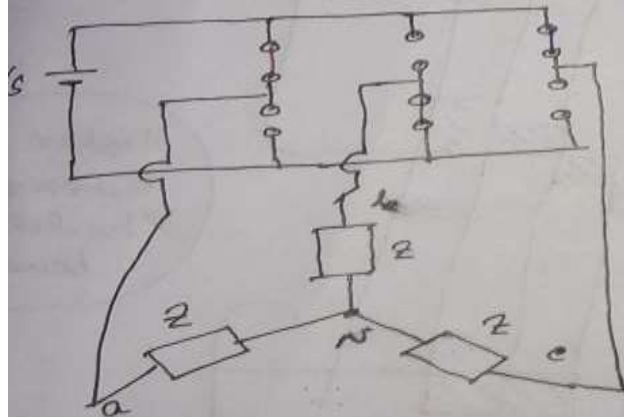
\Rightarrow one from +ve Group & two from -ve Group

two from +ve group & one from -ve group

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For star load

	$0 - 60^\circ$	$60^\circ - 120^\circ$	$60^\circ - 180^\circ$	$180^\circ - 240^\circ$	$240^\circ - 300^\circ$	$300^\circ - 360^\circ$
V_a	$+V_s/3$	$+2V_s/3$	$+V_s/3$	$-V_s/3$	$-2V_s/3$	$-V_s/3$
V_b	$-2V_s/3$	$-V_s/3$	$+V_s/3$	$+2V_s/3$	$+V_s/3$	$-V_s/3$
V_c	$+V_s/3$	$-V_s/3$	$-2V_s/3$	$-V_s/3$	$+V_s/3$	$+2V_s/3$
	$60^\circ - 120^\circ$	$120^\circ - 180^\circ$	$180^\circ - 240^\circ$	$240^\circ - 300^\circ$	$300^\circ - 360^\circ$	$360^\circ - 420^\circ$



$$\text{current} = \frac{V_s}{2+2/2} = \frac{V_s}{3 \cdot 2/2} = \frac{2V_s}{3 \cdot 2}$$

$$V_a = \frac{2V_s}{3 \cdot 2} \cdot \frac{2}{2} = V_s/3$$

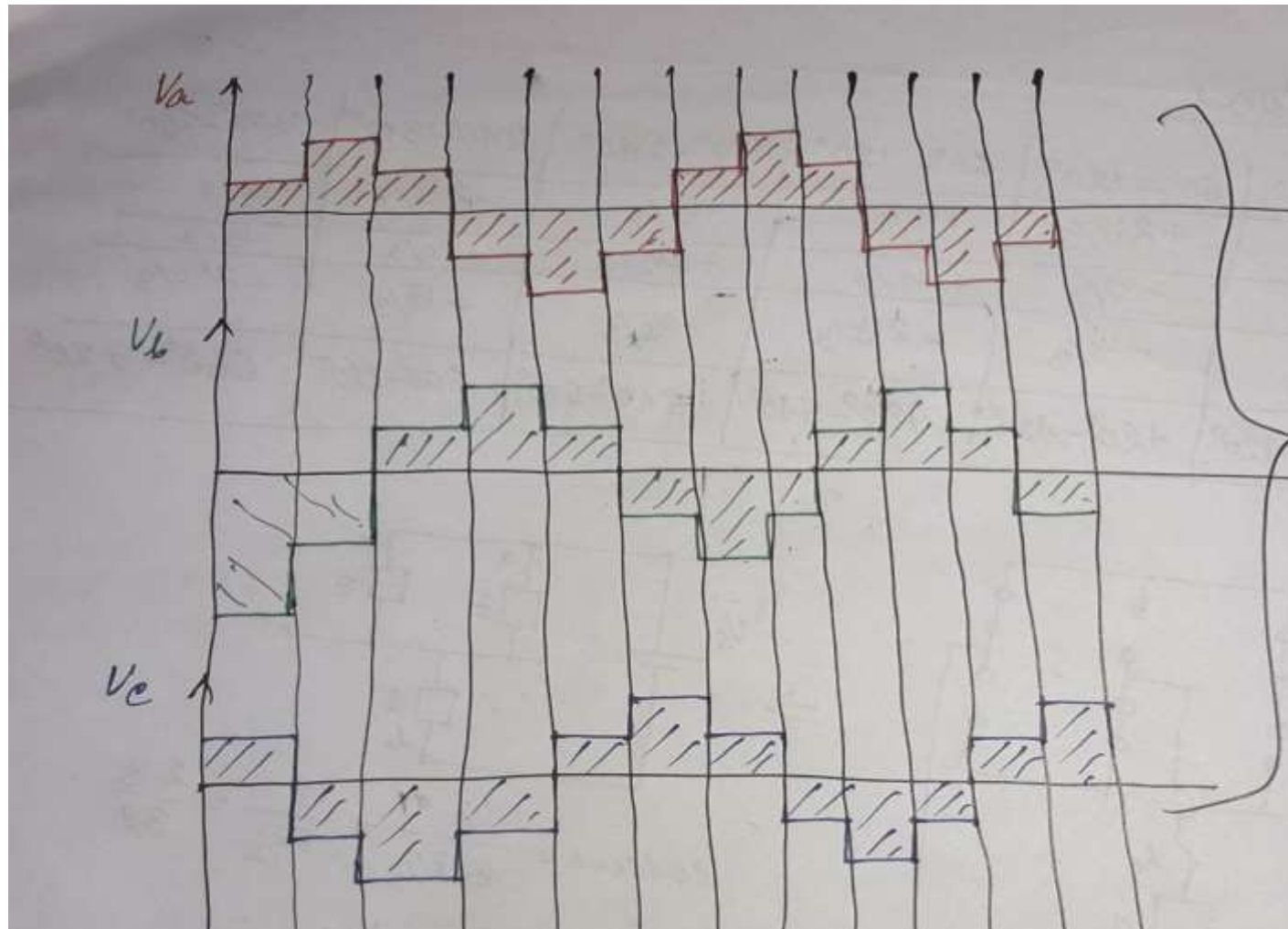
$$V_c = \frac{2V_s}{3 \cdot 2} \cdot \frac{2}{2} = V_s/3$$

