Mill Gearing: Ratio, Roller Speed and Pitch-Line Speed

Roller speed and overall reduction of a mill drive from motor speed, reducer ratio and final pinion and gear teeth, with surface and pitch-line speeds.

Method: Hugot; Handbook of Cane Sugar Engineering; ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Motor or turbine-reducer output speed	1,000.0	rpm
Reducer ratio	42.500	
Final pinion teeth	21.000	
Final gear (spur wheel) teeth	104.00	
Top roller diameter	0.76200	m
Pitch diameter of the final gear	2.4000	m

Calculated results

Parameter	Value	Unit
Roller speed	4.7511	rpm
Overall reduction	210.48	
Roller surface speed	11.374	m/min
Pitch-line speed of the final gear	35.823	m/min

Notes for this case

- Hugot: spur gears up to about 700–825 m/min pitch-line speed; at most about 5 : 1 per spur stage, 10 : 1 for double helical gears.

Formula and method

$$i = i_1 \frac{z_2}{z_1}, \quad n = \frac{n_m}{i}, \quad v = \pi D n, \quad v_g = \pi d_g n$$

Variables

n_m	Motor or turbine-reducer output speed	1/s
i_1	Reducer ratio	-
z_1	Final pinion teeth	-
z_2	Final gear (spur wheel) teeth	-
D	Top roller diameter	m
d_g	Pitch diameter of the final gear	m
n	Roller speed	1/s
i	Overall reduction	-
v	Roller surface speed	m/s
v_g	Pitch-line speed of the final gear	m/s

Method and standards

Gear train kinematics.

Assumptions and limits

- Rigid gear train; no slip. Notes compare the final pair with Hugot's limits (pitch-line speed and 5 : 1 per spur stage); the reducer's own stages are not checked.

References

• Hugot
• Handbook of Cane Sugar Engineering
• 3rd ed. (Elsevier, 1986)
• ch. 17
• mill gearing
• pp. 253–258 (example: 1000 rpm, 42.5 : 1 reducer, 21/104 final pair)

Report details

Report reference	FCC-VE84-HHX2 (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/sugar-ethanol/milling/mill-gearing-ratio

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.