

**Fit For Duty Consulting**  
**Firefighter Fitness Assessment Manual**

Created by Dr. Karlie Moore

Table of Contents:

Overview of the firefighter fitness assessment and supplies needed.....	2
How to perform each test in the firefighter fitness assessment.....	5
Safety Precautions.....	14
Explanation of Results.....	18
Health History Questionnaire.....	20
Informed Consent.....	22
Data card.....	23
Sample results packet.....	24

## **Components of Fitness:**

- **Muscular endurance**
- **Muscular strength**
- **Flexibility**
- **Body composition**
- **Aerobic Capacity**

This is an “assessment” because an assessment is a collection of tests. Fitness assessments are designed by choosing tests to assess each component of fitness.

Many factors are considered in choosing which tests to use, including time required, cost of equipment, space feasibility, relevance/job specificity, and available norms. In this fitness assessment we perform these tests:

Muscular endurance: push-ups, plank

Muscular strength: grip strength, vertical jump

Flexibility: sit and reach, shoulder stretch, lateral trunk stretch

Body composition: waist to hip ratio, skinfolds for body fat percentage

Aerobic Capacity: Moore protocol treadmill walking test

## **Interpreting the results**

You will need to pay a small yearly fee for access to the results spreadsheet/workbook. The workbook contains many formulas needed to convert the data into actual scores/results. Email Dr. Moore at [karliejmoore@gmail.com](mailto:karliejmoore@gmail.com) to purchase.

This workbook will allow you to sit down with the firefighter after their test and explain a) how their scores compare to other people in the general population of their same age and gender, and b) how their scores compare to firefighters. For certain tests, you can also explain if their score places them at risk for an adverse event like an injury or heart attack. Pages 18 and 19 of this manual will help you explain what the results mean and why they matter. You may also give those pages to the firefighter.

## **Equipment needed**

**Using my links to purchase any of these products will give me back a tiny percentage of the sale, which allows me to continue offering free resources like this.**

12-lead ECG monitor. This does not need to be made for exercise. We typically use an extra off an ambulance not in service. Or you can buy a portable one like this: <https://amzn.to/48HPHqW>

Blood pressure sphygmamometer (one handed is best for use during exercise):

<https://amzn.to/4aGKGkp>, and stethoscope <https://amzn.to/48m5dJp>

Gulick measuring tape: <https://amzn.to/3S9W8xW>

Lange skinfold calipers. Do NOT get cheaper ones: <https://amzn.to/47qF8Yt>

Hydraulic grip strength tester: <https://amzn.to/3tJd5FR>

Metronome or you can use a cadence app on your phone: <https://amzn.to/3vuOkxw>

Magnetic vertical jump tester: <https://amzn.to/48nGiW6>

Sit and Reach box: <https://amzn.to/48o6rE4>

Two meter sticks: <https://amzn.to/3vnZDYx>, plus something to adhere them to the wall:

<https://amzn.to/4aK2if5>

Flexible measuring tape with inches. <https://amzn.to/3tvDdUM>

Weighted vest: Calculate 20% body weight for the heaviest person in your department to figure how much weight it will need to hold. Here is a 60# vest: <https://amzn.to/3tFoXZs>

Commercial grade treadmill that can raise to 15% incline: <https://amzn.to/3Oe5Blt>

## **Steps in the Assessment:**

1. Have the firefighter complete the Health History Questionnaire, and read and sign the Informed Consent document. Read these screening documents and identify their risk category (and get more supervision if that is indicated)
2. Perform a resting Electrocardiogram and record resting heart rate and blood pressure
3. Have the person weigh themselves
4. Either ask them for their height or measure it
5. Measure waist and hip circumferences
6. Take skinfold measurements
7. Conduct the grip strength test
8. Conduct the plank test
9. Have the participant(s) warm up their legs
10. Conduct the vertical jump test
11. Conduct the push-up test
12. Conduct the sit and reach test
13. Conduct the lateral trunk flexibility test
14. Conduct the shoulder flexibility test
15. Conduct the treadmill predicted VO<sub>2</sub>max test
16. Enter results into the appropriate Excel workbook (male or female)
17. Discuss results with the participant
18. Optionally, add their results to your own master spreadsheet so you can develop norms for your department.

## Performing the firefighter fitness assessment

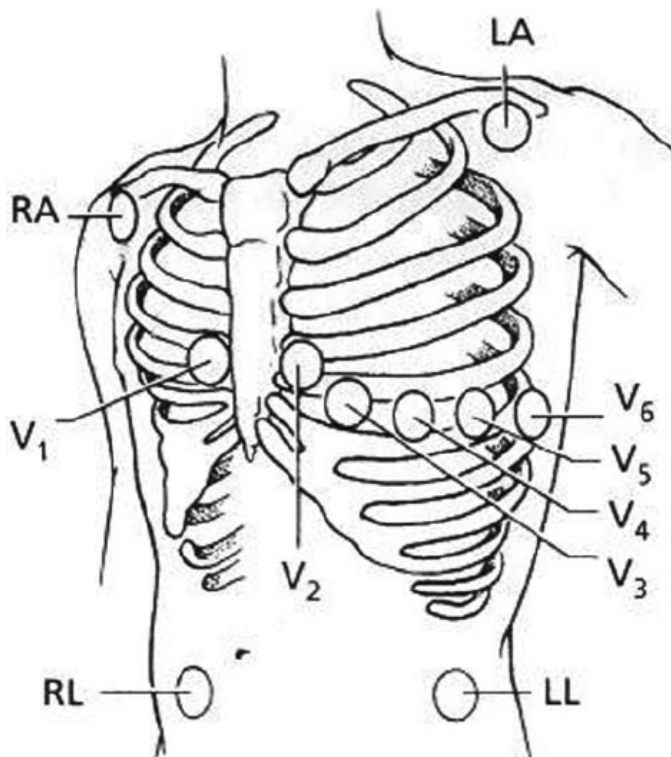
Watch this video for a quick overview of most of these tests. Be sure to read the NOTE in the caption: <https://youtu.be/G9GIEbxMxVw>

