

Formula for the Torque of an Overshot Water Wheel

The torque of a steel (Fitz type) overshot water wheel can be calculated approximately from the following formula:

$$\text{Torque} = (f) \cdot (\pi) \cdot (w) \cdot (D \cdot d - d^2) \cdot (15.605) \cdot D$$

where

f = bucket fill fraction (most working wheels only run with about 1/5 of each bucket filled, so use 0.2 for f)

$$\pi = \text{pi} = 3.14159$$

w = wheel (bucket) width in feet

D = wheel diameter in feet

d = radial bucket depth in feet = about 8 inches or 0.666 foot

15.605 = constant based on weight of water and several other factors

The Fitz water wheel at Falls Mill is 32 feet in diameter and 4 feet wide. The torque is the weight of water (in pounds) acting on half the wheel with a 16-foot “lever” to the axle, so is given in foot-pounds, as follows:

$$\begin{aligned} \text{Torque} &= (0.2)(3.14159)(4)[(32)(0.666) - (0.666)^2](15.605)(32) \\ &= 26,191 \text{ foot-pounds} \end{aligned}$$