

Pulley Systems

T-Method for Calculating Mechanical Advantage

- Start with the part of the rope you are pulling.
- Assign one “T”, or unit of tension to this part of the rope. This is the 1 of 3:1, 5:1, etc.
- Any time the rope makes a bend at a pulley (or carabiner), it has the same number of T’s when it comes out the other side. The pulley, however, is assigned the sum of these T’s (double what the rope entering it had).
- Continue adding the T’s until you reach the load.

Rules for Simple Pulley Systems

- Simple system: single rope reeving between pulleys
- All *traveling* pulleys move toward the *anchor* at the same speed as the load.
- If the rope you are pulling is terminated at the load, then the Mechanical Advantage (MA) is *odd*. These systems are easier to reset due to the progress capture device (PCD) placement at the anchor on the first turn in the rope from the load.
- If the rope you are pulling is terminated at the anchor, then the MA is *even*. These systems are rarely used for long distance hauls because every strand of rope must go all the way from the anchor to the load, or a junction must be used between this system and the mainline. The second option means the PCD is not self tending.
- In a simple system, the number of single pulleys needed is the MA-1.

Rules for Compound Pulley Systems

- A compound system is a series of simple systems. For example, a simple 2:1 pulling a simple 2:1 is a compound system.
- To determine the MA *multiply* the MA of the simple systems. For example, a simple 3:1 pulling a simple 2:1 is a compound 6:1.

Rules for Complex Pulley Systems

- This is a system that does not meet the rules of simple or compound systems. A common sign of a complex pulley system is a pulley moving toward the load.
- The only way to calculate MA in a complex system is to use the T-method.

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General Rules and Definitions for Mechanical Advantage

- Build the haul system short and then extend it. This helps to keep twist out of the system and reduces set up time.
- The haul team should be able to pull the rope hand over hand with some effort, regardless of MA. This gives a smoother lift and allows the pullers to feel any hang ups. If the rope is pulled to easily, reduce the MA or reduce the number of pullers. If the haul team must heave-ho to raise the load, then more MA (or another puller) is needed.