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## DIFFERENT INTERNATIONAL METHODS FOR TESTING THE ABILITY OF FIREFIGHTERS

### *Abstract/Absztrakt*

*The current physical test has become some sort of “necessary evil” among firefighters, and most of them are opposed to it even more strongly than members of the military, the police or the border guards. This rejection can be traced back to the general opinion that the exercises during these tests (2000-meter running, 4x10-meter “pendulum running”, etc.) are regarded unnecessary for the firefighting profession. The question often arises: “When do we have to run 2000 meters while putting out a fire?” This negative attitude towards regular exercise and healthy lifestyle causes a lack of information, deeply affects the level of physical fitness, and it is also responsible for thoughts like “We’ve got to get over with this somehow!” Based on the feedback received from the staff, our firefighters would rather be tested on performing professional tasks that would clearly show their physical fitness for the job.*

*A jelenlegi fizikai tesztekre, mint szükséges rosszra tekintenek a tűzoltók, és közülük számosan nagyobb ellenszenvvel viseltetnek irántuk, mint a katonák, rendőrök, vagy határőrök. Ez az ellenézés arra az általános véleményre vezethető vissza, amely szerint a tűzoltói gyakorlatban feleslegesek a teszt során végrehajtandó feladatok (2000 m-es futás, 4x10 méteres ingafutás, stb.). Gyakran felmerülő kérdés: „Mikor kell nekünk 2000 métert futnunk, amikor tüzet oltunk?”. Ez a negatív hozzáállás a rendszeres mozgáshoz és az egészséges életmódhoz információhiányt okoz, nagyban befolyásolja a fizikai állapotot, és „valahogy csak túl leszünk ezen és megcsináljuk” álláspontot erősíti. A vezetéstől kapott visszajelzések alapján, a tűzoltók felmérése inkább szakmai feladatok alapján kell,*

*hogy történjen, amelyek világosan megmutatják fizikai állóképességüket a munkájuk során.*

**Keywords/kucsszavak:** *ability tests, Fire Service, Candidate Physical Ability Test, Fire-simulation containers ~ képesség tesztek, tűzoltóság, fizikai felvételi teszt, tűz-szimulációs konténerek*

There are different ways of testing firefighter candidates all around the globe. The main purpose of the tests is to measure if the applicant is physically and psychologically fit for the job. Later, when a person becomes a firefighter, his fitness continues to be monitored and evaluation of their performance is conducted on a regular basis.

We have collected material from many different countries and began to select the best possible methods applied around the world. Learning about experiences in other countries proved to be extremely useful in the process of creating a new system for Hungary.

The profession of firefighters is considered to be one of the most honorable occupations in the world that requires outstanding psychological and physical conditioning from each fireman to perform well on duty.

Examining, testing, and analyzing the physical fitness of firefighters as well as discovering new methods to improve their skills based on the results of these tests have been common practice in Hungary for almost ten years. The main purpose of examining the physical fitness of firefighters is to determine their permissible load.

Below are some examples of fitness tests performed around the world from different departments.

### **Nova Scotia, Canada**

A wild-land firefighter's standardized fitness test comes into effect in 2008. The test will include a 4.8-kilometre walk while weighed down by 20-kilogram vest. They will have 45 minutes to finish the course. There will be other tests too.

### **Somerset Fire and Rescue Service, UK**

Specific job related tests are given such as written and aptitude tests, and physical and fitness tests which must be passed before proceeding to interview. The fitness tests that are conducted are very specific to the job required, and include the following:

- Multistage Fitness Test/ bleep test - a pass mark of level 8, shuttle 4
- Hose Running - a test of dexterity, stamina and coordination. This test will involve 25 m lengths of 70 mm hose to be rolled out and returned in a set time.
- Ladder Climb Test - a test for compatibility with working at heights, and will involve locking the legs allowing both arms to be free.
- Ladder Extend Test - a test of arm and grip strength. The test simulates extending the 13.5m ladder that is used extensively within the service.
- Dead lift simulator - device which tests lower back and leg strength and is set at 50 kg.

- Enclosed Space Test - a test of confidence, agility and will identify claustrophobic tendencies. The candidate dons breathing apparatus (BA), facemask and negotiates a crawl and walkway with vision obscured.

Two tests are now not included, the Back and leg pull test using a Dynamometer (due to possible risks through poor technique) and the Hand Grip Test (as grip strength is taken into account during the ladder extension)

### **UK Fire Service**

You will have to undertake a series of tests such as:

- Lung Capacity
- Chester Step Test
- Height
- Weight
- Strength Tests
- Eye Tests
- Urine Sample
- Blood Test
- A visit to the onsite Doctor

### **Surrey County Fire Fighters, UK**

Applicants must complete a practical and physical assessment.

**Practical:** Applicants will be tested in the five different areas listed below. In order to reach the standard, applicants must be successful in all five tests. All five of the practical tests will be conducted in the full fire kit.