$$V_b = -\frac{2V_s}{3 \cdot 2} \cdot 2 = -2V_s/3$$

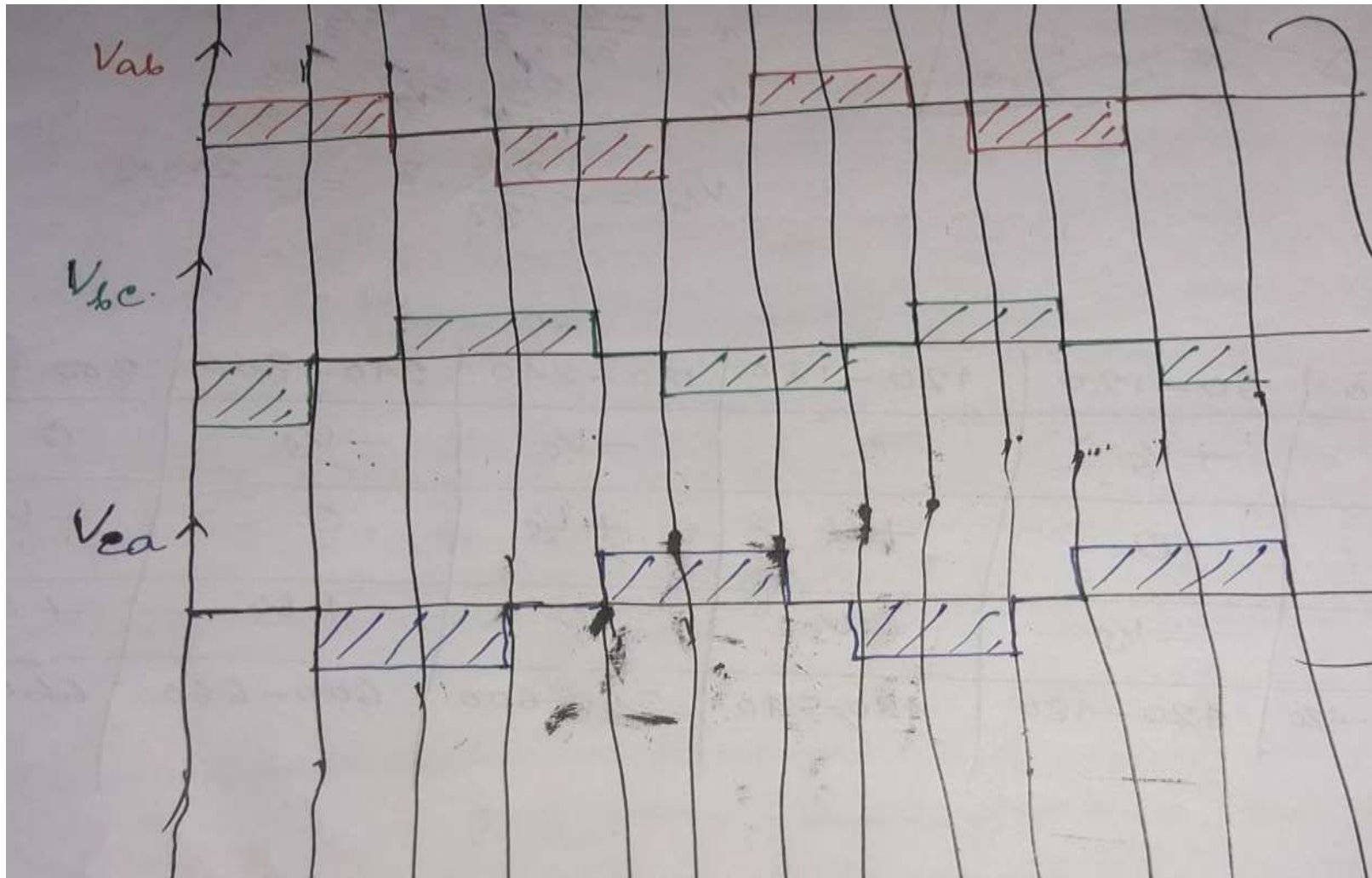
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	0-60	60-120	120-180	180-240	240-300	300-360
V_{ab}	$+V_s$	$+V_s$	0	$-V_s$	$-V_s$	0
V_{bc}	$-V_s$	0	$+V_s$	$+V_s$	0	$-V_s$
V_{ca}	0	$-V_s$	$-V_s$	0	$+V_s$	$+V_s$
	360-420	420-480	480-540	540-600	600-660	660-720

