Stirred Tank: Impeller Reynolds Number, Tip Speed and Froude Number

Impeller Reynolds number, tip speed and Froude number of a stirred tank from impeller diameter, speed and liquid properties, with the flow regime.

Method: Impeller Reynolds number Re = ρND²/μ (McCabe, Smith and Harriott; Paul, Atiemo-Obeng and Kresta)

Input parameters

Unit system: SI

Parameter	Value	Unit
Impeller diameter	0.60000	m
Speed	120.00	rpm
Liquid density	1,050.0	kg/m³
Liquid viscosity	0.050000	Pa·s

Calculated results

Parameter	Value	Unit
Impeller Reynolds number ρND²/μ	15,120	
Tip speed πND	3.7699	m/s
Froude number N²D/g	0.24473	
Regime (1 laminar, 2 transitional, 3 turbulent)	3.0000	

Notes for this case

- Regime bands: laminar below about 10, turbulent above about 10^4 (common practice).

Formula and method

$$Re = \frac{\rho N D^2}{\mu}, \quad v_t = \pi N D, \quad Fr = \frac{N^2 D}{g}$$

Variables

D	Impeller diameter	m
N	Speed	1/s
ρ	Liquid density	kg/m³
μ	Liquid viscosity	Pa·s
Re	Impeller Reynolds number ρND²/μ	-
v_t	Tip speed πND	m/s
Fr	Froude number N²D/g	-
regime	Regime (1 laminar, 2 transitional, 3 turbulent)	-

Method and standards

Definitions.

Assumptions and limits

- Newtonian liquid.

References

- Impeller Reynolds number Re = ρND²/μ (McCabe, Smith and Harriott; Paul, Atiemo-Obeng and Kresta)

Report details

Report reference	FCC-ZGGF-Y3GV (the same inputs always give the same reference)
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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/chemical/reactors/agitator-reynolds-tip-speed

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.