- Dead lift
- Ladder extension
- Ladder ascent and descent
- Enclosed space (Breathing Apparatus)
- Hose running

**Physical:** Applicants will be tested in the three different areas listed below.

- Grip strength test
- Isometric back strength test
- Aerobic capacity test (Chester Step Test)

### **Saskatchewan Environment forest firefighters (Canada)**

The annual testing protocol includes the following tests (plus several others):

- a fitness walk with weight packs. Carrying 20.25 kilograms for 4.8 kilometers in less than 45 minutes.
- hose carry and hose dragging

## **Fire Departments, US**

The International Association of Fire Fighters (IAFF) unveiled several years ago the new Joint Fire Service Candidate Physical Ability Test (CPAT). This unprecedented, innovative and equitable physical ability test for fire fighter candidates is designed to help fire departments measure the physical ability of candidates to perform routine fire fighting tasks. It consists of eight events:

- a stair climb
- hose drag
- equipment carry
- ladder raise and extension
- forcible entry
- search maze
- rescue simulation
- ceiling breach and pull.

It is a pass-fail test that is content-valid based on fire fighter job tasks, but avoids the pitfalls of testing candidates on specific fire fighting skills that require academy training.

The test was designed to be both reliable and valid, meaning the test will produce consistent results and will measure an applicant's ability to display job-relevant characteristics and skills. It has been through an extensive validation process, including scientific, legal, and fire service review.

## **Fire Rescue, Largo**

They have a voluntary fitness program, where members have to meet certain minimum fitness standards for the following tests (the links are to general descriptions of these tests, and may not be the specific procedures used by this department):

- 1-1/2 mile run
- push-ups
- sit-ups
- sit & reach
- chin-ups

## **Houston Fire Department**

The Houston Fire Department uses a job-related physical ability test designed to test determine if an applicant has the strength and endurance needed to perform the job duties of a Firefighter. These job duties require balance, coordination, strength, endurance, and cardiovascular fitness. Applicants will be tested over seven (7) timed, pass/fail events while wearing gloves and an air pack.

- Balance Beam Walk
- Ladder Extension
- Stair Climb
- Equipment Hoist
- Portable Equipment Carry
- Rescue Attempt

- 1.5 Mile Run

### **NSW Fire Brigade, Australia**

During the Firefighting Task Course you will be required to complete the tasks (listed below) in succession, walking from one task to the next. You will be required to wear structural Personal Protective Equipment (PPE) including coat, over-trousers, lightweight helmet, general purpose gloves and non-operational Self-Contained Breathing Apparatus (without face mask).

- Ladder climb
- Hose coupling
- Ladder raise and lower
- Tunnel crawl
- Beam walk
- Chain cutting
- Hose reel drag
- Hose drag and hold
- Tower climb and container haul
- Tower climb and visual recognition

### **Rochester Fire Department, US**

Candidates must pass the physical agility test twice — first to get into the training academy, then after passing a written exam they must do it all again to get out of the academy and join the department. Fail to complete any one of a total eight stations, and they are out.

The testing involves various job specific tasks, including hauling a fire hose, dragging a 165-pound dummy, swinging a sledgehammer, and raising a ladder. The toughest test is three minutes on the stair machine saddled with 75 pounds in weights to simulate equipment.

### **Scotland Fire Fighters**

Although there are no ongoing mandatory fitness tests for Scottish firefighters, six of the eight forces have established their own monitoring regime. Strathclyde Fire and Rescue, has yet to introduce any test, while Fire's service only assesses new recruits. They are both reviewing their procedures with a view to introducing fitness tests for employees every three years. Of those that do regular testing, the demands and frequency of the tests vary widely.

Firefighters in both Dumfries and Galloway and Lothian and Borders take a mandatory fitness test every three years, using an exercise bike. An occupational health therapist monitors their heart rate, blood pressure and body fat.

Central Scotland's service uses the Chester Step Test, as does Tayside carried out every year on uniformed staff. Grampian has used the Chester step test for more than 15 years, with all uniformed staff under the age of 40 being tested every two years and annual tests for those over 40 years of age. Highlands and Islands Fire and Rescue operate a fitness test every three years.

A Scottish Executive spokesman said there were no plans to introduce a national standard fitness test across all the emergency services.

## **The occupation specific physical fitness evaluation [2]**

### **1. Aerobic fitness**

Aerobic fitness will be measured directly using expired air analysis while running on a treadmill. The speed and incline are gradually increased until the candidate reaches his/her maximum intensity. This test is designed to measure endurance or "work capacity".

Participation in moderate to high intensity aerobic workouts (30 - 45 minutes per workout, 4 - 5 times per week) including such activities as jogging, cycling, swimming and rowing, can help you prepare for the aerobic fitness assessment. Consult your physician and/or a qualified fitness instructor before starting any exercise program.

### **2. Job-related performance evaluation**

There are eight job-related performance tests. The tests are designed to simulate the physical demands of a firefighter's job which requires both muscular strength and endurance.

To prepare for these tests, you may wish to participate in supervised weight training, stretching and an aerobic exercise program to increase strength, improve flexibility and enhance aerobic fitness. Consult your physician and/or a qualified fitness instructor before starting any exercise program.

