Three phase current supplied by a generator to a motor establishes three individual magnetic fields within the motor (Figures 1 and 2). The resultant of these individual magnetic fields is the Rotating Magnetic Field (RMF).

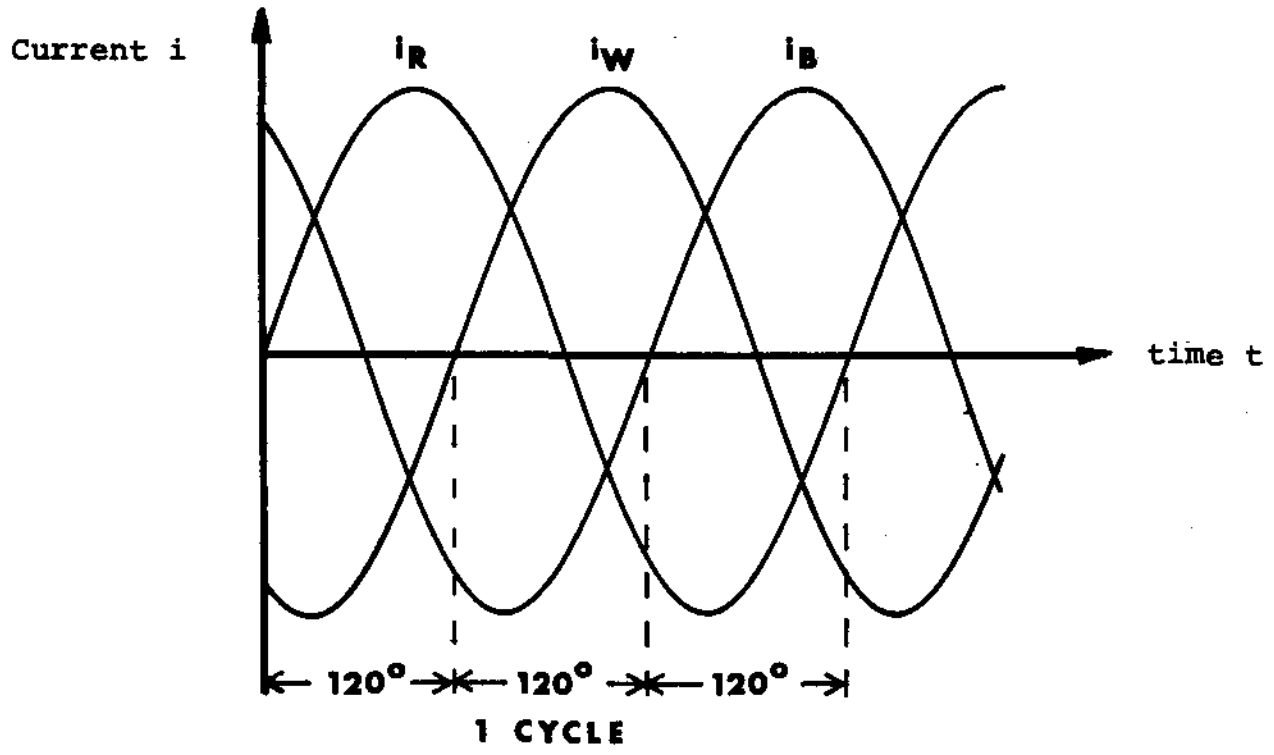


Figure 1: Diagram showing the waveform of currents in the windings of a three phasor motor.

Each magnetic field is sinusoidal, and is 120° out of phase, with respect to each other. Hence, they can be expressed as follows:

$$\Phi_R = \Phi_{PEAK} \sin(\theta)$$

$$\Phi_W = \Phi_{PEAK} \sin(\theta - 120°)$$

$$\Phi_B = \Phi_{PEAK} \sin(\theta + 120°)$$

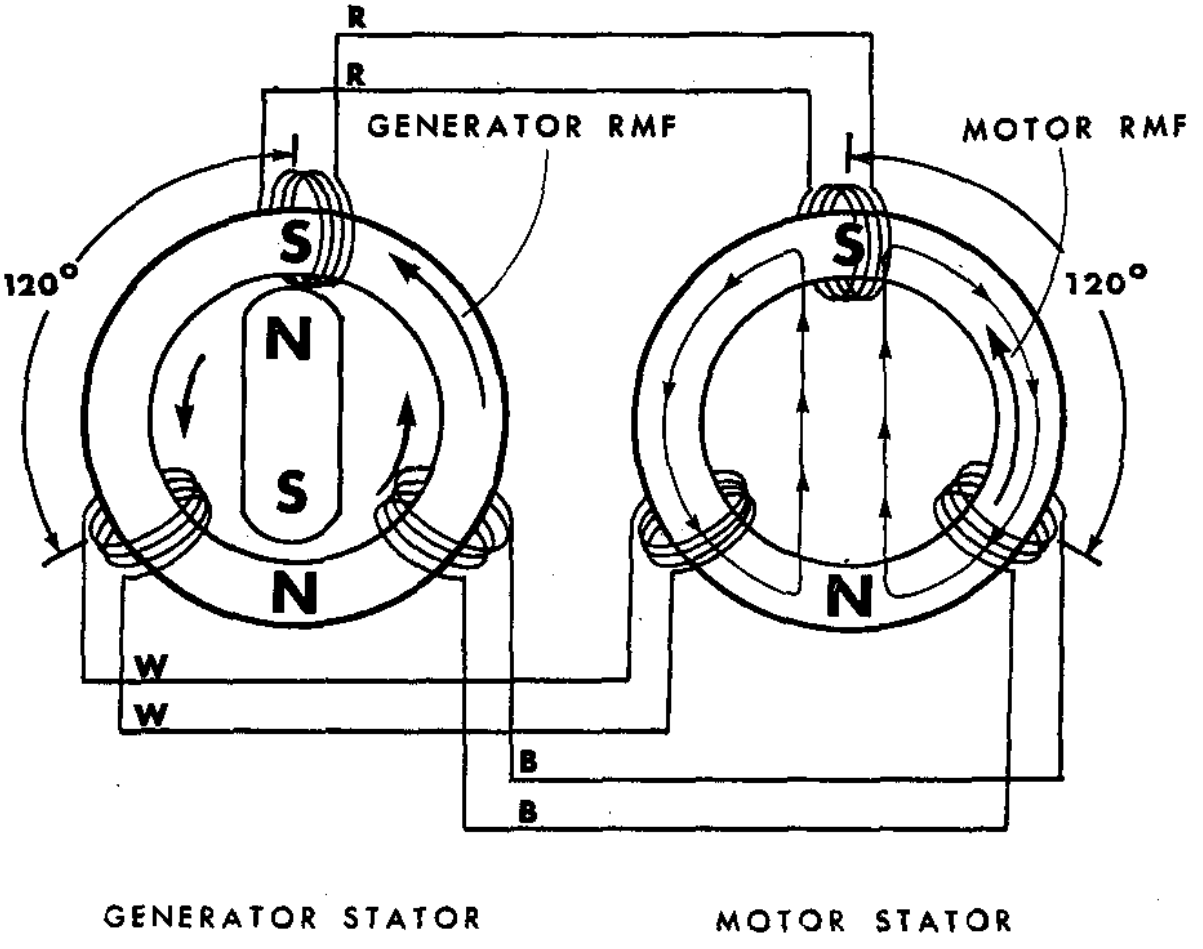


Figure 2: Rotating Magnetic Field in a Motor

These three magnetic fields, Φ_R, Φ_W, and Φ_B can be victorially represented on their respective azes, as shown in Figure 3. The magnetic fields can be victorially added together.

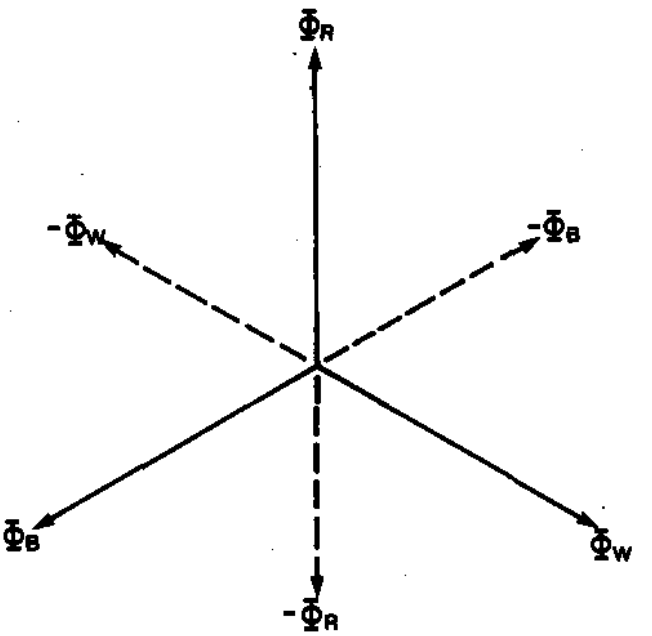


Figure 3: Victorial representation of the Three Magnetic Fields

Notes

Table 1 partially summarizes this phaser addition process and shows the RMF phasor rotation through 360 degrees at 45 degree intervals. Figure 4 displays this phasor rotation.

An obvious advantage of a 3-ϕ motor over a 1-ϕ motor is the constant rotating magnetic field (RMF) which is produced.

