

# KEISER®

STRENGTH | CARDIO | FUNCTIONAL



Designed to simulate forcible-entry chopping, the FORCE Machine is developed and manufactured by Keiser specifically for the fire service.

## SUPPORT EQUIPMENT

### FORCE MACHINE

MODEL 6070

OPERATION MANUAL

BECAUSE...  
**'GOOD  
ENOUGH'  
ISN'T.™**

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IMPORTANCE OF FORCIBLE ENTRY****GENERAL INFORMATION****INTRODUCTION**

Congratulations on the purchase of your new Keiser FORCE Machine and welcome to the Keiser family. For your safety, and to ensure optimal equipment performance, please read and understand this manual before assembly. If you have any questions regarding operation after reading this manual, our Keiser Customer Support team will be happy to assist by telephone at 1 559 256 8000, online 24/7 at [keiser.com/support](http://keiser.com/support), or by email at [service@keiser.com](mailto:service@keiser.com).

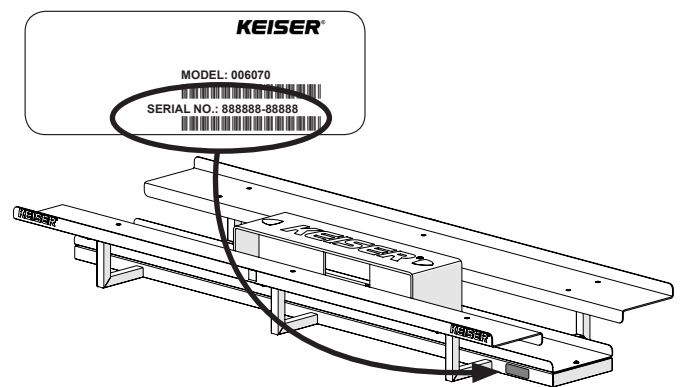
Yours in Health,  
Keiser Corporation

**RECORD YOUR SERIAL NUMBER**

Extra lines provided for multiple units.

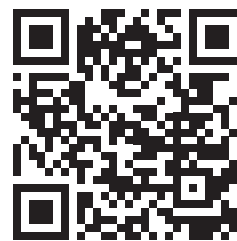
Serial Nos.:


Serial Number Location

**REGISTER YOUR PURCHASE**

Register your product to stay informed of safety notifications and for faster, more accurate warranty service.

Scan the QR Code below to access the interactive online warranty registration.

**SCAN**

<https://www.keiser.com/forms/warrantyregistration>

**KEISER CUSTOMER SUPPORT**

☎ 1 559 256 8000


@ [service@keiser.com](mailto:service@keiser.com)

🌐 [keiser.com/support](http://keiser.com/support)

**KEISER CORPORATION**





📍 2470 S. Cherry Ave.  
Fresno, CA 93706

**IMPORTANT SAFETY INFORMATION**

1.  Read these instructions. Keep these instructions.
2. Heed all warnings. Follow all instructions.
3. **WARNING:** Consult your physician before beginning any exercise program. Incorrect or excessive exercise may cause injury. If you experience any kind of pain, including but not limited to chest pains, nausea, dizziness, or shortness of breath, stop exercising immediately and consult your physician before continuing.
4. **WARNING:** Always wear eye protection during operation to avoid injury from flying debris. This hazard applies to operators and those in close proximity to the equipment during use. Failure to do so can result in serious personal injury.
5. **Heavy Equipment:** The FORCE Machine weighs 346 lbs (157 kg). Help is required when transporting or handling the equipment to prevent potential muscle strain or back injury.
6. **CRUSH HAZARD:** Keep feet clear of equipment frame during transport and handling of the FORCE Machine.
7. Always place the FORCE Machine on a level surface with appropriate clearance around the equipment (refer to "Location and Placement" section, page 6).
8. Replace damaged, worn, or broken parts immediately using only Keiser supplied components. Keep the FORCE Machine out of use until repaired.
9. Only use attachments/accessories specified by Keiser Corporation.
10. Failure to adhere to the "Safe Use of the FORCE Machine" section (page 6) prior to normal use will void the warranty and could result in serious injury.
11. Keiser Corporation is not responsible for damage or serious injury caused by incorrect placement or use of the FORCE Machine.
12. Use of the FORCE Machine or any purpose not explicitly specified by the manufacturer will void the warranty and could result in serious injury.
13. It is the responsibility of the facility owner or owner of the FORCE Machine to instruct users on the safe and proper operation of the equipment.
14. Users, agents, and/or anyone directing the use of the FORCE Machine shall determine the suitability of the equipment for its intended use, and said parties are specifically put on notice that they shall assume all risk and liability in connection herewith.

