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In the system shown below water is pumped from a reservoir to a constant-level storage tank. Calculate the cost of operating the pump per hour, if the efficiency of the pump assembly is 40%. The water flow in the system is to be maintained at 100 gal/min. The temperature of the water is 60°F. The material of construction for the pipe is steel. Assume that the cost for electrical energy is 3.0 cents/kW-hr.

Solution

Step 1. Choose as a basis 1 lb of flowing water and then apply the total mechanical-energy balance equation between points 1 and 2. Some properties of water that we need to know are:

density of water at 60°F = 62.3 lb/ft³
viscosity of water at 60°F = 1.12 cP

or

$$(1.12 \text{ cP})(6.72 \times 10^{-4} \text{ lb/s} \cdot \text{ft} \cdot \text{cP}) = 7.52 \times 10^{-4} \text{ lb/s} \cdot \text{ft}$$

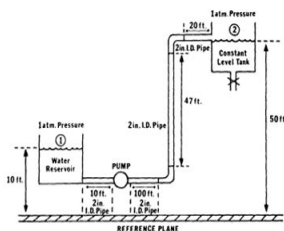


Figure 5.12 Flow system for Example 5.3.

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