Power Consumption

Often an individual wants to know how much it will cost to run a pump. This will depend on various factors. Let's explore how to calculate the power consumption of a pump based on a couple of different methods.

The cost to operate a pump is simple if you know the duty cycle and input watts. Follow along:

cost to operate per day = (hours run per day) x (input power) x (electrical cost)
input power is in kilowatts (kilowatts = watts / 1,000)
electrical cost is in dollars per kilowatt hour

EXAMPLE: a 2 HP pump running on a 25% duty cycle and requiring 3,000 watts input.

First, determine how many hours per day the pump will run:

hours run per day = (duty cycle) x 24 hours
= 0.25 x 24 hours
= 6 hours

cost to operate per day = (hours run per day) x (input power) x (electrical cost)
= (6 hours) x (3 kilowatts) x ($ 0.10 per kW hour)
= $1.80 per day

To find the cost to operate per year, multiply by the number of days in a year:

cost to operate per year = ($ per day) x (365 days per year)
= ($1.80) x (365 days per year)
= $657.00 per year

In most installations, we will not know the input watts without consulting the pump manufacturer. Another method is given if the known is duty cycle, voltage, amperage, and power factor are known.

First, we must convert the electrical readings to an input power (kilowatt):

input power = (voltage) x (amperage) x (power factor) x (square root of the phase)

Voltage is in volts, amperage is in amps, power factor is in percent (usually about 0.8 for single phase and 0.9 for three phase), square root of the phase is 1 for single phase and 1.73 for three phase

Once the input power has been established, use that same formula as before:

cost to operate per day = (hours run per day) x (input power) x (electrical cost)
input power is in kilowatts (kilowatts = watts / 1000)
electrical cost is in dollars per kilowatt hour

EXAMPLE: Let's use a single phase, ½ HP pump used in a STEP system. A time dosing panel is used which runs eight times a day for ten minutes each time. The electrical readings are 242 volts and 5.2 amps.

First, we must convert the electrical readings to an input power (kilowatt):

input power = (voltage) x (amperage) x (power factor) x (square root of the phase)
= (242 volts) x (5.2 amps) x (0.8) x (1)
= 1007 watts
= 1.0 kilowatts

Second, determine how many hours per day the pump will run:

hours run per day = (times run per day) x (length of each time in minutes) / (60 minutes per hour)
= (8 times per day) x (10 minutes each) / (60 minutes per hour)
= 1.33 hours

cost to operate per day = (hours run per day) x (input power) x (electrical cost)
= (1.33 hours) x (1 kilowatt) x ($ 0.10 per kW hour)
= $0.133 per day

cost to operate per year = ($0.133) x (365 days per year)
= approximately $48.55 per year

One last item to note is that the inrush power to a pump is not considered during the cost-to-operate calculation. Although the inrush can be several times higher than the actual run amperage of the pump and therefore seem to increase the cost to operate considerably, this is not the case. Since the inrush duration is a very short period, typically less than a second, the overall power consumption calculation would be affected by a very minor amount.