# How difficult is it to pump a Simple Pump hand pump? – An explanation of what to expect when hand pumping a Simple Pump hand pump.

Steve Schmid – February 2024

In this document, we explore the effort required to operate a Simple Pump hand pump. Understanding the physical exertion involved in hand pumping is crucial, yet challenging due to the diverse conditions of wells and the varied physical capabilities of users. We aim to set the right expectations by examining factors that influence pumping effort, including well depth, user strength, and pump design.

We showcase the Simple Pump's innovation through its use of lightweight, strong fiberglass rods coated in FDA-approved resin, unlike the heavier steel rods other manufacturers use. This choice significantly reduces the total weight users lift with each pump action, a crucial consideration when comparing manual pumps.

We are committed to offering you a thorough understanding of the effort involved and assisting you in deciding if a hand pump meets your needs. Through this document's comparative analysis, we highlight how the Simple Pump's design efficiently minimizes effort without sacrificing performance.

## User Strength Variability:

Our hand pumps serve a diverse user base, from young children to senior citizens, regardless of gender. A pump system with a weight of 20 pounds on the end of the handle may feel light to a 30-year-old male user but heavy to a 75-year-old female user.

## Total Dynamic Head Calculation:

Understanding the pumping effort starts with calculating the Total Dynamic Head (TDH) of your pumping system. Total Dynamic Head represents that work that needs to be done by the pump to move water from your well to its point of use. TDH is represented in vertical feet of water that that needs to be pumped. You can easily calculate the TDH of your pumping system by knowing three factors: the static water level of your well, the vertical rise to your point of use, and the pressure you are pumping into (if pumping into pressure). We go into each of these in more detail below, but simply add all three together to calculate your system's TDH.

S – Static Water Level (in feet)

R – Vertical Rise (in feet)

P – Pressure You Are Pumping Into (converted from PSI to feet)

TDH = S + R + P

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## Static Water Level:

Static water level is the depth at which water sits below the ground in your well and directly influences the pumping effort. Simply put, the deeper the water, the more effort it takes to bring it to the surface. By understanding your well's static water level, you can better predict the effort needed for pumping.

## Vertical Rise:

Vertical rise refers to the elevation difference between the well head and the point of use. This difference can increase or decrease your system's TDH depending on whether the use point is above or below the well head. Due to relatively low pumping velocities, horizontal distance from the well head to the point of use typically has little impact on TDH for most Simple Pump applications. Horizontal distance only impacts TDH if the horizontal run is excessively long (>200 feet) or the horizontal pipe/hose has a small inside diameter (<0.5 inches).

Example 1: Your well head is 20 feet below and 40 feet away from the cistern. In this example, you would need to add 20 feet to your system's TDH.

Example 2: Your well head is 24 feet above and 100 feet away from your basement where your home pressure tank is. In this example you would need to subtract 24 feet from your TDH.

## Pressure:

If you are pumping water into a pressurized system, your system's Total Dynamic Head (TDH) is increased due to that pressure.

Convert the system's pressure from PSI (pounds per square inch) into feet of head by multiplying the pressure in PSI by 2.31. Due to the weep hole in our system, the maximum pressure the Simple Pump can pump into is 45PSI.

For example, if you are pumping into a pressure tank that is pressurized to 35 PSI, then add 81 feet (35*2.31) to your system's TDH.

Remember, as the pressure you are pumping into increases, so does the effort needed to pump.

## Total Dynamic Head Calculation Example:

For example, if your static water level is 80 feet, vertical rise is 10 feet and you are pumping into a pressure tank at 20 psi, your Total Dynamic Head is 136.2 feet.

TDH = S + R + P

TDH = 80 feet + 10 feet + 20*2.31 feet

TDH = 136.2 feet

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## Optimizing Pump Effort

### Volume Per Stroke and Mechanical Advantage:

Though your well's static water level, location, and the laws of physics are beyond your control, you can still make pumping easier. When you request a quote, we'll recommend a pumping cylinder and handle length tailored to your needs. Here's how you can adjust for easier pumping.

1. Choose the Right Pumping Cylinder: The size of the pumping cylinder affects how much water you pump with each stroke. A smaller cylinder means less water per stroke, reducing effort. We offer cylinders suited for various pumping capacities. Your quote will guide the best fit for your situation. We offer three different pumping cylinders: 100CA, 125CA-82515 and 200CA with maximum volumes per stroke of 4.5 ounces, 8.5 ounces, and 20 ounces, respectively. The Total Dynamic Head of your system limits which size cylinder you can use. The 100CA cylinder is limited to a TDH of 325 feet. The 125CA-82515 cylinder is limited to a TDH of 225 feet. The 200CA cylinder is limited to a TDH of 110 feet. See the charts at the end of this article for details on the effort differences between the pumping cylinders.