Watch this video tutorial for the Moore protocol weighted walking test:

[https://youtu.be/f\\_k\\_ewBJEV8?si=msOFh2yOm-9Bsx80](https://youtu.be/f_k_ewBJEV8?si=msOFh2yOm-9Bsx80)

Use the data card included in this packet. Put the data card on a clipboard and use a pencil to record firefighters' data as they go through the assessment. When completed, you will type the numbers on the data card into the results spreadsheet/workbook. After entering data on the first page of the workbook, go to the second page, which is the "results" tab at the bottom of the page, to see their results. See page 2 of this manual to learn how to get access to the workbook.

**To conduct the resting ECG:** use the Mason-Likar placement for electrodes. The main difference from a traditional placement is that the limb leads are on the trunk. This is because we can't have the wires on the extremities while running. Leads must be placed on bare, clean skin, and remain there for the entirety of the assessment. Be sure the person is free of any rhythms that would be a contraindication to exercise testing.



**To measure waist circumference:** wrap your gulick tape around your participant and find the narrowest part of their waist. Be sure the tape is straight and take your measurement to the nearest  $\frac{1}{2}$  cm.

**To measure hip circumference:** Lower the tape after finding waist circumference and find the largest girth around their hips/buttocks. Be sure the tape is straight and take your measurement to the nearest  $\frac{1}{2}$  cm.

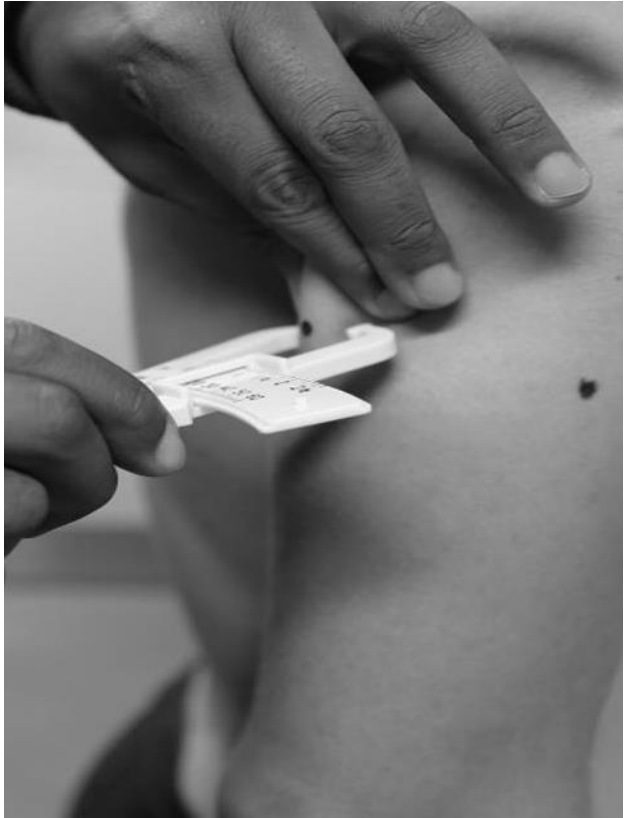
**Taking skinfolds:** We take measurements to the nearest millimeter at 7 sites. These are put into a formula, which predicts body fat percentage with an error of 2.5%.

A hard pinch is taken, creating a “fold” of skin that includes skin and subcutaneous fat, but no muscle. Pinch using your pointer finger and thumb. It is best to first measure and mark each of the sites. Then take two sets of measurements; go through the 7 sites once, then again in the same order. All measurements are taken on the right side. Below are the 7 sites.

**Site #1: Subscapular:** site is just below the lowest angle of the scapula. A fold is taken on a diagonal line directed at a 45 degree angle toward the right side. Have the participant put their right hand behind their back so you can locate the bottom tip of the scapula. Then have them move their arm back when you take your measurement.



**Site #2: Tricep:** site is halfway between the acromion process on the shoulder and the elbow. While the arm rests at the participant's side, the fold is taken vertically on the back of the arm.



**Site #3: Midaxillary:** site is on the midline, at the level of the xiphoid process. The fold is taken vertically. Have the participant raise their arm out in front of them so you can access their midline.



**Site #4: Chest:** site is halfway between the armpit and nipple for men, and 1/3 of this distance away from the armpit for women. The fold is taken at an angle.



**Site #5: Suprailiac:** site is just above the suprailiac crest. Pinch should be taken near the midline, diagonally. For some people this will be along the natural crease of the skin. You can ask the participant to move their arm slightly back to gain better access.





**Site #6: Abdomen:** site is 2 cm to the right of the participant's umbilicus. The fold is vertical.



**Site #7: Thigh:** site is halfway between the inguinal crease and the knee. Ask the participant to put their weight on their left foot and pull their shorts up. If they have pants/shorts on that they can't pull up high enough, measure the skin over top of the clothing, then measure the clothing and subtract it.



**To perform the grip strength test:** Have the participant hold the grip strength tester in their hand with their elbow bent to 90 degrees and their forearm touching their side. Instruct them to squeeze as hard as they can. They will then do this on the other side, then again on both sides, for a total of two trials. Record their highest scores on each hand to the nearest Kg.

If a person has an injury/weakness on one side, double the good side for their results.