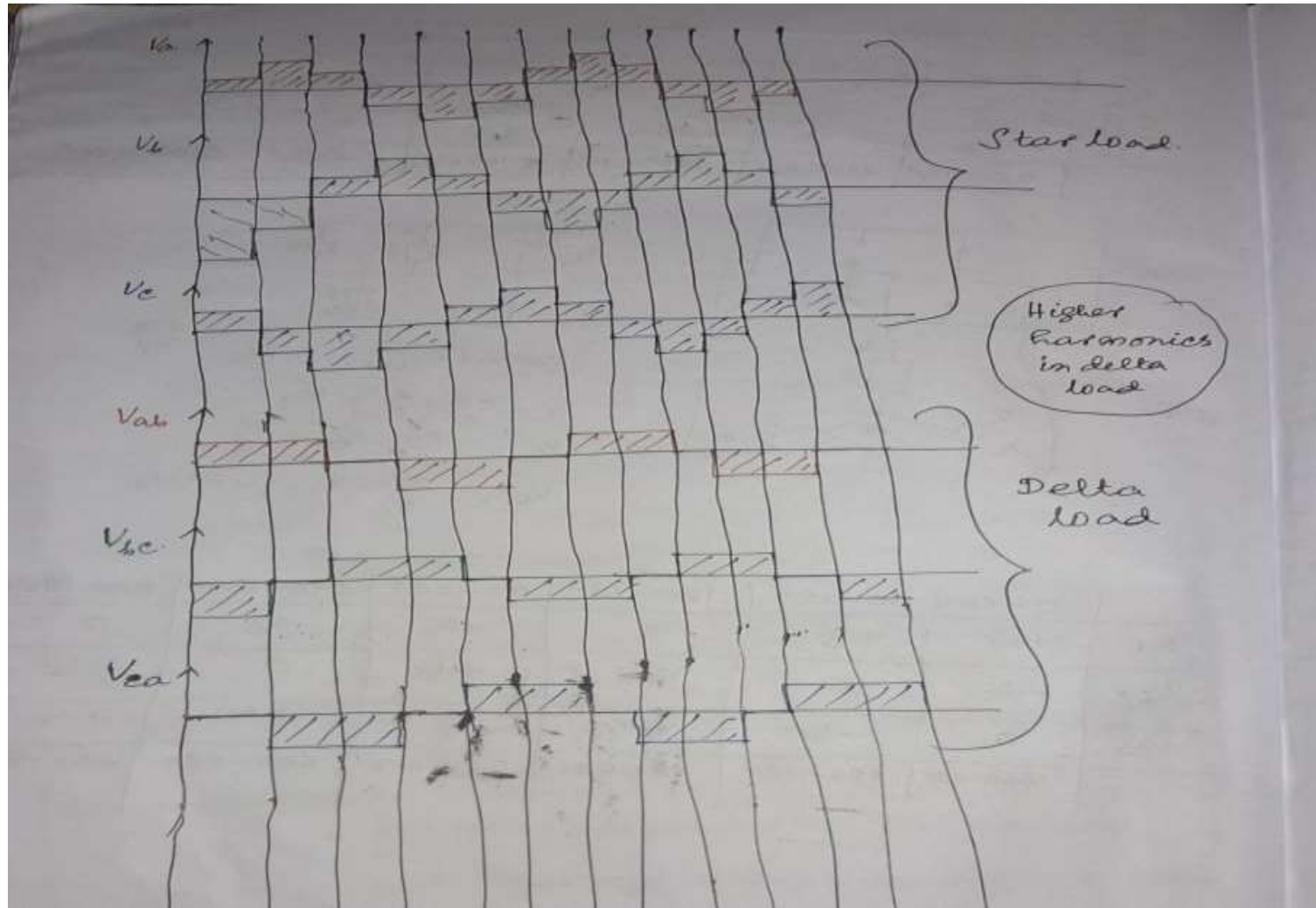
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