2. Optimize Lever Arm Length: The length of the lever arm influences the effort required to pump water. Longer arms provide more mechanical advantage, requiring less downward force applied at the pump handle. We'll suggest the optimal lever arm length for your setup, but switching to a longer arm could further ease the pumping process. We offer two different lever arms: 24LA (24" in length) and 36LA (36" in length). The 24LA provides a 3-to-1 mechanical advantage, while the 36LA offers a 5-to-1. This means a 36LA requires less downward force than a 24LA. See the charts at the end of this article for detail on the downward force differences between the lever arms.

By considering these adjustments, you can optimize water flow and pumping effort for your system.

### Managing Effort with Pumping Pace:

Controlling your pumping pace is a practical way to manage effort. Faster pumping requires more effort. A slower, steady pace makes pumping more manageable.

### Optimizing Pump Performance with TDH, Cylinder, and Handle Calculations:

The charts below provide the water volume per stroke and the required downward force applied to the handle for different cylinder and handle options.

### Volume per Stroke

As Total Dynamic Head increases, water volume per stroke slightly decreases a result of rod stretch. The graphs below show the water per stroke for each cylinder at different system TDH heights (in feet). This information helps you accurately predict the water flow rate that you will be able to pump, guiding your choice of pumping cylinder based on your specific needs.

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## Force Applied on the Handle

The charts below show force calculations (in pounds) for the different cylinder and handle options. These charts show the downward force that will need to be applied to the handle at different system TDH (in feet).

By consulting the charts below, you can determine the most suitable pumping cylinder and handle combination for your needs, ensuring optimal balance water flow and effort during use.