**To perform the plank test:** Demonstrate to participants what a proper plank looks like, with a flat back and hips in line with the rest of the body. Instruct them to perform their plank on their forearms (they can put a towel underneath their elbows), and toes. Keeping good form, hold as long as they can, although you will stop them if they reach 3 minutes. If they feel any significant back pain, they should stop. If their form is severely compromised, for example if their back is sinking, you should stop them. Record how long they held their plank in seconds. Be aware that some people may not have enough core strength to perform a plank correctly at all.

**To perform the vertical jump test:** The vertical jump tester will need to be installed to a wall in a place with a high ceiling, or outside. To measure their actual jump you will be taking the DIFFERENCE between their standing reach and jumping reach.

To measure standing reach, participants should hold the magnet and place it on the board with their fingers bent (just as they will be holding it when they jump). They should not stretch the arm too much out of the shoulder socket (that will hurt their score!); it should just be a natural raise of the arm.

To jump, they will start with either two feet planted under the board, or one foot under the board and the other stepped behind them. There are no running starts! If they start with one foot back, they will take a “half step” before jumping off both feet. They should swing their arms in preparation for their jump. They can have up to 3 trials and you will record their standing reach and the best of their 3 jumps.

People with back, hip, or leg pain may need to skip this one. If their performance on the test is going to be hindered by the pain, they should strongly consider not attempting this.

**To perform the push-up test:** While male participants do push-ups on their hands and toes, female participants will do push-ups on their knees because the national norms are derived from women doing push-ups on their knees. Participants can place their arms in the orientation that is most comfortable to them for push-ups (wide or narrow). Either way, they will lower their body

with each push-up only until their elbows are at 90 degrees / in line with their torso. They should not touch their chest to the ground. Their body should be flat like a plank; the hips should not rise or sink. They need to perform their push-ups to a cadence of 80 beats per minute. Each beat is an “up” or “down” motion. Start the cadence / beeping noise, and demonstrate how to perform the push-ups to the cadence. Let them know that you will help them stay on the beat by saying “slower” or “faster,” and that you will count their push-ups for them. They must do them continuously; they cannot stop for a break or their test is over.

People with shoulder pain may need to skip this one. If their performance on the test is going to be hindered by the pain, they should strongly consider not attempting this.

**To perform the sit and reach test:** have participants take their shoes off. They will sit with their feet flat up to the sit and reach box, and their arms reached out in front of them. Trying to remain relaxed, they will reach forward, keeping their knees straight. They must hold for 2 seconds before coming back up. They can have up to 3 trials and you will record the best of 3 in cm. The tester may need to “not count” trials if they see the knees bending or if not held for 2 seconds.

**To perform the lateral trunk flexibility test:** Two yardsticks should be placed about 4 feet apart, adhered to a wall. The units should be cm and the numbers should be higher at the top and get smaller as they go toward the floor. Participants will stand with their back against the wall, and place their feet wherever is comfortable. With their middle fingers flat on the measuring sticks, you will record their starting point on both sides. They will then be instructed to lean to one side without sticking their hip out, and without bending their knee or taking their foot off the ground. You should put a dowel or stick next to the hip that they are bending away from to ensure that they don’t stick it out. You will record their ending point. Do only 1 trial each side.

**To perform the shoulder stretch test:** Participants will reach their hands behind their back, trying to bring their middle fingers as close together as possible. The Right side measurement is taken with the right hand reaching over the shoulder and down to the middle of the back while the left hand reaches under and up. Use a soft measuring tape to measure the distance between the middle fingers or overlap. Record either negative (the distance between the fingers), zero (if fingers touch), or positive (if the fingers overlap), to the nearest 1/2 inch. Repeat on the left side. Do only 1 trial each side.

**To perform the Moore protocol treadmill walking test (see video link earlier in this manual)**

1. Be sure you have reviewed the person's risk factors, and that you have proper supervision (see safety precautions.) Get the supervision if you need it.
2. Prepare the vest to weigh 20% of the person's body weight, being sure to account for the weight of the vest itself.
3. The participant should still be warm since this is the last part of their fitness test. If they are not still warmed-up, have them do so when you prepare the vest.
4. Attach the heart rate monitor or electrocardiogram to the participant. Be sure there are no indications for not beginning an exercise test (see safety precautions.)
5. Have the participant put on the vest and stand on the treadmill, then take their blood pressure. Be sure it is not too high to begin an exercise test (see safety precautions.)

Performing the Test:

1. The treadmill test officially begins with the participant walking on the treadmill at approximately 3.0 mph at 0% grade for the first 3 minutes (the mph for the warm-up can be slower if the participant prefers.) Use the clock on the treadmill as the official timer.  
The person's heart rate/rhythm and blood pressure should be monitored throughout the test.
2. When the clock says 3:00, the treadmill speed should be increased to the participant's fastest possible walking speed. The person should be walking very briskly but not feel as if he/she needs to break into a run. This will be different for everybody based on their leg length, but most people will be between 3.8 and 4.0 mph.  
The participant walks at this speed at 0% grade for one minute. The speed will not change for the rest of the test.
3. When the clock says 4:00, increase the grade on the treadmill to 1%. Each minute after that, continue to increase the grade by 1%.
4. The participant should continue walking until he or she reaches exhaustion, unless: a) the person completes 19 minutes – the maximum time and 15% incline, or b) they elicit any of the criteria for stopping a treadmill test (see safety precautions), or c) they request to stop.
5. Record the number of minutes that the person was able to complete.

The chart below shows the predicted VO<sub>2</sub>max for each minute that a person achieves on the test. In reality, their VO<sub>2</sub>max is + or - 2.5 from that number. For example, if a person walks until the timer says 14:00 minutes, their predicted VO<sub>2</sub>max is 41.9 or somewhere between 39.4 and 44.4.

