Agitator Formula commonly used

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Power Number Np

$$BHP = \frac{SG * N_p * D^5 * N^3}{6.12E7} \quad [HP]$$

- Motor nameplate = BHP / Motor efficiency
- N = rpm
- D = feet
- Np = depends on impeller type
- SG = specific gravity of the mixture

Power numbers assume fully baffled vessels with impeller viscosity and proximity correction factors (off bottom and multiple impellers) of 1.0.

Pumping numbers derive primary pumping capacity only, entrained flow is often described as 2.5 to 3 (or more) times greater. Pumping numbers assume Impeller Diameter to Tank Diameter ratio (D/T) is 0.33. The N_Q values given can be modified for different D/T ratios in the range of 0.2 to 0.45 by using the following equation:

$$\left[\frac{D/T}{0.33}\right]^{-0.1} (N_Q)$$

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Impeller Tip Speed

$$TS = \pi * D * N \quad [FPM]$$

- Tip Speed = feet per minute
- N = rpm
- D = feet
- Important when shear can effect your product

Flow Number Nq

$$Q = 7.48 * N_Q * N * D^3 \quad (Single\ Impeller) \quad [USGPM]$$

- For two of the same impellers Flow = 1.8 x single impeller
- N = rpm
- D =
- Nq = depends on impeller type

Superficial velocity Vs Chemscale = Vs/6

$$V_s = \left(\frac{N_Q * N * D^3}{\frac{\pi * T^2}{4}} \right)$$

- For two of the same impellers Flow = 1.8 x single impeller
- N = rpm
- D = feet
- T = tank diameter in feet
- Chemscale determines mild, moderate, vigorous mixing level

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Mixing Levels :

Torque per specific volume
Power per volume

$$\left(\frac{T_Q}{\rho\ V}\right) = \left(\frac{\frac{BHP*63025}{N}}{SG*V}\right)$$

- For two of the same impellers Flow = 1.8 x single impeller
- N = rpm
- T = tank diameter in feet
- V = mixing volume in gallons
- TQ = Torque in inch-pounds
- BHP = brake HP

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Mixer Tank Support Design Loads:

$$Static\ Weight = Sum\ of\ Component\ Weights$$

$$Dynamic\ Torque = \frac{HP*63025*2}{N} \quad [In.Lbs.]$$

$$Bending\ Moment = \sum_{x=1}^{NI} \left(\frac{HP*FQ_x*48025*L_x*CF}{N*D_x} \right) \quad [In.Lbs.]$$

- N = rpm
- FQx = impeller HP fraction
- NI = Number of impellers
- Lx = Distance of impeller to mixer mount
- HP = Motor nameplate HP
- CF = 1.0 for PBT
  = 1.5 for high efficiency axial impellers

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