Induction Motor Synchronous Speed and Slip

Synchronous speed of an AC induction motor from supply frequency and poles, and the slip, slip speed and rotor frequency at the running speed.

Method: n_s = 120 f / p

Input parameters

Unit system: SI

Parameter	Value	Unit
Supply frequency	50.000	Hz
Number of poles	4	
Running (rotor) speed	1,475.0	rpm

Calculated results

Parameter	Value	Unit
Synchronous speed	1,500.0	rpm
Slip	1.6667	%
Slip speed	25.000	rpm
Rotor current frequency	0.83333	Hz

Formula and method

$$n_s = \frac{120 f}{p} \ \text{rpm} \ \ (= 2f/p \ \text{rev/s})$$

$$s = \frac{n_s - n}{n_s}, \quad f_r = s f$$

Variables

f	supply frequency	Hz
p	number of poles	-
n	running speed	rev/s
n_s	synchronous speed	rev/s
s	slip	-
$n_s - n$	slip speed	rev/s
f_r	rotor current frequency	Hz

Method and standards

The stator field turns once every p/2 cycles of the supply, so its speed is 2f/p revolutions per second (120 f/p in rpm). Slip is the rotor's lag behind the field as a share of synchronous speed; rotor currents alternate at slip times supply frequency.

Assumptions and limits

- Induction motors; synchronous motors run at n_s with zero slip.
- Steady running speed.

References

- n_s = 120 f / p

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/electrical/motors/motor-speed-slip

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.