If you were to do only the treadmill test for your firefighter fitness assessment, you could use this chart to inform people of their results. But when conducting the entire assessment, you would use the results spreadsheet and enter their data which would give you their estimated VO<sub>2</sub>max.

Note that the incline column on the chart shows what the incline should be increased to at the start of that minute. So, if a person were to walk for 14 minutes, their last minute (the 13<sup>th</sup>) was at 10% incline and, since they stopped, the incline would not have been increased to 11%.

<u>Minute</u>	<u>Incline</u>	<u>Speed</u>	<u>VO<sub>2</sub>max</u>
(0-2:59)	0%	3.0 mph / 4.8 kph	
3	0%	↑ to fast walk	<b>17.9</b>
4	1%	no change	<b>20.1</b>
5	2%		<b>22.3</b>
6	3%		<b>24.5</b>
7	4%		<b>26.7</b>
8	5%		<b>28.8</b>
9	6%		<b>31.0</b>
10	7%		<b>33.2</b>
11	8%		<b>35.4</b>
12	9%		<b>37.6</b>
13	10%		<b>39.8</b>
14	11%		<b>41.9</b>
15	12%		<b>44.1</b>
16	13%		<b>46.3</b>
17	14%		<b>48.5</b>
18	15%		<b>50.7</b>
19	Test stops when clock says 19:00		<b>52.9</b>

Firefighters should strive for a VO<sub>2</sub>max of 42 or higher

## Safety Precautions

The tester and participant should understand that there are risks associated with exercise and they are participating in this test at their own risk. However, said risk is no greater than if one was to participate in a high intensity workout or complete a firefighting task that required maximal exertion.

The tester must have the cognitive skills needed to conduct exercise testing including being knowledgeable about initial screening and appropriate supervision, indications for not beginning an exercise test, and the criteria for stopping an exercise test. These are explained below.

### **Initial screening and appropriate supervision**

Initial screening should be done to ensure that the participant has the proper clearance and supervision for participating in a maximal exercise test/high intensity exercise. This will reduce the risk of the participant experiencing cardiac complications during the test and will ensure that the tester cannot be held liable for any adverse events occurring on the basis of negligence.

Initial screening is completed by determining the person's risk category for heart disease (low, moderate or high) according to the American College of Sports Medicine (ACSM) Guidelines.

Listed below are the heart disease risk factors. People who have less than two of these risk factors are considered **low risk** and do not need physician approval to exercise or special supervision to participate in a maximal exercise test. People with two or more of the heart disease risk factors are considered **moderate risk**. According to ACSM, people in the moderate risk category should be encouraged to consult with their physicians prior to participating in high intensity exercise but do not need special supervision to participate in a maximal exercise test.

- Age: males > 45 years of age, or females > 55 years of age
- Family history: myocardial infarction (heart attack), coronary revascularization, or sudden death in an immediate relative (male <55 years or female <65 years)
- Smoking: current smoker or those who quit within the past 6 months
- Hypertension: resting systolic blood pressure  $\geq 140$  mmHg or diastolic blood pressure  $\geq 90$  mmHg, or on antihypertensive medication (counts as no more than 1 risk factor if

any apply)

- Poor cholesterol: Total cholesterol >200 mg/dL or HDL cholesterol <40 mg/dL or LDL cholesterol >130 mg/dL, or on lipid-lowering medication (counts as no more than 1 risk factor if any apply)
- High blood glucose: Fasting blood glucose  $\geq$  100 mg/dL confirmed on two separate occasions
- Obesity: BMI >30, or waist girth >102 cm (40 in) for men and > 88 cm (35 in) for women, or waist-to-hip ratio  $\geq$  0.95 for men and  $\geq$  0.86 for women
- Inactivity: not participating in a regular exercise program or accumulating 30 minutes or more of moderate physical activity on most days of the week
- Subtract one risk factor if the person possesses an HDL cholesterol >60 mg/dL

A person is only considered **high risk** if they have one of the following conditions or symptoms listed below. People who have or are at high risk for heart disease should be supervised by a physician or a paramedic while participating in a maximal exercise test. According to ACSM, “supervision” means that they are “in the immediate vicinity and available for emergencies.”

- Cardiac heart, peripheral vascular, or cerebrovascular disease
- chronic obstructive pulmonary disorder, asthma, interstitial lung disease, or cystic fibrosis
- Diabetes mellitus type 1 or 2, thyroid disorders, renal, or liver disease
- angina (chest pain)
- ankle edema
- shortness of breath at rest or with mild exertion, or unusual fatigue or shortness of breath with usual activities, or dizziness or syncope (fainting), or orthopnea or paroxysmal nocturnal dyspnea
- palpitations or tachycardia
- intermittent claudication
- known heart murmur

If appropriate supervision is unavailable, or if the participant and/or the tester do not feel comfortable having the participant perform the test to maximal exertion, the participant could stop at a submaximal level and estimate the number of minutes that he/she thinks he/she could

have achieved. This will reduce risk but will also make the predicted aerobic capacity less accurate.

While this test can be completed just using a heart rate monitor, if the participant is connected to an electrocardiogram (EKG), that will provide an additional level of safety.