**CONVENTIONS USED**

This manual contains the following marks:

-  **WARNING:** Indicates a hazardous situation that, if not avoided, could result in death or serious injury.
-  **HEAVY OBJECT:** Indicates help is required during lifting to avoid muscle strain and/or back injury.
-  **TWO-PERSON PROCEDURE:** Indicates help is required to safely and successfully complete installation.
-  **IMPORTANT:** Indicates information considered critical, but not hazard-related.

**EQUIPMENT SPECIFICATIONS**

See Figure 1 for equipment size and weight specification.

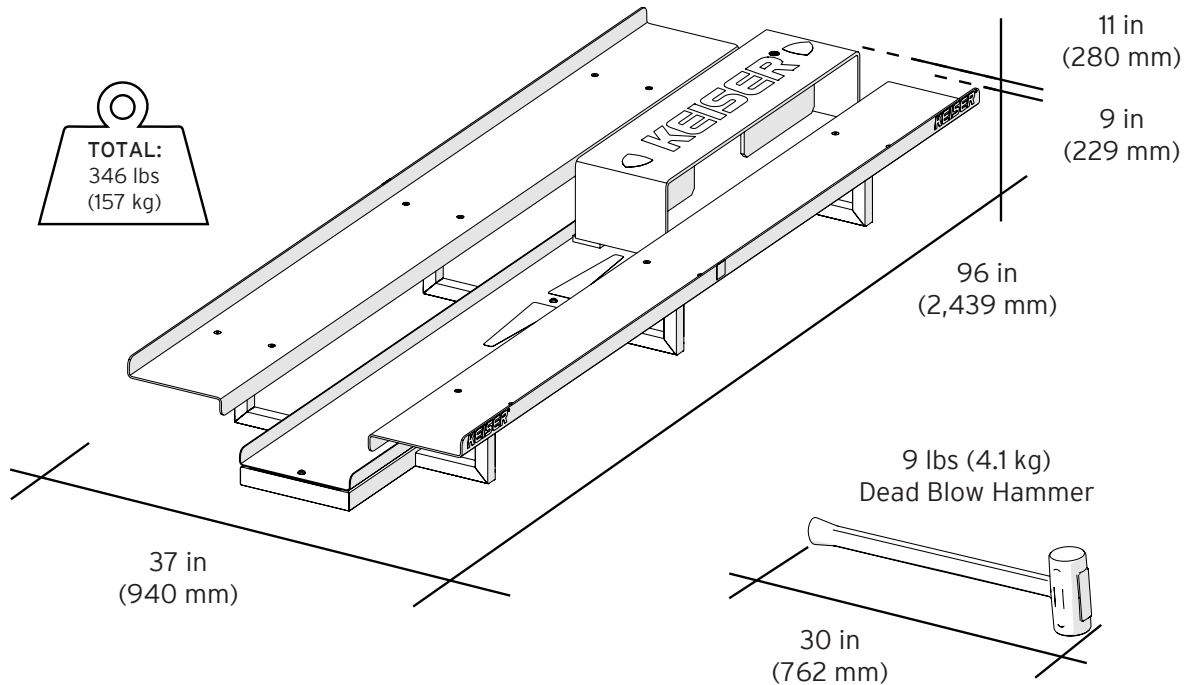


Figure 1. Equipment Size and Weight Specification

**Other specifications:****STRIKING BLOCK**

Weight: 151 lbs (69 kg)  
Travel Distance: 60 in (1,524 mm)  
Strike Plate Dimensions: 10 in x 7.5 in (254 mm x 191 mm)  
Track Dimensions: 96 in x 12 in (2,439 mm x 305 mm)  
Track Glide System: Polyethylene plastic on stainless steel