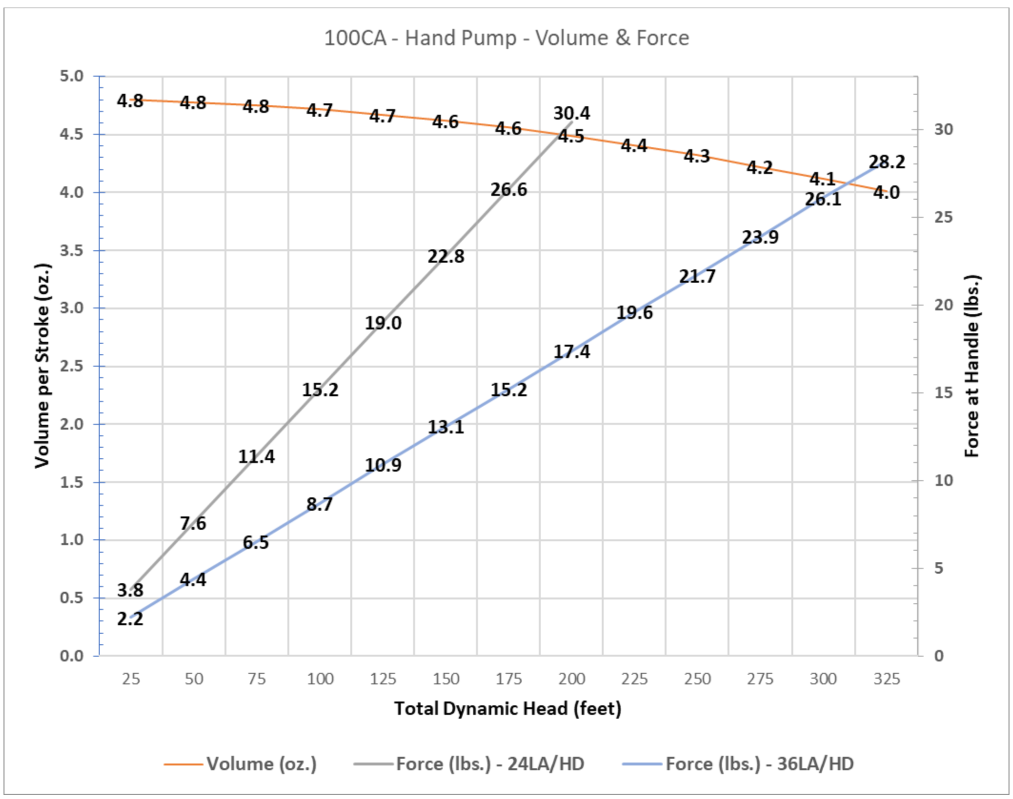


Figure 1: 100CA Volumes and Force at Handle

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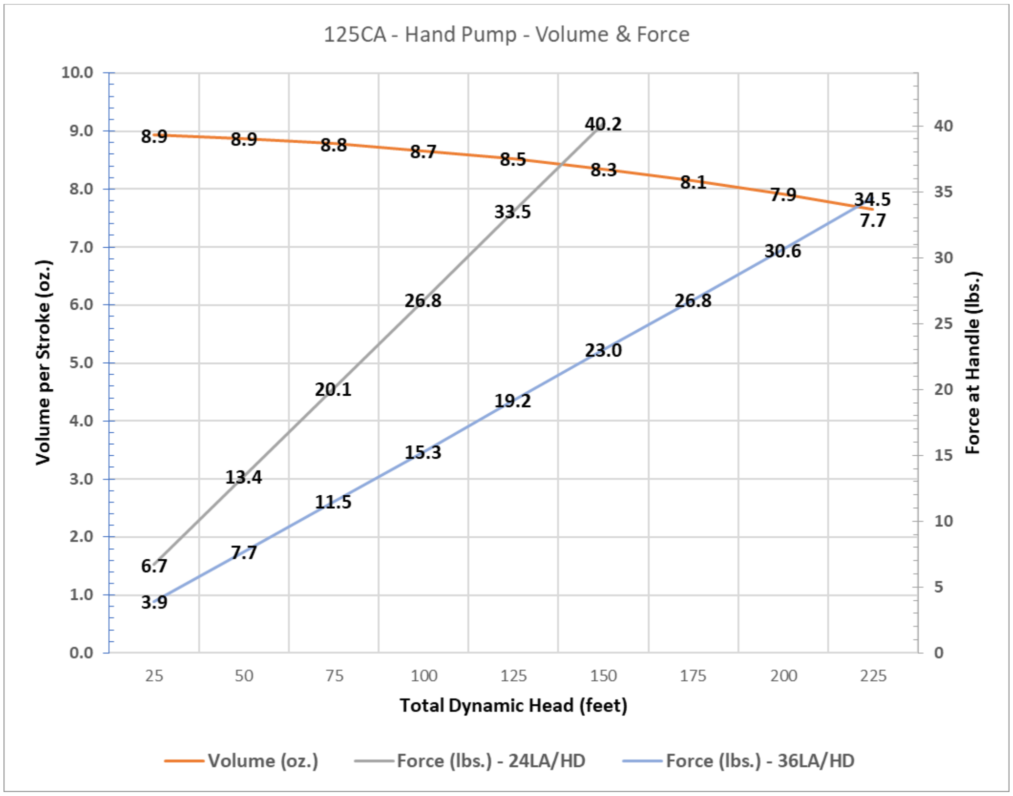


Figure 2: 125CA Volumes and Force at Handle

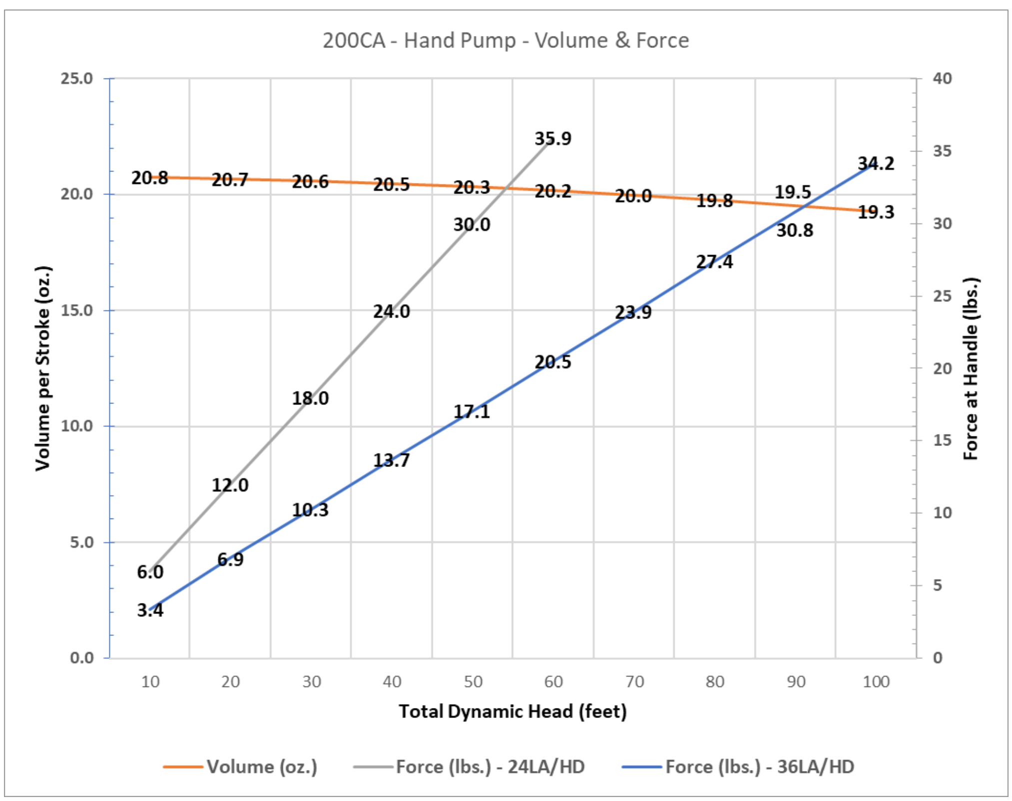


Figure 3: 200CA Volumes and Force at Handle

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