### **Indications for not beginning an exercise test**

The tester should also be mindful that the participant may not be in a condition to even start an exercise test. The following are indications that the person is not safe to participate in the exercise test:

- Any cardiac event having occurred recently
- Suspected ischemia or myocardial infarction, aortic stenosis, heart failure, pulmonary embolus/infarction, myocarditis/pericarditis, dissecting/ventricular aneurism, left main coronary stenosis, stenotic valvular heart disease, hypertrophic cardiomyopathy, electrolyte abnormalities
- Chest pain
- uncontrolled cardiac arrhythmias: ie. second / third degree AV block, atrial fibrillation, left bundle branch block, frequent premature ventricular contractions or ventricular tachycardia
- systolic blood pressure greater than 200 mmHg or diastolic blood pressure greater than 110 mmHg
- ST-segment elevation or depression
- Current acute illness, chronic infectious disease, or uncontrolled metabolic disease

### **Criteria for stopping an exercise test**

The tester should also be mindful that the participant may not respond appropriately to exercise.

The following are indications that the person is not safe to continue the exercise test:

- chest pain
- drop in systolic blood pressure of >10 mmHg
- rise in systolic blood pressure > 250 mmHg or diastolic blood pressure > 115 mmHg
- ST-segment elevation (+ 1.0 mm) or depression (> 2 mm horizontal, or downsloping depression)



- Signs of poor perfusion (circulation or blood flow), including pallor (pale appearance to the skin), cyanosis (bluish discoloration), or cold and clammy skin
- Severe or unusual shortness of breath, wheezing, leg cramps or claudications
- Central nervous system symptoms: ie. ataxia (failure of muscular coordination), vertigo, visual or gait problems, confusion
- Serious arrhythmias: ie. second / third degree AV block, atrial fibrillation, bundle branch block, increasing premature ventricular contractions or sustained ventricular tachycardia
- Patient's request (to stop)

## Explanation of results

**Body fat percentage:** Your body fat percentage is the percentage of your tissue that is fat. Women naturally have higher body fat content than males. Being obese is one risk factor for developing heart disease. It increases firefighters' risk of having a fatal heart attack on the job by 2.2 times. It is also the greatest risk factor for developing high blood pressure and type II diabetes, two other heart disease risk factors that increase firefighters' risk of having a fatal heart attack by 12 and 10.2 times, respectively. You may have noticed that the "healthy range" for body fat percentage is very large. That is because your longevity and risk for chronic disease is not solely dependent on your body fatness - the quality of your diet and your activity levels, along with other health habits, like smoking, also play a large role. So someone with a higher body fat percentage, but a high level of fitness and other healthy habits, may still have a low risk of early death.

**Grip strength and vertical jump:** These tests assess your muscular strength and power. The grip strength test correlates well with a bench press test and in fact, your entire body strength. Having a great deal of strength has been shown to improve firefighters' job performance and therefore it may lower your injury risk or your risk of injuring someone else whom you are lifting with. It is also extremely important to have a lot of strength later in life as having low muscle mass is one of the greatest risk factors for developing chronic diseases and dying early.

**Plank test:** The plank test is an assessment of your core strength and endurance. Core strength is extremely important for avoiding low back pain and for firefighters to avoid back injury.

**Push-ups:** Push-ups are an excellent assessment of your muscular endurance, which describes your ability to exert a modest amount of force for a longer period of time. This is very important for firefighters when having perform physically for a long duration, like fighting a fire. You should know that it is very difficult to have both muscular strength and muscular endurance because when you train for one, it is at the expense of the other. Therefore, it is very typical for a person to do better in one than the other, during their fitness assessment. And someone who excels at both possesses a very high level of muscular fitness.

Flexibility: The sit-and-reach test assesses both your back (~40%) and hamstring flexibility (~60%). Although it's not good for firefighters to have extreme flexibility in their backs (that increases risk for back injury), you should have a modest amount to avoid back pain. Lacking hamstring and trunk flexibility is a major risk factor for back pain for all people. For firefighters, lacking hamstring flexibility could increase your risk for a back injury because it is more difficult to keep a neutral spine during lifting tasks (when most back injuries occur) if you have very tight muscles in your lower body. This also applies to the shoulder flexibility test. If your shoulders are very inflexible, it may be more difficult to avoid twisting your back when transferring patients, which will significantly increase your risk of suffering an injury.

Treadmill test: The treadmill test assesses your aerobic capacity also known as "VO<sub>2</sub> max." This test has been scientifically validated to predict your VO<sub>2</sub> max within 3.2 ml/kg/min and was developed specifically for firefighters by Dr. Karlie Moore. Your aerobic capacity plays a huge role in your risk of developing chronic disease and early death. In fact, it increases your risk of developing heart disease to a greater degree than all other risk factors including hypertension, poor cholesterol, obesity, high blood glucose, and even smoking!

For firefighters, having a low aerobic capacity is very risky because it takes a lot of VO<sub>2</sub> to do the physically demanding tasks that you must do on the job, especially fire suppression. Firefighters are 64-110 times more likely to have a heart attack while fighting a fire compared to other non-fire emergency tasks. This is because it is so stressful on the cardiovascular system. If you do not possess the VO<sub>2</sub> that fighting a fire requires, you are likely to over-exert your cardiovascular system, which is a heart attack. It's like having money in the bank - if you don't have enough, you will be overdrawn. That is why the minimum suggested VO<sub>2</sub>max for firefighters is 42 ml/kg/min. Improving your aerobic capacity requires that you do activity (it doesn't matter the activity) that increases your heart rate and breathing. The higher the intensity of the exercise, the greater the rate of improvement in your aerobic capacity.

