M.A.T.H.

Mechanical Advantage of The Halligan

This presentation uses field calculations and rough math to help the student understand the basics of the mechanical advantage the different working ends of the Halligan have to offer

These calculations are rough estimates due to the fact that the fulcrum and point of tool contact with the load (door) will change while positioning the tool / flex of the door; hand position and location where force is applied to the tool will also change the mechanical advantage

In order to achieve the greatest mechanical advantage you have to **maximize the force to fulcrum distance**, meaning you must pull or push from the opposite end of the Halligan

This presentation is designed to enforce a better understanding of what you are doing, what's happening, and why you are doing it

Equation / Terms

$$\text{Mechanical Advantage} = \frac{\text{distance from effort to fulcrum}}{\text{distance from load to fulcrum}}$$

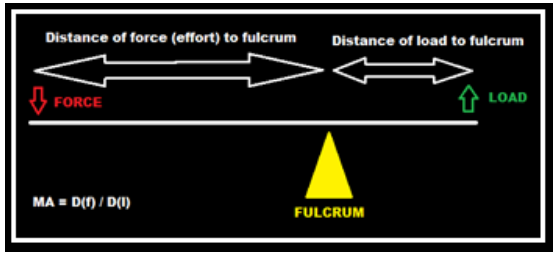
Effort (force) = fireman working from the opposite end of the tool

Fulcrum = door jamb

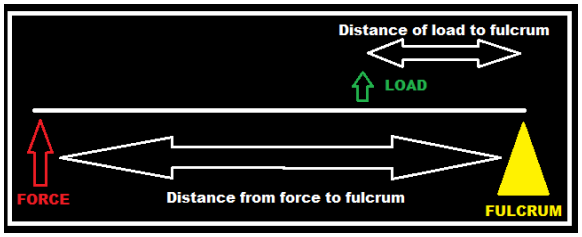
Load = door

Class I and II Levers

<u>Class I Lever:</u> Fulcrum in the middle: the effort is applied on one side of the fulcrum and the resistance (or load) on the other side



<u>Class II Lever:</u> Fulcrum on one side, load between the effort and the fulcrum



The door frame is our **fulcrum, the door itself is our **load**, and the **force applied (effort)** is the fireman working from the opposite end of the Halligan.**

Standard 30” Pro Bar Halligan

30” Pro Bar Halligan is the most popular Halligan--type bar used in the fire service

Based on the original design created by Hugh Halligan (FDNY– re6red)

The Pro Bar is 30” long from the tip of the fork end to the top of the adz end

Made from a high quality single piece of drop--forged steel

Adz End (Pro Bar)

Adz end of the Pro Bar is 2” wide at the tip and 1.5” wide closer to the pike

Adz end is 6” long

Lets do some math:

- 30” length of the tool divided by the 2” width of the adz=
  15:1 MA
- 30” length of the tool divided by the 1.5” width of the adz=
  20:1 MA
- 30” length of the tool divided by the 6” length of the adz=
  5:1 MA

Which option offers the most mechanical advantage when using the adz end of the Halligan and why do you need to know this?

Fork End (Pro Bar)

Fork end of the Pro Bar is 6” long, but the crotch of the forks is 5” from the tips (which is where the tool will be set, coming in contact between the leading edge of the door and the jamb)

Lets do some math:

- 30” length of the tool divided by 5” length of the fork end=

  6:1 MA

This mechanical advantage calculation is used when the bevel (outside curve) of the forks is facing away from the door jamb

Standard 30” Maxximus Rexx Halligan

30” Maxx Rexx Halligan is a new Halligan / lock pulling hybrid tool created by retired FDNY Capt. Bob Farrell of Fire Hooks Unlimited

The Maxx Rexx offers a slightly wider adz end which has an integrated lock puller for pulling deadbolts, rim locks, KIK locks, etc

The Maxx Rexx is nearly two pounds lighter than the Pro Bar and made from a stronger 4140 chrome vanadium steel

Adz End (Maxx Rexx)

Adz end of the Maxx Rexx is 2.75” wide at its widest point and 1.5” wide at its smallest (near the pike)

Like the standard Pro Bar, the adz end is 6” long

Lets do some math:

- 30” length of the tool divided by the 2.75” width of the adz=

  11:1 MA

- 30” length of the tool divided by the 1.5” width of the adz=

  20:1 MA

- 30” length of the tool divided by the 6” length of the adz=

  5:1 MA

Fork End (Maxx Rexx)

Fork end of the Maxx Rexx comes standard with squared shoulders and thinner forks with no ramp on the tips

Like the Pro Bar, the forks are 6” long, but the crotch of the forks measures 5” from the tips (which is where the tool will be set, coming in contact between the leading edge of the door and the jamb)

Lets do some math:

- 30” length of the tool divided by 5” length of the fork end=

  6:1 MA

This mechanical advantage calculation is used when the bevel of the forks is facing away from the jamb

In Summary

These are basic calculations to help reinforce the different techniques used while forcing a door with a Halligan

Due to different effects, such as the flex of the door or the location of force applied to the tool, the mechanical advantage results may change

This presentation shall be used alongside a basic irons class / demonstration to show the students how mechanical advantage applies to the techniques used to defeat a door

Credits / Special Thanks

Search & Destroy Fire Training

Findings and Analysis of the Testing Process of the Maxximus Rexx" by Sean Wilson

Irons & Ladders

Halligan By The Numbers" by Ben Shultz

Fire Hooks Unlimited