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ILVA SHEAR
BASICALLY, KINETIC ENERGY OF ROTATION IS:

\[ \text{K.E.} = \frac{1}{2} I \omega^2 \]

BY DEFINITION

where \( I \) = moment of inertia
\( \omega \) = angular velocity

2. MOMENT OF INERTIA OF A MASS \( I = \int r^2 \, dm = kr^m \)
is in units of \( \text{slug ft}^2 \) or \( \frac{1 \text{ lb ft}}{\text{sec}^2 \times \text{sec}} \)

\[ = \frac{1 \text{ lb ft}}{\text{sec}^2 \times \text{sec}} \rho \]

ANOTHER MEASURE OF MOMENT OF INERTIA IS \( \text{W}k^n \)
which is \( I \times \frac{32}{2} \times \frac{1}{\text{sec}^2} = \frac{1 \text{ lb ft}}{\text{sec}^2} \rho \)

3. \( \omega = \text{radians/second} \), \( N = \text{RPM} \)
\[ \omega \times 60 = N \]
\[ \Rightarrow \omega \times 9.56 = N \]

Therefore \( \text{K.E.} = \frac{1}{2} I \omega^2 \)

\[ \text{K.E.} = \frac{1}{2} (Wk^n) \times \frac{N^n}{9.56^n} = \frac{Wk^n N^n}{91.5 \times 32.2 \times 9.56} \]

or \[ \text{K.E.} = \frac{Wk^n N^n}{5880} \]

4. A MACHINE (ILVA SHEAR) HAS A \( Wk^n = 151 \text{ FT}^{16} \)
AT THE MOTOR SHAFT. HOW FAST MUST THIS MACHINE BE RUN NOMINALLY SO THAT WHEN 2480 FT FT16 OF ENERGY IS GIVEN UP BY THE SYSTEM, THE SPEED DROP IS 50%? 

5. \( K.E._1 = f(W^n) \), \( K.E._2 = f(W^n) \)

\[ K.E._1 - K.E._2 = f(W^n) - f(W^n) = f(W^n) - f[1 \cdot \omega \cdot (1 - n)] \]

\[ K.E._1 - K.E._2 = f[1 \cdot (1 - n)] \omega^n = \frac{[2x' - x^n]}{2} f(W^n) \]

(where \( x = \text{speed drop} \))

\[ \Delta \text{K.E} = \frac{[2x' - x^n]}{2} \text{K.E.} = \text{energy given up in shearin} \]

\[ \text{where } \Delta = \frac{2x' - x^n}{2} = 1 - .25 = .75 \]

\[ \text{K.E.} = \frac{\Delta \text{K.E.}}{.75} = \frac{2480}{.75} = 3310 \]
6. RETURNING TO ITEM 3:

\[ KE = \frac{WK^n N^n}{5880} \]

\[ N = \sqrt[7]{\frac{5880 KE}{WK^n}} \]

\[ N = \sqrt[7]{\frac{5880 \times 3310}{151}} = 129000 \]

\[ N = 359 \text{ RPM} \]