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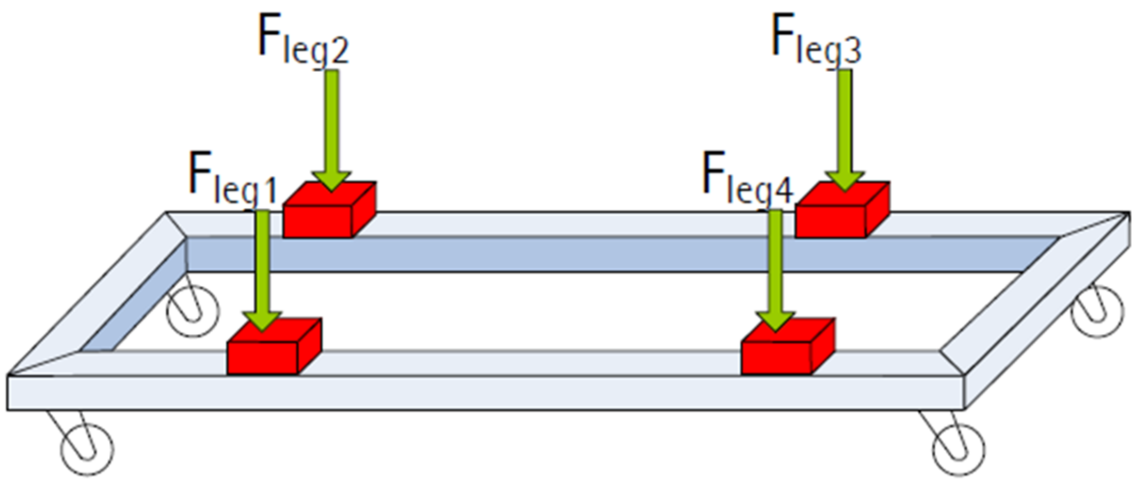
How to Accurately Weigh Portable Tanks



providing measurable solutions

In order for a portable tank system to have high system accuracy, it must have a rigid foundation that does not flex or bow, regardless of external influences. Realistically speaking, no system is perfectly rigid, but a system that limits its amount of flex will increase its chances of having higher system accuracy. Portable tank systems can perform as well as stationary systems if they follow this fundamental rule. There are several design variations with portable tank systems, and this article will cover the designs that work and the ones that don't.

Four- or three-legged systems? Short answer is three, but four-legged systems can work by adding additional framing. Consider the four-legged system as shown in **Figure 1**:

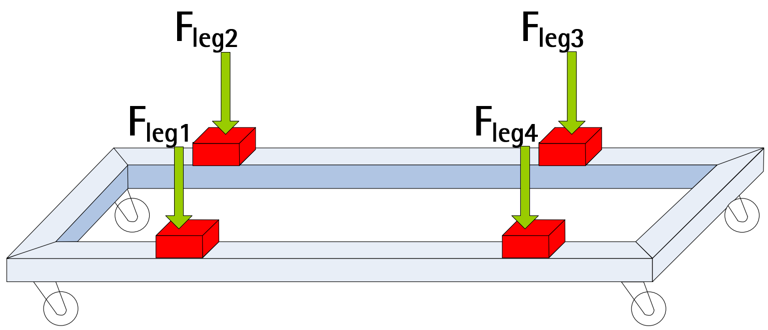


Figure 1: Incorrect four-legged portable tank system

This solution mounts a four-legged tank directly to a frame with wheels. The problem here is focused on the weight distribution of the tank, which reaches the load cells as shown in red. Four-legged systems never evenly distribute weight among all four support points (picture a four-legged chair on an uneven kitchen floor pivoting back and forth on the opposite corners). Normally, four-legged tanks work fine with stationary systems just as long as all four of the tank's load cells are under compression. This is typically compensated for by mechanical shimming, and once done, the tank does not move. Portable systems are at a disadvantage, however, because when a tank system is initially calibrated, the flatness and rigidity of its foundation are factored into the calibration and these characteristics will *always* be different when a tank is moved to another location. Since load cells are highly sensitive force sensors, these small change in a floor's flatness can be detected as changes in weight by the load cells. All it takes is a change of a thousandth of a millimeter for a load cell to detect a weight change. The load cells would have to be re-calibrated every time they are moved, which is neither practical nor efficient.