**FRAME**

Weight: 195 lbs (89 kg)  
Platform: Aluminum, diamond plate aluminum tread  
Material: Steel, powder-coated finish

**Product Description:**

Designed to simulate forcible-entry chopping, the FORCE Machine is developed & manufactured by Keiser specifically for the fire service.

On average, 20 to 25 strikes are required to move the Striking Block 5 feet (1.5 m) – a level of effort and movement consistent with forcible-entry situations during firefighting.

**PRODUCT OVERVIEW**

No assembly required. See Figure 2 below for product overview.

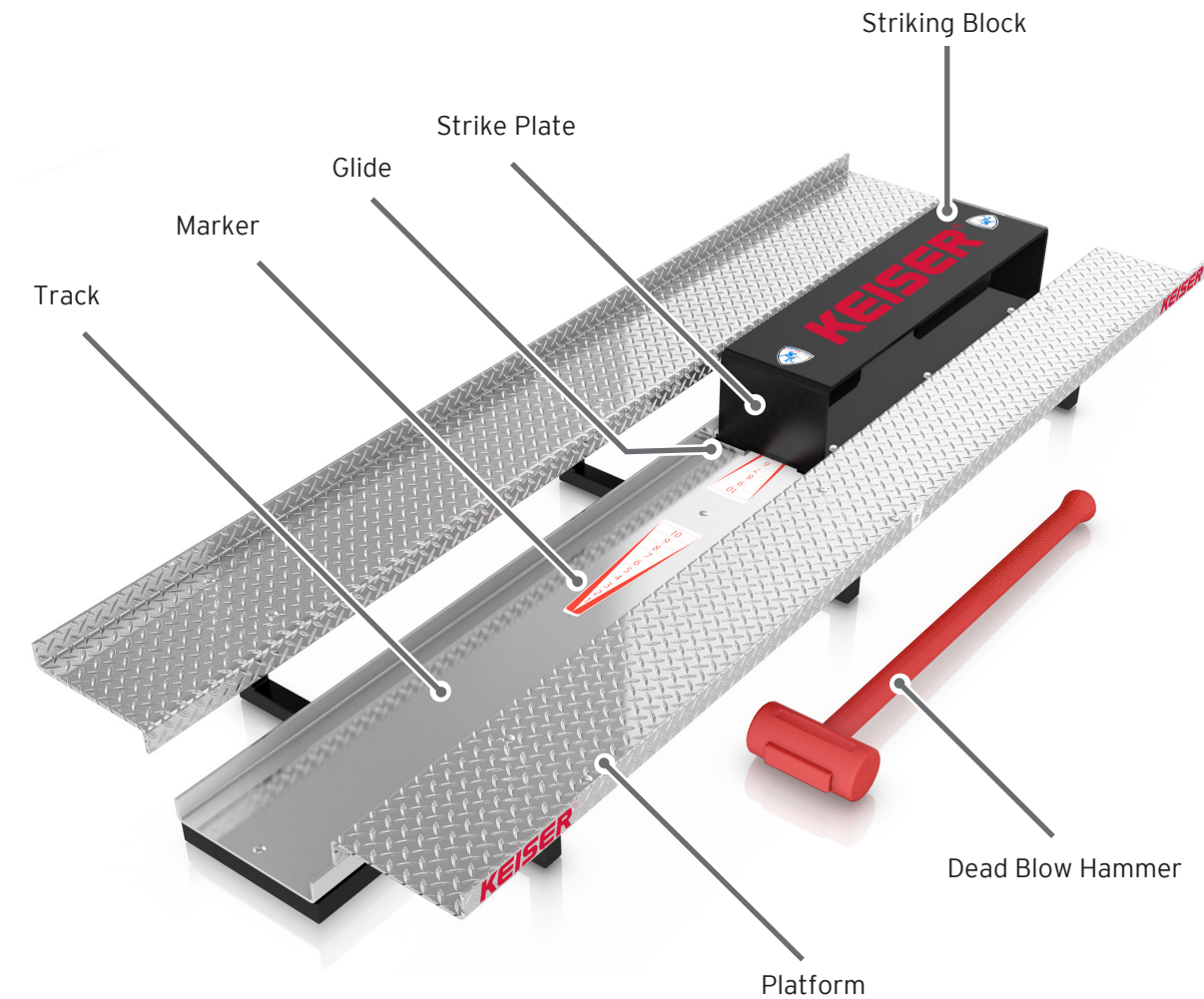


Figure 2. Keiser FORCE Machine

Check for any damage or missing parts. If parts are damaged or missing, contact your local dealer, distributor, or Keiser Customer Support by telephone at 1 559 256 8000.

## LOCATION AND PLACEMENT

The minimum amount of required free space around the FORCE Machine is 24 inches (610 mm) for the sides and 60 inches (1,524 mm) for the front and rear (see Figure 3). Make sure the space where the Dead Blow Hammer will travel (swing arc) is free from obstruction. Always test clearances before use.