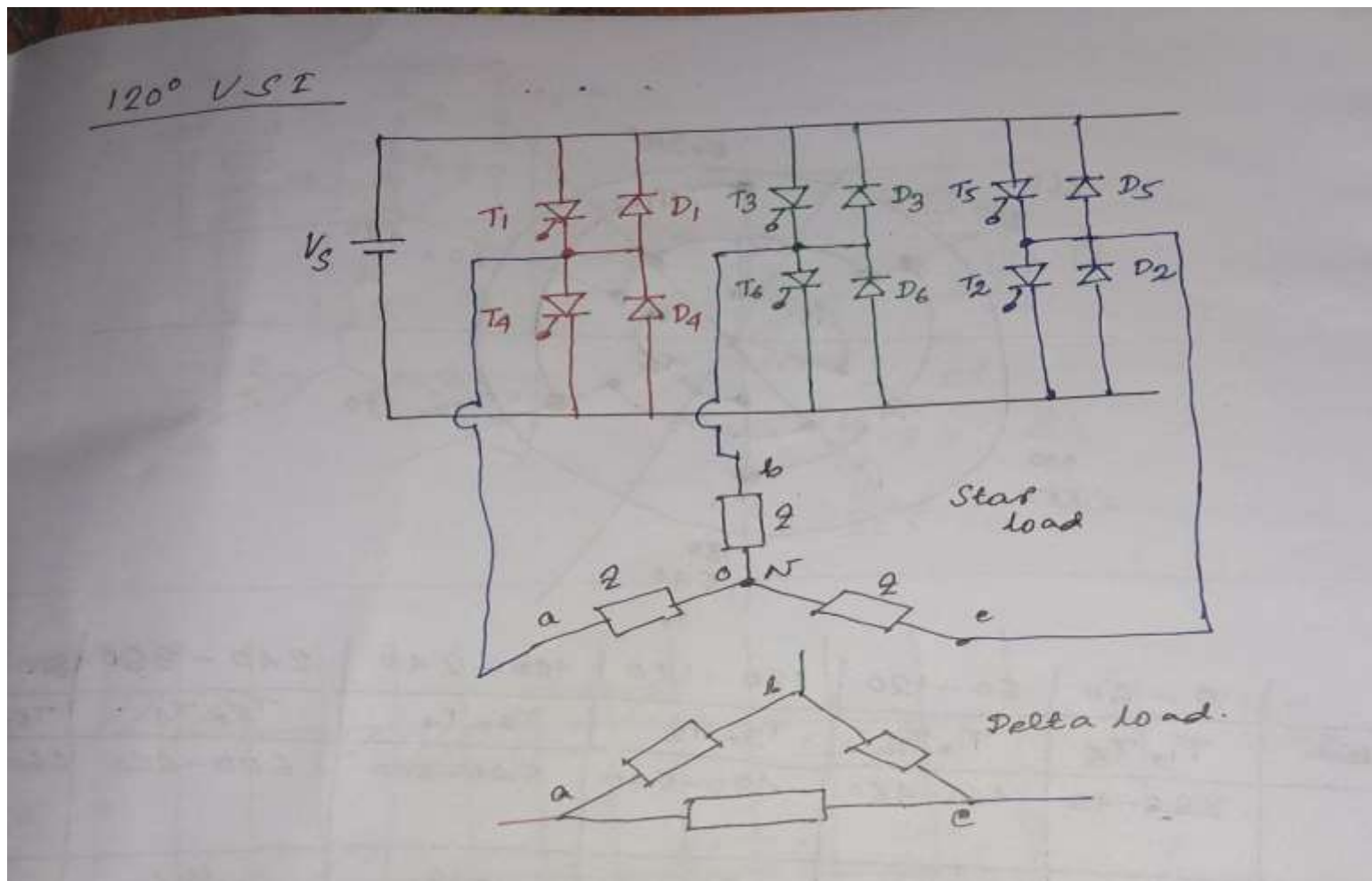
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Three Phase Inverter