## Health History Questionnaire

Name: \_\_\_\_\_  
Last
First
age
gender
today's date

E-mail address: \_\_\_\_\_

**Medications: If you are currently taking any medications, check the appropriate box and list the medication**

- Blood Pressure \_\_\_\_\_
- Cholesterol or Triglycerides \_\_\_\_\_
- Diabetes \_\_\_\_\_
- Heart \_\_\_\_\_
- Any other that might affect you physically during a fitness test \_\_\_\_\_

**Please check yes or no for the following questions:** yes no

Have any one of your immediate family members (sibling or parent) experienced a heart attack, coronary revascularization or sudden death before age of 55 (males) or 65 (females)?		
Are you a current smoker or have you quit within the past 6 months?		
Do you have a resting systolic blood pressure equal to or greater than 140 or a resting diastolic blood pressure equal to or greater than 90?		
Do you participate in a regular exercise program in which you accumulate 30 minutes or more of moderate physical activity on most days of the week?		
Is your total cholesterol greater than 200 mg/dL? Or have you been told by your doctor that you have high total cholesterol?		
Is your HDL cholesterol less than 40 mg/dL? Or have you been told by your doctor that you have low HDL cholesterol?		
Is your LDL cholesterol greater than 130 mg/dL? Or have you been told by your doctor that you have high LDL cholesterol?		
Is your fasting blood glucose equal to or greater than 100 mg/dL or has your doctor told you that you have high fasting blood glucose?		
Is your HDL cholesterol greater than 60 mg/dL or has your doctor told you that you have high HDL cholesterol?		
Have you ever had pain, pressure, or a squeezing feeling in the chest that came on during physical activity?		
Have you ever had any bouts of rapid or irregular heart action or palpation?		
Have you ever had a suspected heart problem such as myocardial infarction, coronary occlusion, coronary attack, coronary insufficiency or coronary thrombosis? (circle)		
Do you have a heart murmur or any known heart conditions?		
Do you have Diabetes?		
Do you have asthma, COPD or any other lung condition?		

Have you ever had a heart attack or stroke (circle)? \_\_\_\_\_ If yes, how long ago? \_\_\_\_\_

Have you ever had surgery such as a coronary artery bypass? If yes, please explain and state how long ago \_\_\_\_\_

Do you have any other chronic illnesses not accounted for above? If yes, please explain \_\_\_\_\_

Have you ever had an abnormal stress test or an abnormal resting or exercise ECG? If yes, please explain \_\_\_\_\_ Did a doctor review it? \_\_\_\_\_ Did the doctor state that was normal for you? \_\_\_\_\_

**Orthopedic concerns:**

List any past injuries that may be of concern during your test today: \_\_\_\_\_

List any current injuries or aches and pains that may be of concern/limit your abilities during your test today: \_\_\_\_\_

***By signing I certify that I have accurately completed this health history questionnaire and I have no concerns about my health that would affect my participation in this fitness assessment including a graded exercise test on the treadmill.***

---

Signature

Date signed

## Statement of Informed Consent

This document provides you with information regarding the risks and benefits of participating in a fitness evaluation. By signing this form you are agreeing to not hold \_\_\_\_\_ liable for any adverse events that occur during your fitness test. If you experience an injury during or as a result of this test you should follow the procedures that your employer has in place to address on-duty injuries. You will not be entitled to any treatment or compensation from \_\_\_\_\_.

### Purpose of a fitness evaluation

Research repeatedly shows that at least 50% of on-duty deaths in firefighters are due to heart attack. It is well known that regular exercise lowers one's risk for heart disease and heart attack. Aerobic activity is also associated with fewer pain complaints, injuries, and days off due to injury in uniformed personnel. This assessment will provide you with a comprehensive summary of your current fitness level as it relates to risk for adverse events on the job and overall health. It may also be used to tailor a workout program according to your strengths and weaknesses.

### Procedures of the tests

During the first phase of the assessment you will have your body composition assessed beginning with height, weight, waist and hip circumferences. To assess your body fat percentage, the tester will pinch 7 sites on your body to measure subcutaneous fat. Measurement by the skinfold caliper will not hurt but the pinches may be slightly painful.

During the second phase of the test your muscular strength will be assessed. To evaluate grip strength you will be asked to squeeze tightly on a hand grip dynamometer. In a vertical jump test, you will be asked to jump as high as you can and touch a marker on the wall. You will also be asked to perform as many push-ups as you are capable of (up to 80) while keeping your rhythm to a pre-set cadence, and perform a "plank" (core strength exercise) for as long as you can. Any of these tests may cause extreme fatigue initially and muscle soreness over the next few days. Overexertion can also cause injury so you should try to perform within your limits.

You will then be given a warm-up before undergoing several flexibility tests.

An aerobic capacity (or "stress test") will also be conducted using a 12-lead ECG. For this test you will walk/run on a treadmill as the workload (incline or speed) increases each minute. This test is intended to screen for cardiac complications and not to diagnose any conditions. If your tester observes any warning signs (for heart attack), such as frequent PVC's, they will suggest you see your physician, which will be entirely up to you. Potential complications during this test can be extreme fatigue, dizziness, chest pain, heart arrhythmias, fainting or death (the risk of death is 1 in 20,000). The test will be terminated if any serious arrhythmias or symptoms including high blood pressure or ischemia are exhibited. You may also stop the test at any time.

All results will be kept confidential. Please contact \_\_\_\_\_ at (phone) \_\_\_\_\_ or \_\_\_\_\_ (email) if you have any questions.

I understand the procedures and conditions of my participation stated above. My questions have been answered to my satisfaction.