**HEAVY OBJECT:** Help is required during lifting to avoid muscle strain or back injury. Use proper lifting techniques or lifting aids when transporting the equipment.

**TWO-PERSON PROCEDURE:** Due to the size of the equipment, help is required to safely locate and place the equipment.

- Locate the FORCE Machine indoor or outdoor in a clean and dry environment.
- Place the FORCE Machine on a flat, level surface.
- When transporting the FORCE Machine, remove Striking Block from the frame to avoid shift in load.

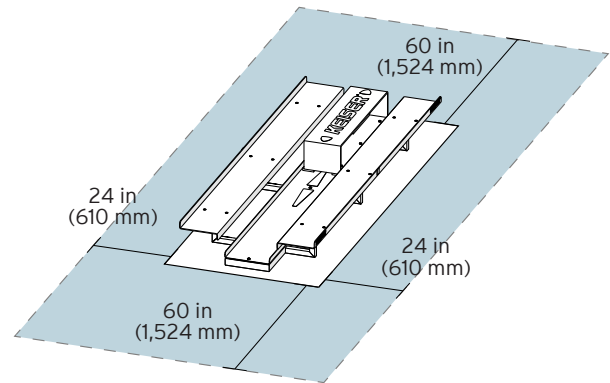


Figure 3. FORCE Machine Footprint and Free Space

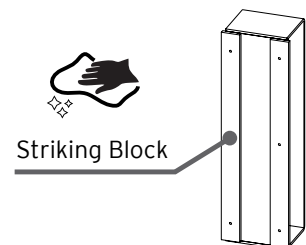
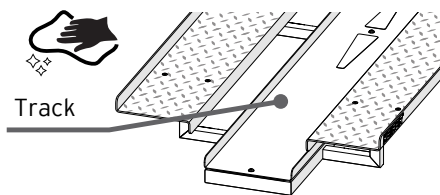
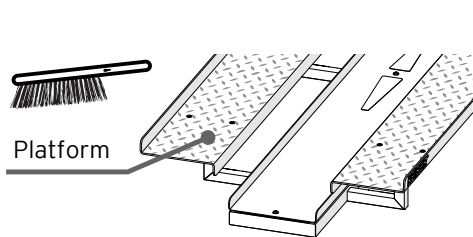
## SAFE USE OF THE FORCE MACHINE

**⚠ WARNING:** Consult your physician before beginning any exercise program. Incorrect or excessive exercise may cause injury. If you experience any kind of pain, including but not limited to chest pains, nausea, dizziness, or shortness of breath, stop exercising immediately and consult your physician before continuing.

**⚠ WARNING:** Always wear eye protection during operation to avoid injury from flying debris. This hazard applies to operators and those in close proximity to the equipment during use. Failure to do so can result in serious personal injury.

