Centrifugal Clutch: Engagement Speed and Torque

Speed at which a centrifugal clutch engages from shoe mass, spring force and radius, and the torque it transmits at a running speed.

Method: Rattan; Theory of Machines; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Mass of each shoe	0.50000	kg
Number of shoes	4.0000	
Radius of the shoe centre of gravity	100.00	mm
Drum inner radius	125.00	mm
Spring force on each shoe at engagement	300.00	N
Friction coefficient	0.30000	
Running speed	1,500.0	rpm

Calculated results

Parameter	Value	Unit
Engagement speed	739.69	rpm
Centrifugal force per shoe at running speed	1,233.7	N
Torque transmitted	140.06	N·m
Power transmitted	22.000	kW

Notes for this case

- Shoe radius taken as constant from engagement to running. Torque rises with the square of speed above engagement.

Formula and method

$$\omega_e = \sqrt{\frac{F_s}{mr}}, \quad T = n\mu(mr\omega^2 - F_s)R$$

Variables

m	Mass of each shoe	kg
n	Number of shoes	-
r	Radius of the shoe centre of gravity	m
R	Drum inner radius	m
F_s	Spring force on each shoe at engagement	N
μ	Friction coefficient	-
N	Running speed	1/s
N_e	Engagement speed	1/s
F_c	Centrifugal force per shoe at running speed	N
T	Torque transmitted	N·m
P	Power transmitted	W

Method and standards

Centrifugal force balance.

Assumptions and limits

- Rigid shoes; constant radius; the shoe centre of gravity inside the drum radius and a whole number of shoes.

- Below the engagement speed the torque is zero, with a note.

References

• Rattan
• Theory of Machines
• 4th ed. (McGraw-Hill, 2014); Bhandari
• Design of Machine Elements
• 4th ed. (McGraw-Hill, 2017) (centrifugal clutch)

Report details

Report reference	FCC-KQYT-787Z (the same inputs always give the same reference)
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Release checks	2 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/machine-design/centrifugal-clutch

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.