Signature \_\_\_\_\_ Date \_\_\_\_\_

Name: \_\_\_\_\_

Age: \_\_\_\_\_

Date: \_\_\_\_\_

**Body composition:**

Height (in)	_____	Weight (lb)	_____
Waist circumference	_____	Hip circumferen.	_____
<u>skinfold measurements:</u>			
subscapular	_____		
tricep	_____		
axillary	_____		
chest	_____		
suprailiac	_____		
abdominal	_____		
quadricep	_____		

**Muscular Fitness:**

Right grip strength	_____
Left grip strength	_____
Vertical jump	_____
standing reach	_____
Push-ups	_____
Plank	_____

**Flexibility:**

Sit and Reach	_____
Shoulder stretch	R/L _____   _____
Right lateral	start/end _____   _____
Left lateral	start/end _____   _____

Resting heart rate \_\_\_\_\_

Resting blood pressure \_\_\_\_\_

risk factors: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

min	Treadmill incline	HR	Blood pressure	Notes
0-2	0% (warm-up)	_____	_____	_____
3	0%, _____ mph	_____	_____	_____
4	1%	_____	_____	_____
5	2%	_____	_____	_____
6	3%	_____	_____	_____
7	4%	_____	_____	_____
8	5%	_____	_____	_____
9	6%	_____	_____	_____
10	7%	_____	_____	_____
11	8%	_____	_____	_____
12	9%	_____	_____	_____
13	10%	_____	_____	_____
14	11%	_____	_____	_____
15	12%	_____	_____	_____
16	13%	_____	_____	_____
17	14%	_____	_____	_____
18	15%	_____	_____	_____
19	test ends	_____	_____	_____
1	cool down	_____	_____	_____
2	cool down	_____	_____	_____
3	cool down	_____	_____	_____
4	cool down	_____	_____	_____
5	cool down	_____	_____	_____
	<b>Final time</b>	_____	_____	_____

# FireFighter Fitness Assessment Results (males)

Name Joe Example

Age: 38

Date of test: 9/10/19

## BODY COMPOSITION

<b>Waist to Hip Ratio :</b>					<b>0.81</b>	
<b>Risk for Heart Disease and Diabetes</b>					<b>Ave. for Firefighters</b>	
<b>age</b>	<b>20-29</b>	<b>30-39</b>	<b>40-49</b>	<b>50-59</b>	<u>age</u>	<u>ratio</u>
Low	<.83	<.84	<.88	<.9	20-29	0.84
Moderate	.83-.88	.84-.91	.88-.95	.9-.96	30-39	0.87
High	.89-.94	.92-.96	.96-1	.97-1.02	40-49	0.9
Very High	>.94	>.96	>1	>1.02	50-59	0.9

<b>Body Fat Percentage :</b>					<b>15.7</b>	$\pm 2.5\%$
<b>Percentiles</b>	<b>20-29</b>	<b>30-39</b>	<b>40-49</b>	<b>50-59</b>		
90	7.1	11.3	13.6	15.3		
80	9.4	13.9	16.3	17.9		
70	11.8	15.9	18.1	19.8		
60	14.1	17.5	19.6	21.3		
50	15.9	19	21.1	22.7		
40	17.4	20.5	22.5	24.1		
30	19.5	22.3	24.1	25.7		
20	22.4	24.2	26.1	27.5		
10	25.9	27.3	28.9	30.3		
<b>Health Outcomes</b>					<b>Ave. for Firefighters</b>	
Unhealthy range (too low)			$\leq 5\%$		<u>age</u>	<u>%</u>
Healthy Range (lower end)			6-15%		20-29	15.44
Healthy Range (upper end)			16-24%		30-39	16.60
Unhealthy Range (too high)			$\geq 25\%$		40-49	18.87
					50-59	17.83



## MUSCULAR STRENGTH/POWER

<b>Total Grip Strength : 111 Kg</b>				
<b>Age</b>	<b>20-29</b>	<b>30-39</b>	<b>40-49</b>	<b>50-59</b>
Excellent	≥ 115	≥ 115	≥ 108	≥ 101
<b>very good</b>	104-114	<b>104-114</b>	97-107	92-100
good	95-103	95-103	88-96	84-91
fair	84-94	84-94	80-87	76-83
needs improvement	≤ 83	≤ 83	≤ 79	≤ 75
<b>Ave. for Firefighters</b>				
	<u>age</u>	<u>Kg</u>		
	20-29	114		
	<b>30-39</b>	<b>117</b>		
	40-49	108		
	50-59	106		

<b>Vertical Jump : inches 24 Power : 5043 Watts</b>				
<b>Age</b>	<b>20-29</b>	<b>30-39</b>	<b>40-49</b>	<b>50-59</b>
<b>Excellent</b>	>5094	<b>&gt;4860</b>	>4320	>4019
<b>Very Good</b>	4640-5093	4389-4859	3700-4319	3567-4018
<b>Good</b>	4297-4639	3967-4388	3242-3699	2937-3566
<b>Fair</b>	3775-4296	3485-3966	2708-3241	2512-2936
<b>N.I.</b>	<3774	<3484	<2707	<2511
<b>Average for Firefighters</b>				
	<u>age</u>	<u>inches</u>	<u>Watts</u>	
	20-29	21.5	5129.14	
	<b>30-39</b>	<b>20.5</b>	<b>5249.87</b>	
	40-49	17.0	4924.96	
	50-59	16.5	4744.07	

## MUSCULAR ENDURANCE

<b>Push-ups : 46</b>				
<b>Age</b>	<b>20-29</b>	<b>30-39</b>	<b>40-49</b>	<b>50-59</b>
Superior	≥ 62	≥ 52	≥ 40	≥ 39
<b>Excellent</b>	47-61	<b>39-51</b>	30-39	25-38
Good	37-46	30-38	24-29	19-24
Fair	29-36	24-29	18-23	13-18
Poor	22-28	17-23	11-17	9-12
Very Poor	≤ 21	≤ 16	≤ 10	≤ 8
<b>Ave. for Firefighters</b>				
	<u>age</u>	<u>#</u>		
	20-29	39		
	<b>30-39</b>	<b>36</b>		
	40-49	33		
	50-59	30		