### HOW TO PREPARE THE FORCE MACHINE BEFORE EACH USE

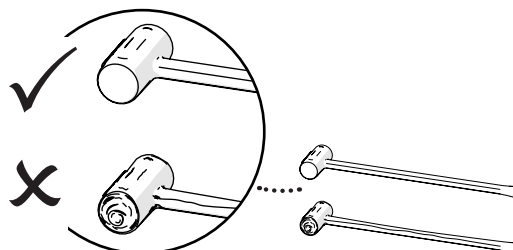
- 1 Brush/wipe the equipment clear of any sand, grit, or debris.



### ⚠ IMPORTANT:

- Avoid the application of silicone sprays or other lubricants on any equipment parts.
- Maintain the Platform and Track free of water/moisture.

- 2 Check Dead Blow Hammer is fit for duty with no signs of excessive wear (no tearing, cracks, or broken pieces).





**BIOMECHANICAL POSITION**

The biomechanical positioning illustrated below is necessary for safe and effective training/testing on the FORCE Machine.

**RANGE OF MOTION**

To achieve maximum force, raise the dead blow hammer as high as you are able to:

1. maximize the affects of gravity;
2. allow a greater distance between the hammer head and Striking Block for greater hammer head speed.

Remember: the greater the force generated per strike, the farther the Striking Block will travel. This efficiency is key to effectively reducing strike reps.

**STRIKING**

Start the chopping motion slowly before you build into a rhythm. Strike the end of the Striking Block squarely. This allows for maximum energy to be transferred—and the objective of driving the Striking Block more efficiently from start to finish is achieved.

**STANCE**

Straddle the Striking Block as you stand on the Platform with your ankles even with, or just below, the end of the Striking Block. Wear appropriate footwear to reduce the potential of slipping (keep footing free of water or ice).

Maintain the natural curvature of the spine to prevent injury; avoid arching your back to achieve proper posture.



Figure 4. Proper Biomechanical Position on the FORCE Machine

**REMEMBER TO ...**

- Warm-up by stretching properly before you start training.
- Wear gloves to enhance your grip and reduce vibration.
- Always use eye protection during operation.
- Keep your form and control throughout the routine to achieve maximum efficiency and to prevent injury.
- Keep the optimal strike angle where the hammer head makes impact at a right angle to the end of the Striking Block (see Figure 5).
- Inspect the hammer periodically to ensure there is no evidence of fatigue.
- Keep the tracks clear of sand, grit or debris; this will keep the surface from becoming scarred and abraded.

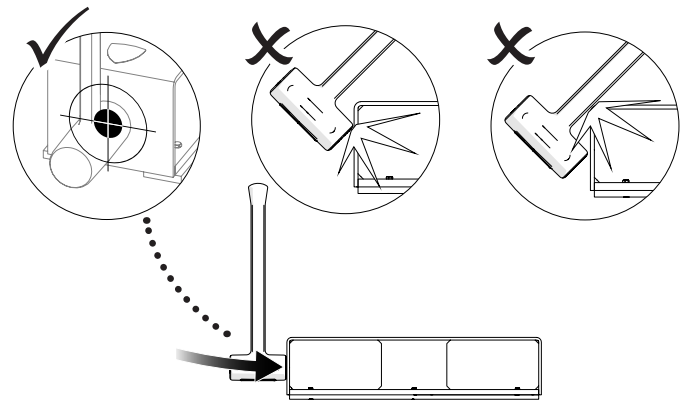


Figure 5. Optimal Strike Angle Illustration

## TRAINING WITH THE FORCE MACHINE

Improvement can be measured by:

1. **STROKES:** The number of strokes taken to move the Striking Block end-to-end (5 Feet / 1.5 m).
2. **TIME:** elapsed time to accomplish the task.