A better solution for a four-legged portable tank system is illustrated in **Figure 2**:

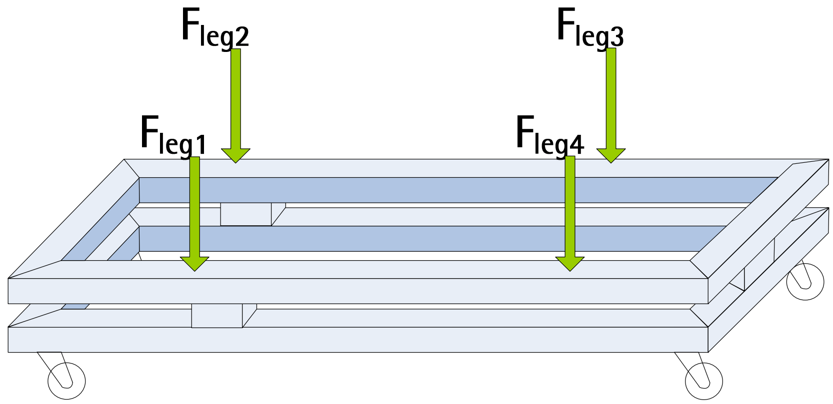


Figure 2: Correct four-legged portable tank system (double-frame design)

The four-legged tank is attached to a sub-frame, which "sandwiches" three load cells in between a base frame and the tank's sub-frame. This creates a three-point load cell system, which ensures that all three load cells will be in compression at all times. A three-point system helps guarantee that the load cells are not affected by the changes in a floor's properties from one location to another. With this design, the load cells do not need to be re-calibrated when they are transported to a new location. For new installations, it is recommended to build a portable tank system with three legs (as shown in **Figure 4**), but for tanks already built with four legs, a sub-frame needs to be built to "sandwich" the three load cells.

Why flat steel plates don't work: As previously described, successful portable tank systems need to be as rigid as possible in order to have high system accuracy. Tank systems that are mounted to a flat steel plate, as shown in **Figure 3,** have stability and rigidity issues and do not produce accurate weight values. A thick steel plate may seem like a rigid, stable surface that does not flex when a load is applied to it; however, this is not the case. **Figure 3** shows the forces of a three-legged portable tank system and the flex that is created. No matter how thick the plate is, a significant amount of flexing will occur and system accuracy will be reduced.

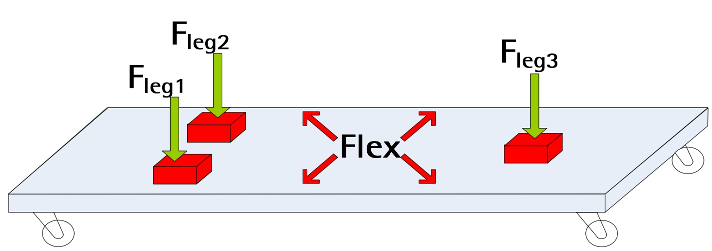


Figure 3: Incorrect portable tank system with steel plate

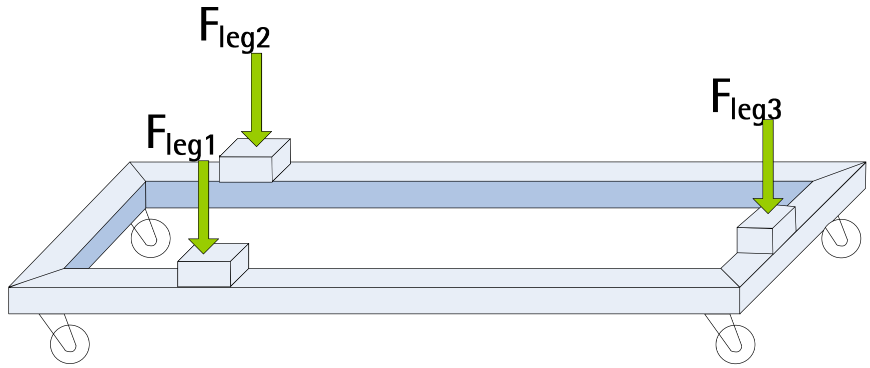


Figure 4: Correct portable tank system design for a 3-legged tank

Instead of mounting the load cells on a steel plate, the load cells should be mounted to a frame as shown in **Figure 4**. This structure, which is many times more rigid than a flat plate, offers much better system accuracy. The frame should be made out of hollow tubular steel, typically. As always with all tank weighing systems, the legs of the tank should be kept as short as possible.

In summary: For a four-legged portable tank system, stick with the double-frame design utilizing three load cells. This design will always provide better system accuracy than a four-legged design that is directly mounted to a frame with wheels which would require four cells. Also, a flat steel plate is not an acceptable substitute for a frame for either a four- or a three-legged tank system. Hollow tubular square or rectangular frames are more rigid and provide the most support. Following the portable tank design considerations as described in this article will help ensure higher system accuracy.