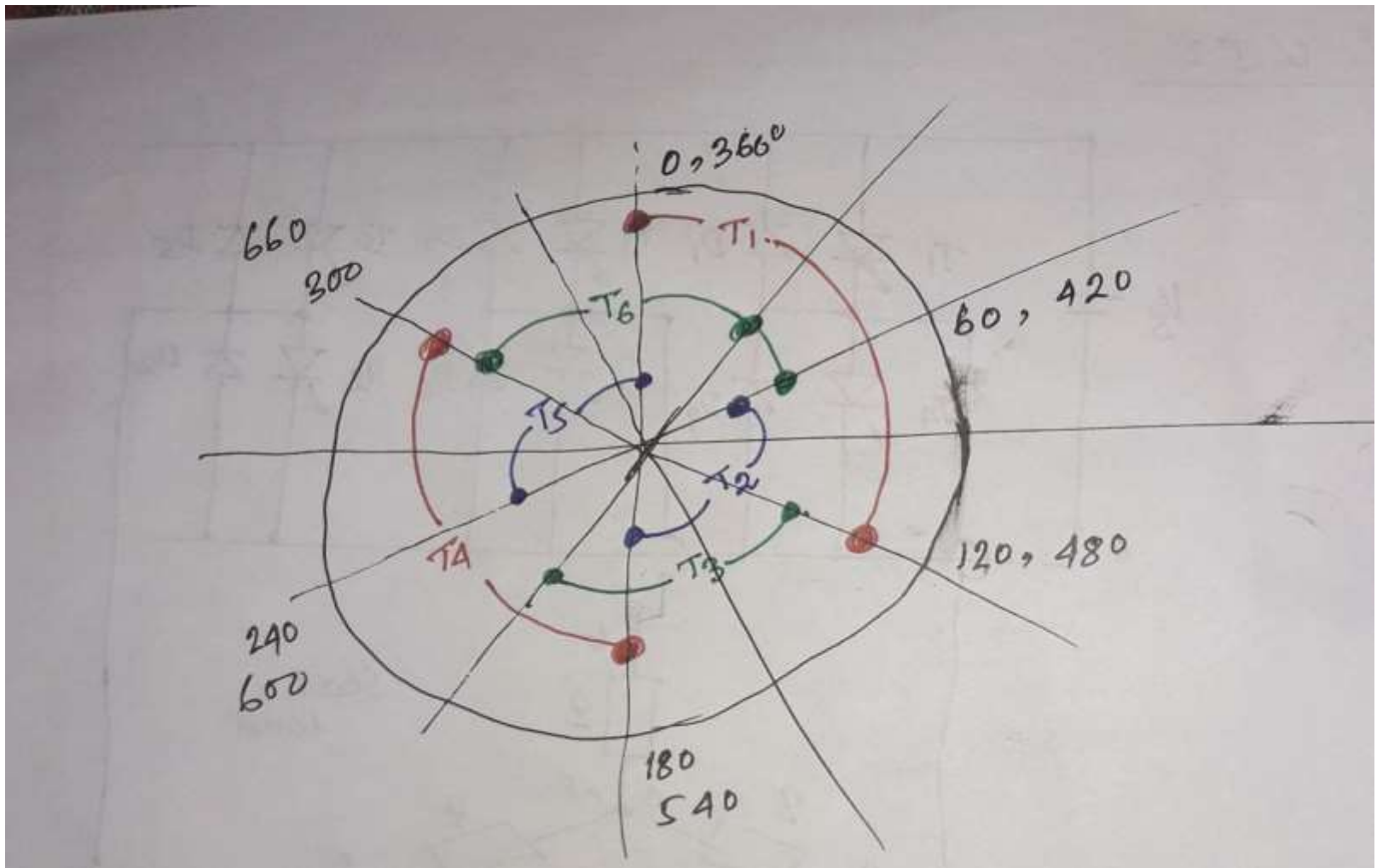


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- Each thyristor will conduct for 120°

phase a $T_1 \rightarrow 0^\circ - 120^\circ$; $T_4 \rightarrow 180^\circ - 300^\circ$
phase b $T_3 \rightarrow 120^\circ - 240^\circ$; $T_6 \rightarrow 300^\circ - 420^\circ$
 $T_5 \rightarrow 240^\circ - 360^\circ$; $T_2 \rightarrow 420^\circ - 540^\circ$

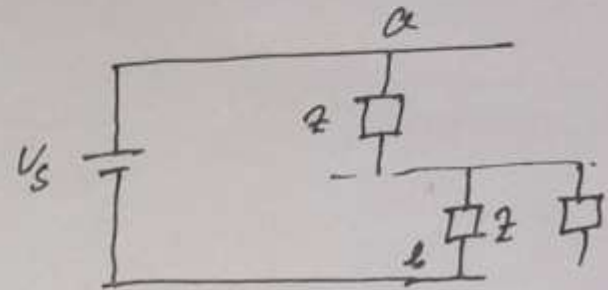
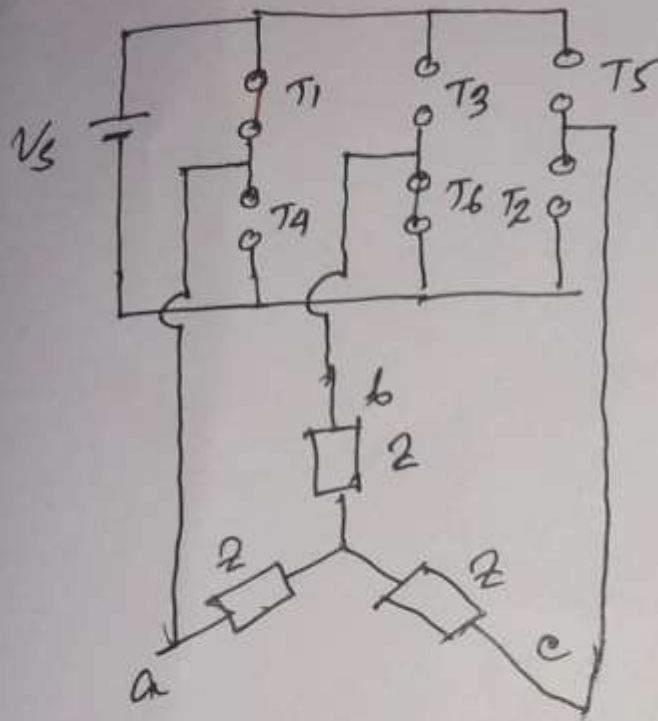
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Three Phase Inverter

	0 - 60	60 - 120	120 - 180	180 - 240	240 - 300	300 - 360
Conduction	T_1, T_6	T_1, T_2	T_3, T_2	T_3, T_4	T_5, T_4	T_5, T_6
	360-420	420-480	480-540	540-600	600-660	660-720
V_a	$+V_s/2$	$+V_s/2$	0	$-V_s/2$	$-V_s/2$	0
V_b	$-V_s/2$	0	$+V_s/2$	$+V_s/2$	+V_s/2 0	$-V_s/2$
V_c	0	$-V_s/2$	$-V_s/2$	0	$+V_s/2$	$+V_s/2$
V_{ab}	$+V_s$	$+V_s/2$	$-V_s/2$	$+V_s$	$-V_s/2$	$+V_s/2$
V_{bc}	$-V_s/2$	$+V_s/2$	$+V_s$	$+V_s/2$	$-V_s/2$	$-V_s$
V_{ca}	$-V_s/2$	$-V_s$	$-V_s/2$	$+V_s/2$	$+V_s$	$+V_s/2$