A suggested regimen would be as follows:

<b>Day 1:</b>	Test for time and number of strokes for one set of chopping.
<b>Rest Day</b>	
<b>Day 2:</b>	Perform two sets of chopping, resting 2-4 minutes between sets.
<b>Rest Day</b>	
<b>Day 3:</b>	Perform two sets of chopping, resting 2-3 minutes between sets.
<b>Rest Day</b>	
<b>Day 4:</b>	Perform three sets of chopping, with rests of 4 minutes between sets.
<b>Rest Day</b>	
<b>Day 5:</b>	Perform four sets of chopping, with 4 minutes between sets.

Physical training with the FORCE Machine can increase job performance, since the ability of chopping (i.e., generating more force as an adaptation or consequence of training) is the intended outcome. Individuals who possess low levels of upper body strength and endurance are quickly identified by use of the FORCE machine. Improvement can be measured by either the number of strokes or time taken to accomplish the routine. Using known principles of physical training, such a progressive overload, the FORCE Machine can provide an effective means for improvement. Suggested programs include "intervals" where the firefighter adds a lap, or number of hammer strikes each training day to the work-out. The device lends itself very nicely to measured amounts of work, since each trip down the tracks can be linked to the number of strikes required to produce results or the total time it takes to accomplish the task.

Not surprisingly, you may experience residual muscle soreness particularly in the forearms. Residual muscle soreness is a usual consequence when embarking on a new or unique type of exercise. Allow sufficient rest between your workouts to recover from the previous workout. Soreness is a good indicator of when it's proper to resume the training activity. In other words, if you're sore, cease the activity until the soreness subsides. This advice is appropriate for any type of resistance training program.



## CARE AND MAINTENANCE

### CLEANING

Brush equipment with a soft brush. Keep tracks and glides clear of sand, grit or debris; this will keep the glides and track becoming scarred and abraded.

Wipe down equipment, including the hammer, with a clean cloth using only water and mild soap. Wipe dry the equipment.


#### **IMPORTANT:**

- Do not use cleaning solvents as they can be caustic and can promote corrosion.
- Do not use silicone sprays or other lubricants as this will significantly alter the coefficient of drag and affect the reliability of the FORCE Machine.

### MAINTENANCE

**HAMMER** – Inspect the hammer periodically for excessive wear (tearing, cracks, or broken pieces, etc.). Hammer is not a serviceable part. Replace hammer if worn, damaged, or broken. Contact Keiser Customer Support for certified replacement part (see back page for contact info).

**Striking Block** – Slide the Striking Block to the end of the track and stand on end to thoroughly wipe down the glides. Check for and remove any gravel or debris from the gliders.

 **IMPORTANT:** When performing Striking Block maintenance, it must be stood on end or laid on its side; never on the glides.

**TRACK** – Maintain track clear of sand, grit or debris; this will keep the surface from becoming scarred and abraded.

**FRAME** – The steel frame is powder-coated to ensure maximum protection from the elements. Spot prime and paint scratches, dings, etc. to prevent rust/corrosion.

### STORAGE

For best equipment performance, store the FORCE machine on a level surface. If the Striking Block is stored separately from the frame, lay the Striking Block it on its side; never on the glides. Cover the FORCE Machine to keep dirt, dust, and debris from settling onto the equipment.

Review the “Important Safety Information” section (page 3), including the “Safe Use of the FORCE Machine” section (page 6), when removing the equipment from storage and before each use.

## WARRANTY STATEMENT

For information about Keiser’s product warranty and thereto related information, refer to [keiser.com/support/warranty](http://keiser.com/support/warranty).

## APPENDIX A: BIOMECHANICS OF CHOPPING

Use of an axe has a number of factors that influence your effectiveness. Factors which impact the performance on the FORCE Machine or chopping activities include:

- The angular speed and acceleration of the hammer head (gravity + muscular force)
- The range of motion of the hammer head (vertical height)
- The angle at which the hammer head strikes the plate (force vector)
- The time interval between the strikes (rate)
- The stance of the individual
- Your ability (physical work capacity)

### ANGULAR SPEED AND ACCELERATION

Angular speed is defined as the angular distance traveled (the arc of the path) with respect to time. Angular acceleration is defined as the rate at which the velocity changes with respect to time. Naturally, the greater your ability to generate higher speed and acceleration of the hammer head the greater your success in meeting the objective. This is generally referred to as power, the ability to perform work with respect to time. Individuals who can perform the work in less time are considered to be more powerful.