TABLE 1 - RMF ROTATION

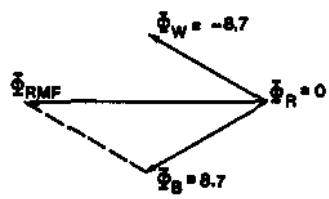
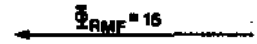
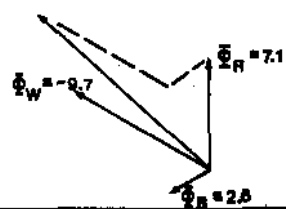
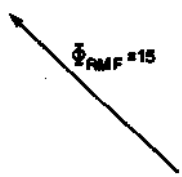
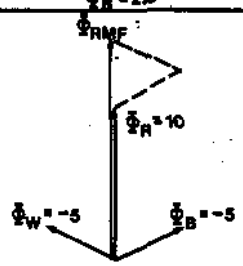
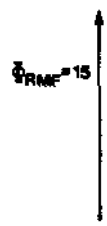
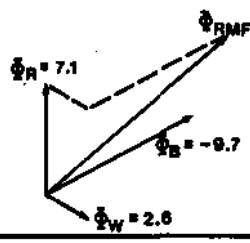
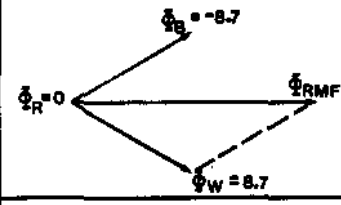
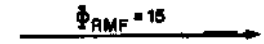
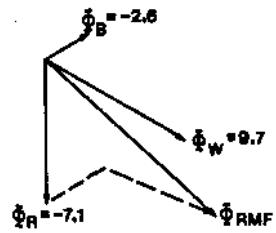
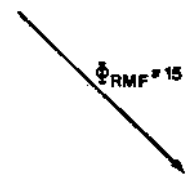
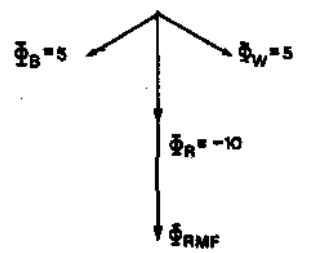
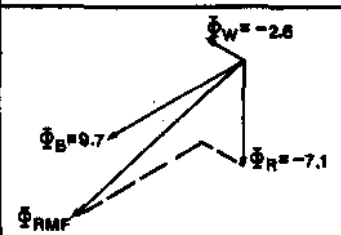
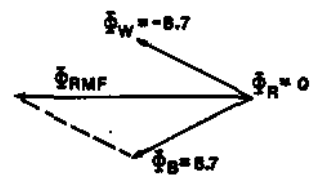
No.	Θ	$\bar{\Phi}_R$	$\bar{\Phi}_B$	$\bar{\Phi}_W$	PHASOR ADDITION	RMF
1	0°	0	8.7	-8.6		
2	45°	7.1	2.6	-9.7		
3	90°	10	-5.0	-5.0		
4	135°	7.1	-5.0	-5.0		

Table I - RMF Phasor Rotation (continued)

No.	Θ	Φ_R	Φ_B	Φ_W	PHASOR ADDITION	RMF
5	180°	0	-8.7	8.7		
6	225°	-7.1	-2.6	9.7		
7	270°	-10	5.0	5.0		
8	315°	-7.1	9.7	-2.6		
9	360°	0	8.7	-8.7		

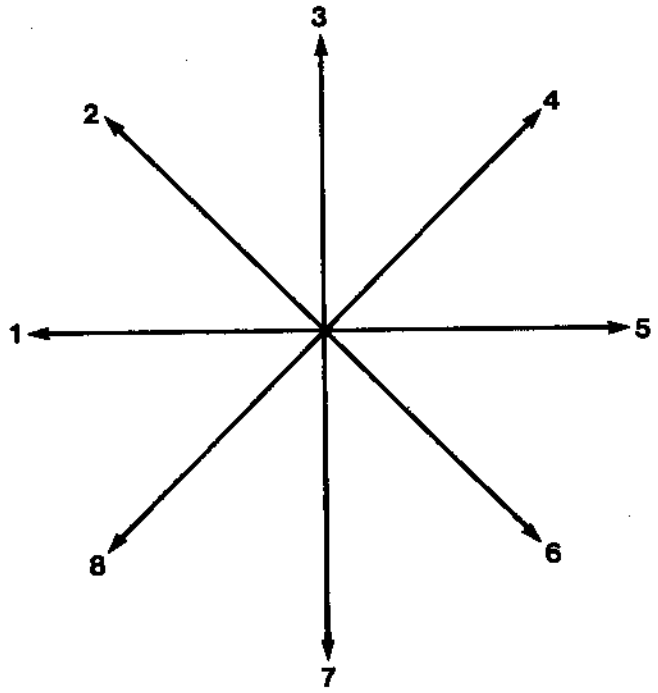


Figure 4: RMF Phasor Rotation

It could easily be shown that, by using this method, the RMF rotation in a motor and the rotor rotation could be made to change direction simply by interchanging any two of the red, white or blue power phases into the motor. That is, in Figure 2, connect the Red generator phase voltage to the White motor winding and vice versa).

It should also be noted that the resultant flux (RMF) always has a magnitude of 150 percent of the individual fluxes for 3-ϕ motors.

Notes