<b>Plank time : 180 seconds</b>	
<b>Superior</b>	<b>180 seconds</b>
Excellent	120-179 seconds
Good	80-119 seconds
Fair	40-79 seconds
Poor	< 40 seconds
<b>Ave. for Firefighters</b>	
<u>Age</u>	<u>time</u>
20-29	164
<b>30-39</b>	<b>158</b>
40-49	154
50-59	147
Female	145

## FLEXIBILITY

<b>Sit and Reach      16    cm</b>						
<b>Age</b>	<b>18-25</b>	<b>26-35</b>	<b>36-45</b>	<b>46-55</b>	<b>Ave. for Firefighters</b>	
<i>excellent</i>	22	21	21	19	<u>age</u>	<u>cm</u>
<i>very good</i>	20	19	19	17	20-29	16.5
	19	17	17	15	<b>30-39</b>	<b>18.6</b>
<b>good</b>	18	17	<b>16</b>	14	40-49	17.6
	17	15	15	13	50-59	15.0
<i>Fair</i>	15	14	13	11		
	14	13	13	10		
<i>needs improvement</i>	≤ 13	≤ 12	≤ 11	≤ 9		

<b>Shoulder Stretch (inches)</b>					
<b>Right</b>	<b>0</b>	<b>Left</b>	<b>-1</b>	<b>Average</b>	<b>-0.50</b>
<u>Right</u>		<u>Left</u>		<b>Ave. for Firefighters</b>	
Excellent	≥ 1	Excellent	≥ 1	<u>age</u>	<u>inches</u>
<b>Good</b>	<b>0</b>	Good	0	20-29	0
Average	-0.25 - -1.75	<b>Average</b>	<b>-0.25 - -1.75</b>	<b>30-39</b>	<b>-4</b>
Poor	≤ -2	Poor	≤ -2	40-49	-5
				50-59	-3

<b>Lateral Stretch (cm)</b>					
<b>Right</b>	<b>20</b>	<b>Left</b>	<b>22.5</b>	<b>Average</b>	<b>21.25</b>
<u>Percentile</u>	<u>30-39</u>	<u>40-49</u>	<u>50-59</u>	<b>Ave. for Firefighters</b>	
80th	24.1	23.1	20.6	<u>age</u>	<u>cm</u>
<b>60th</b>	<b>22.1</b>	21.6	18.7	20-29	24.8
40th	20.2	19.8	17.1	<b>30-39</b>	<b>24.2</b>
20th	18.5	15.5	14.7	40-49	22.2
				50-59	20.3

## AEROBIC CAPACITY (CARDIOVASCULAR ENDURANCE)

**Treadmill: 19:00**

**Predicted VO<sub>2</sub>max: 52.9 ± 3.2 mL/kg/min**

The minimum VO<sub>2</sub>max recommended for firefighters is 42 ml O<sub>2</sub>/Kg/min

Percentile	20-29	30-39	40-49	50-59
90	55.1	52.1	50.6	49.0
80	52.1	50.6	49.0	44.2
70	49.0	47.4	45.8	41.0
60	47.4	44.2	44.2	39.4
50	44.2	42.6	41.0	37.8
40	42.6	41.0	39.4	36.2
30	41.0	39.4	36.2	34.6
20	37.8	36.2	34.6	31.4
10	34.6	33.0	31.4	29.9

**Ave. for Firefighters**

<u>age</u>	<u>VO<sub>2</sub>max</u>
20-29	47.3
30-39	44.9
40-49	42.8
50-59	43.0

## RESULTS OVER THE YEARS

	<u>2009</u>	<u>2010</u>	<u>2011</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>
Age	28	29	30	31	32	33	34
Weight	176	171	165	175	175	175	171
Waist circumference	85.0	82.5	84.5	85.5	86.0	85.0	85.5
Waist to Hip Ratio	0.81	0.79	0.83	0.81	0.83	0.80	0.83
Body Mass Index	26.76	25.92	25.09	26.61	26.22	26.61	26.00
Body Fat %	15.10	17.40	16.32	17.25	17.72	16.96	16.26
Grip strength	112	120	114	115	117	110	118
Vertical jump	23.0	23.5	25.5	26.0	24.5	24.5	25.0
Push-ups	38	42	43	47	37	43	46
Plank time (s)	160	170	180	180	180	180	180
Sit and Reach	1.00	1.00	1.00	1.00	-0.50	0.00	1.00
Shoulder flexibility	-0.75	-1.00	-0.50	-0.75	-0.75	-0.75	-1.00
lateral flexibility	21.0	20.5	18.8	19	21.0	20.5	22.8
Treadmill time	15:30	15:20	15:00	19:00	16:00	19:00	19:00
Aerobic capacity	55.96	55.96	48.99	52.93	46.3	52.9	52.9
	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>			
Age	35	36	37	38			
Weight	172	177	172	165			
Waist circumference	85.5	87.0	86.0	83.0			
Waist to Hip Ratio	0.82	0.82	0.79	0.81			
Body Mass Index	26.15	26.9	25.4	24.4			
Body Fat %	17.89	18.3	17.9	15.7			
Grip strength	114	105	117	111			
Vertical jump	23.5	24.5	22.5	24.0			
Push-ups	45	44	50	46			
Plank time (s)	180	180	180	180			
Sit and Reach	1.00	0.00	0.00	16.00			
Shoulder flexibility	-0.50	-0.75	-0.50	-0.50			
lateral flexibility	19.0	19.50	19.75	21.25			
Treadmill time	19:00	19:00	18:00	19:00			
Aerobic capacity	52.9	52.9	50.7	52.9			