### RANGE OF MOTION

In order to generate enough power, you should raise the hammer high enough to maximize the affects of gravity and allow a greater distance with which to impart greater speed to the hammer head. It is more important to generate as much force as possible per strike and limit the number of repetitions than it is to perform at a lower percentage of maximum thereby increasing the number of repetitions. More will be said about this later.

### ANGLE OF HAMMER HEAD

The angle of the hammer head (force vector) plays a significant role in how the force is applied to the movement of the sled. If you direct the hammer head to hit the end plate at a  $45^\circ$  angle, a significant portion of that force will act to create additional force exerted perpendicular to the sliding surface (see Figure 6). In other words, a greater parallel force would have to be generated to compensate for the increase in friction that results.

Striking the Striking Block at too extreme an angle results in the handle taking the brunt of the impact (see Figure 6), a condition that is the least efficient in moving the Striking Block, not to mention, very hard on the hammer handle.

When the hammer head impacts the end of the strike plate at a right angle (Figure 7), more energy is properly transferred, and the objective of driving the Striking Block with the fewer number of strikes is more efficient.

### STANCE

In Panglossian terms, you will be best served by a position that will allow the optimum force to be generated and the optimum striking angle to be achieved. Standing directly over point of impact, as opposed to in front or behind it, will make greater use of gravity and allow for a more parallel force vector at contact. Shorter individuals will be at a disadvantage over taller people because they have less distance to generate force and less time in which to impart that force to the Striking Block. However, what they may lose in force, they may gain in stability on the platform.

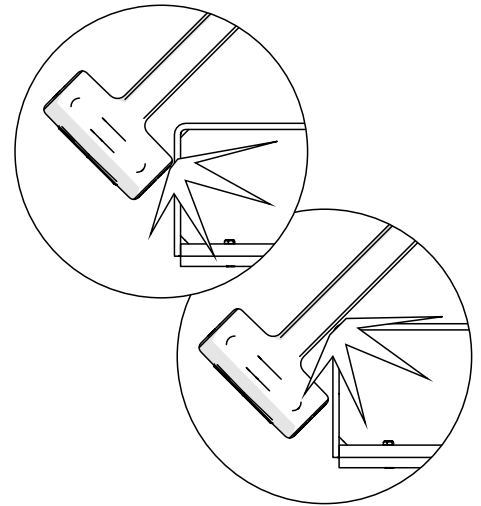


Figure 6. Strike Angle Less Than  $90^\circ$

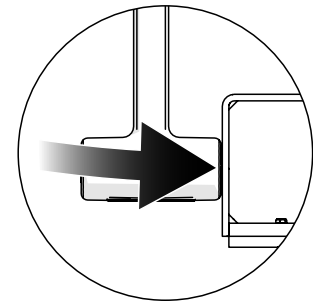


Figure 7. Optimal Strike Angle

## APPENDIX B: HISTORY AND IMPORTANCE OF FORCIBLE ENTRY

The fire, or pick head axe has been a symbol of the fire service for well over a hundred years. Forcible entry, the process of gaining entry for the purpose of effecting interior extinguishment has been a strategy employed by structural firefighters for the past two and half decades. While there have been a number of technological advances in tools for gaining building entry such as powered saws, there is still a frequent requirement to do it the old fashioned way; use an axe. The advantages of an axe are very clear. It has no moving parts and will always work, provided the individual wielding it has sufficient upper body strength to get the job done.

In numerous task analyses conducted by Applied Research Associates (ARA) Human Factors for fire departments across the country, forcible entry evolutions have typically headed the list of being a critical and essential job function. The weightings given this task are usually the highest for arduousness and criticality. The FORCE Machine provides an effectible and reliable method for testing essential fire suppression ability.