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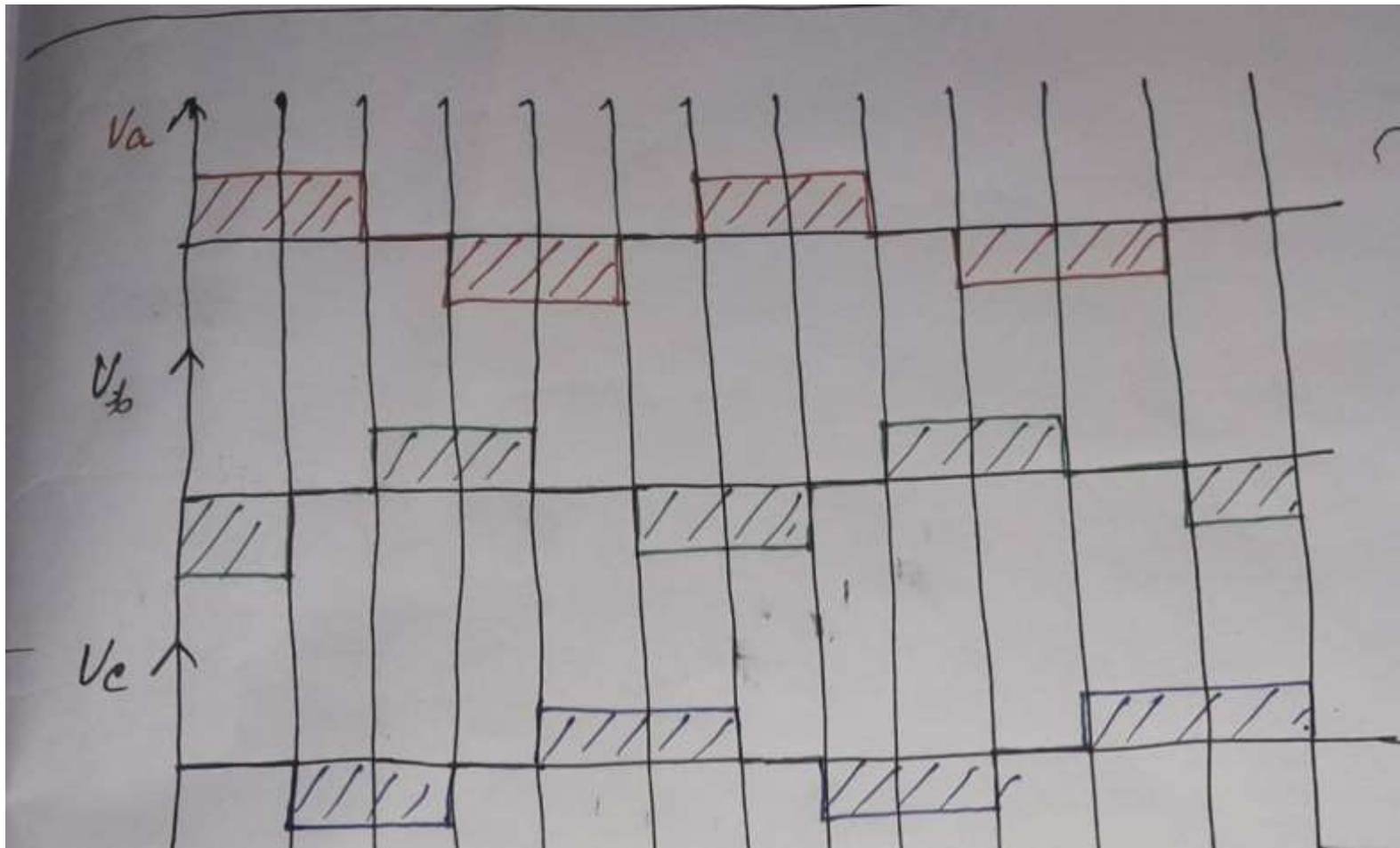


