Slip Coupling or Eddy-current Drive: Slip Loss and Efficiency

Slip power lost in a magnetic or eddy-current coupling driving a pump, from motor and load speeds and load torque, and the worst-case loss for a fan-law load.

Input parameters

Unit system: SI

Parameter	Value	Unit
Motor speed	1,780.0	rpm
Load speed	1,200.0	rpm
Load torque at this speed	600.00	N·m
Load power at full speed (for the peak loss)	150.00	kW

Calculated results

Parameter	Value	Unit
Input power	111.84	kW
Load power	75.398	kW
Slip loss	36.442	kW
Coupling efficiency	67.416	%
Slip	32.584	%
Peak slip loss on a cubic load (at 2/3 speed)	22.222	kW

Notes for this case

• Torque is the same on both sides of a slip coupling, so efficiency equals the speed ratio and the lost power appears as heat in the conductor or oil. On a friction-only (cubic) pump system the slip loss peaks at 2/3 speed at 4/27, about 15 % of full-load power; a static head lowers that peak.

Formula and method

$$P_{slip} = T(n_m - n_l), \quad \eta = \frac{n_l}{n_m}, \quad P_{slip,max} = \frac{4}{27} P_r \quad \text{(cubic load)}$$

Variables

n_m	Motor speed	rad/s
n_l	Load speed	rad/s
T	Load torque at this speed	N·m
P_r	Load power at full speed (for the peak loss)	W
P_{in}	Input power	W
P_{out}	Load power	W
P_{slip}	Slip loss	W
η	Coupling efficiency	-
s	Slip	-
$P_{slip,max}$	Peak slip loss on a cubic load (at 2/3 speed)	W

Method and standards

Slip power of torque-transmitting couplings.

Assumptions and limits

- Windage and friction neglected.

Report details

Report reference	FCC-Q7XC-23NJ (the same inputs always give the same reference)
Generated	23 November 2026, 18:00 UTC
Calculator	Slip Coupling or Eddy-current Drive: Slip Loss and Efficiency
Method last reviewed	17 November 2026
Software release	FireCAD Calc, release of 22 November 2026
Release checks	3 reference cases of this calculator, computed independently, are checked on every release

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

This calculator online

https://calc.firecad.com/mechanical/pumps/slip-coupling-loss

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.