Based on ARA's interaction with Subject Matter Experts (SMEs) it has been determined that the duration and intensity of chopping and forcible entry evolutions vary considerable. Faced with the prospects of having to create a ventilation hole in a roof, a firefighter would choose the use of a K-12 or XL-98 saw over an axe depending on the structured components of the roof and the level of difficulty in breaking through. The question was, what is the number of swings in which an axe might be expected to be used before a fire fighter would use a gasoline powered saw? The answer from our SME panel: in the range of 20 to 40 hits.

While fire axes are carried on virtually every piece of fire apparatus in America today, until the advent of the Keiser FORCE Machine, there hasn't been a method to objectively measure an individual's ability to use such tools.

### Forcible Entry Simulation Attempts

The investigation for the physiological and biomechanical aspects of chopping and forcible entry began in the mid to late 70s. In 1976, while conducting a US Fire Administration funded study of fire fighting tasks, Drs. Davis and Dotson identified working with an axe as one of the most critical and arduous tasks required of firefighters. In an attempt to measure and reproduce forcible entry a number of approaches were studied. The actual use of axes was considered. However, the logistics of obtaining adequate quantities of logs or telephone poles was a staggering prospect.

Accelerometers, placed in the head of the sledge, or on the handle near the head, were rejected as too costly and probably of short-duration, since the forces generated are quite high.

The US Fire Administration study simulated chopping through the use of a laser timing system. This system allowed for the measurement of velocity. The subjects used a sledgehammer, directing it at a rubber target bolted to a railroad tie. Knowing the time it took for the sledgehammer to travel one foot allowed the calculation of the force produced, since work is equal to: mass x distance. The system relied upon the firefighter to consistently direct the axe in a similar path with each stroke. However, it is difficult to standardize the route taken by a sledge or axe head, and the laser timing gates require uniformity in the swing pattern. The firefighters had difficulty directing their blows in a consistent manner. Needless to say, the device had little practical application outside of very controlled settings.

In the continued quest to objectively quantify the amount of work performed in effecting forcible entry, the idea of a railroad tie was used. The process was quite simple; beat on the end of the tie and drive it a fixed distance. The only problem with this protocol was standardization (railroad ties varied significantly in their weight, oftentimes by as much as 50 pounds for an eight-foot section). And the surface upon which they rested had an appreciable affect, since the coefficient of friction always differed. Railroad ties did not last very long and were always in need of replacement. It was also evident that the surface upon which the tie was placed would have an appreciable affect on the characteristics of the blow. Creosote-soaked ties, particularly when placed on asphalt, had a very high coefficient of drag, whereas drier ties placed on concrete had very little. The temperature could also affect the creosote, with variations in the number of strokes ranging from as little as 5 to nearly 50.

Plunger devices have been designed and implemented in a number of settings. Car springs are used, with plungers that would strike a sound-producing device such as a saw blade or bell. The limitations of these approaches are that the devices rarely differentiate between individuals. In other words, two individuals can strike the target and both produce a "count," while one may strike the target with twice as much force as the other.


Attempts at using a steel Striking Block also presented difficulties. Striking the end plate with a sledgehammer resulted in much of the energy being redirected back into the head of the hammer. Placing high-impact rubber on the end of the Striking Block helped, but this material deteriorated. Again, the surface contributed to inconsistency.

Unlike the roof ventilation simulator, where just the number of qualifying hits are counted, the FORCE Machine requires that the hits result in a measured amount of work. The roof ventilation simulator is not capable of determining the total amount of work; subsequently, two individuals can both hit the target and receive credit. One of the subjects could have applied sufficient force to trigger the switch, while the other achieves the same score but applied twice the amount of power.

Enter Keiser Sports Health Equipment. Keiser's engineering staff examined numerous video tapes and the Davis-Dotson studies before developing the FORCE Machine. The FORCE Machine is now the centerpiece of the FIREFIGHTER COMBAT CHALLENGE.

## **CUSTOMER SUPPORT**


If you have any questions regarding Force Machine operation after reading this guide, contact Keiser Customer Support:

 **1 559 256 8000**

 **service@keiser.com**

 **keiser.com/support**

### **KEISER CORPORATION**

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