$$\text{Current} = \frac{V_s}{2Z}$$

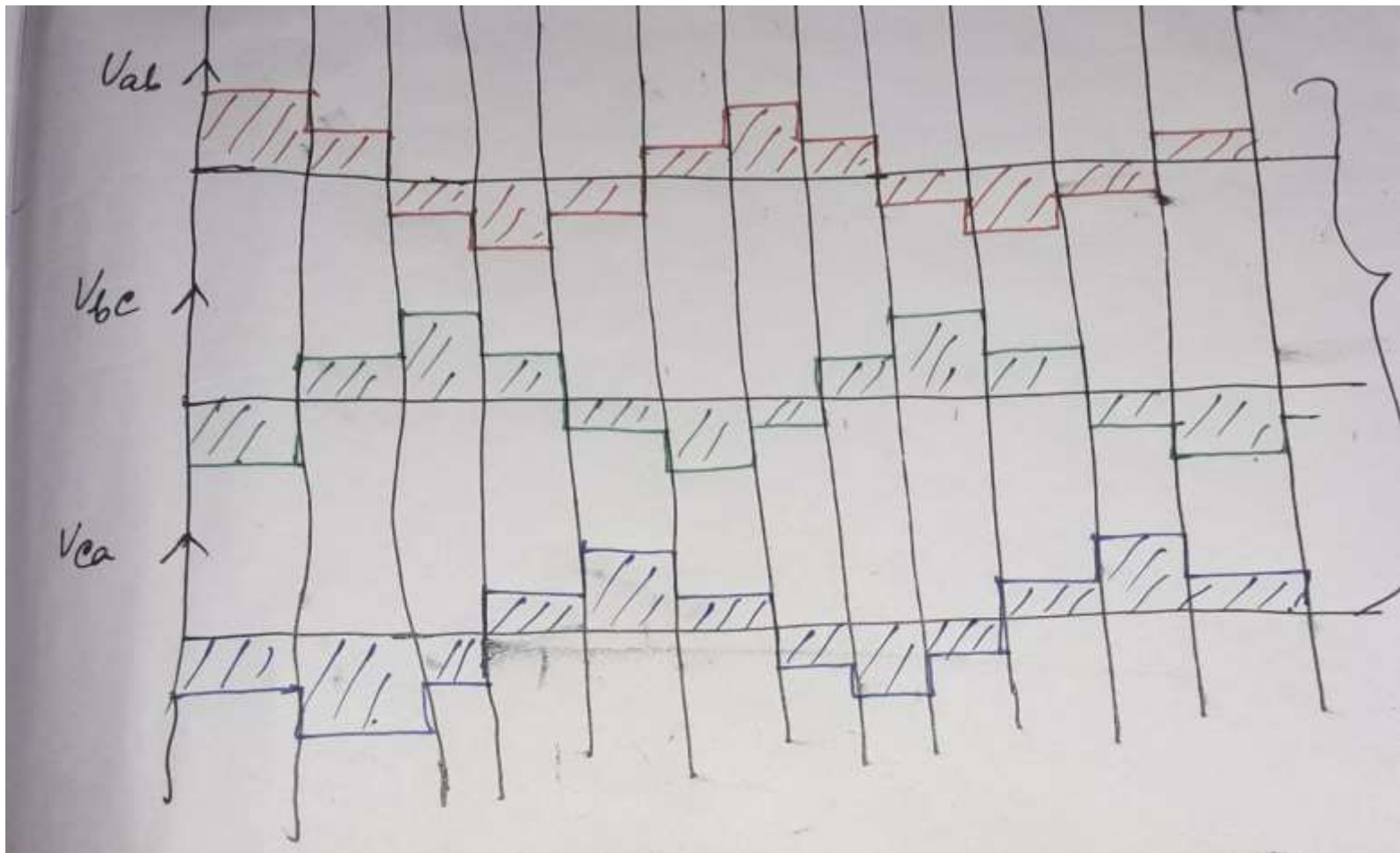
$$V_a = \frac{V_s}{2Z} \cdot Z = +V_s/2$$

$$V_b = -\frac{V_s}{2Z} \cdot Z = -V_s/2$$

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