Rotary Kiln Drive Power (Friction and Load)

Drive power of a rotary kiln as roller-bearing friction plus load power, with sin θ found from the degree of filling, by Duda's formulas.

Method: Duda; Cement Data Book; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Total vertical load on all roller shaft bearings	725.75	t
Roller shaft bearing diameter	406.40	mm
Riding ring (tyre) diameter	4,419.6	mm
Support roller diameter	1,066.8	mm
Kiln speed	1.7000	rpm
Roller bearings	Oil-lubricated (F = 0.018)	
Kiln diameter inside the lining	3.5052	m
Degree of filling	12.000	%
Kiln length	57.912	m
Material	Cement, wet or dry (35° repose)	

Calculated results

Parameter	Value	Unit
sin θ from the filling	0.76425	
Friction power	22.265	kW
Load power	124.27	kW
Total drive power	146.54	kW

Notes for this case

• Duda reads sin θ from a chart against filling; here it is the sine of half the bed's central angle, which reproduces the chart (0.77 at 12 %). Add drive losses and a start-up margin; Duda's ratio for preheater kilns is about 4.5–4.8 m³ of kiln volume per kW.

Formula and method

$$HP_f = \frac{W b_d t_d N F 0.0000092}{r_d}, \quad HP_l = (D \sin\Theta)^3 N L K, \quad \frac{2\Theta - \sin 2\Theta}{2\pi} = f$$

Variables

W	Total vertical load on all roller shaft bearings	kg
b_d	Roller shaft bearing diameter	m
t_d	Riding ring (tyre) diameter	m
r_d	Support roller diameter	m
N	Kiln speed	1/s
F	Roller bearings	-
D	Kiln diameter inside the lining	m
f	Degree of filling	-
L	Kiln length	m
K	Material	-

$\sin\Theta$	sin θ from the filling	-
P_f	Friction power	W
P_l	Load power	W
P	Total drive power	W

Method and standards

Friction and load horsepower.

Assumptions and limits

- Imperial formula; uniform bed.

References

• Duda
• Cement Data Book
• Vol. 1
• 3rd ed. (Bauverlag / Macdonald and Evans, 1985)
• sec. 19.1.6 and its worked example

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/chemical/cement/rotary-kiln-drive-power

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.