#### **1. Ladder climb**

Wearing a 9.1 kilogram cylinder from an S.C.B.A. (self-contained breathing apparatus), you will climb a 12.2 metre extension ladder, uncouple and re-couple a wall-mounted hose connection, then climb down the ladder. This test assesses fear of heights (acrophobia) and manual dexterity.

#### **2. Search enclosed area (revised)**

Wearing a blacked-out face piece, you will be locked in a confined area for a time to be determined by the tester. While you are confined, you will be instructed by the tester to reach up to the top, left front corner and count the number of washers on a bolt sticking out of the wall. You must then call out the correct number to the tester. This test detects fear of confined areas. It is scored on a pass/fail basis - it is not timed

**Note:** During the remaining tests you will be wearing a 13.5 kilogram vest plus 2.3 kilogram weights on each ankle. These weights approximate the heaviness of the protective clothing and SCBA worn by firefighters. You will be timed when you perform all tests except the Ladder Lift Test.

#### **3. Hose carry/climb**

You will lift and carry over your shoulder a 38.5 kilogram bundle of hose up and down five flights of stairs. This test simulates carrying equipment to the staging areas of a high-rise fire. It assesses dynamic balance, muscular strength of the upper body and back, plus muscular endurance and power of the legs.

#### **4. Rope pull**

Using a rope, you will hoist and lower in a hand-over-hand manner a 22.5 kilogram weight a height of 20 metres. This test simulates hoisting fire fighting equipment to and from

windows or roofs. It assesses manual dexterity plus the muscular strength and endurance of the upper body and back.

### **5. Hose advance/drag**

You will pull a 70 kilogram load which simulates a charged hose line (a hose line that is ready to discharge water), a distance of 15 metres. This test assesses leg power and muscular strength of the upper body.

### **6. Ladder lift**

You will remove and replace a 25.5 kilogram ladder from brackets mounted 1.93 metres above the floor. This test simulates the demands involved in numerous fire fighting activities (ie. pike poling, removing ladders from aerial beds, etc.) which require working at or above chest/shoulder height. It assesses muscular strength and endurance of the upper body and back.

### **7. Victim drag**

You will drag a 91 kilogram "victim" a distance of 15 metres while weaving in and out of traffic cones placed every 3 metres. This simulates rescuing a downed firefighter wearing full turn-out gear. It assesses upper body, back, plus lowers body muscular strength, agility and dynamic balance.

### **8. Forced Entry (new)**

In this test you are required to move a heavily weighted tire a distance of 12 inches (30.5 cm), until the tire contacts the wall, by hitting the tire repeatedly with a 10 lb (4.5 kg) sledge hammer.

This task simulates a forced entry through a door or wall and requires upper body strength, upper body endurance and motor ability. The height of the table is the height of a door handle and also the height at which a sledge hammers or axe is normally swung during a forced entry.

Moving a tire of this weight a distance of 12 inches has been documented to require the same amount of sledge hammer work as breaking through a door or wall.

The tester will record the number of hits and the total time taken to complete the task. Timing begins when you first draw the sledge hammer back from the tire and ends when the tire first contacts the wall.

Please be aware that the hammer will rebound, so hold onto the hammer tightly during both the hit and rebound.

## **Budapest Fire Brigade**

The current physical test (2000 m, 4X10 m "pendulum running", sit-ups, push-ups) is regulated by a decree and firefighters have a strong dislike for, because it is not specifically made up of profession-related exercises and does not reflect reality.

In the world of professional sport, it has been standard practice to model sports events and measure the performance of the athletes. Based on similar experiences, it is clear that performance can only be measured in its entirety and not by examining certain selected skills. Experiments with professional athletes prove that even our Olympic and world champions lack certain skills in areas like fitness, coordination, or mental abilities, but they are still world-best in their own event.

Annual physical testing of the staff has been compulsory since 1997. The decree gave all units and the entire staff five years of grace period to prepare for regularly meeting the new requirements. Passing the yearly physical tests and having medical and psychological check-ups have become compulsory for everyone on the job.

However, the current physical test has become some sort of “necessary evil” among firefighters, and most of them are opposed to it even more strongly than members of the military, the police or the border guards.

This rejection can be traced back to the general opinion that the exercises during these tests (2000-meter running, 4x10-meter “pendulum running”, etc.) are regarded unnecessary for the firefighting profession. The question often arises: “When do we have to run 2000 meters while putting out a fire?” This negative attitude towards regular exercise and healthy lifestyle causes a lack of information, deeply affects the level of physical fitness, and it is also responsible for thoughts like “We’ve got to get over with this somehow!”

Based on the feedback received from the staff, our firefighters would rather be tested on performing professional tasks that would clearly show their physical fitness for the job.

Fire-simulation containers can perfectly model interior fires to be extinguished in lifelike circumstances. During these practices, firefighters are under close observation and they can gain true-to-life experience regarding some unpredictable happenings and difficulties similar to the ones they might encounter while putting out a fire in an apartment or a basement. They can also experience some of the physical and psychological effects a fire might have on their body, and also they can learn how to put out the fire effectively and as quickly as possible. (photos: 1, 2, 3, 4)

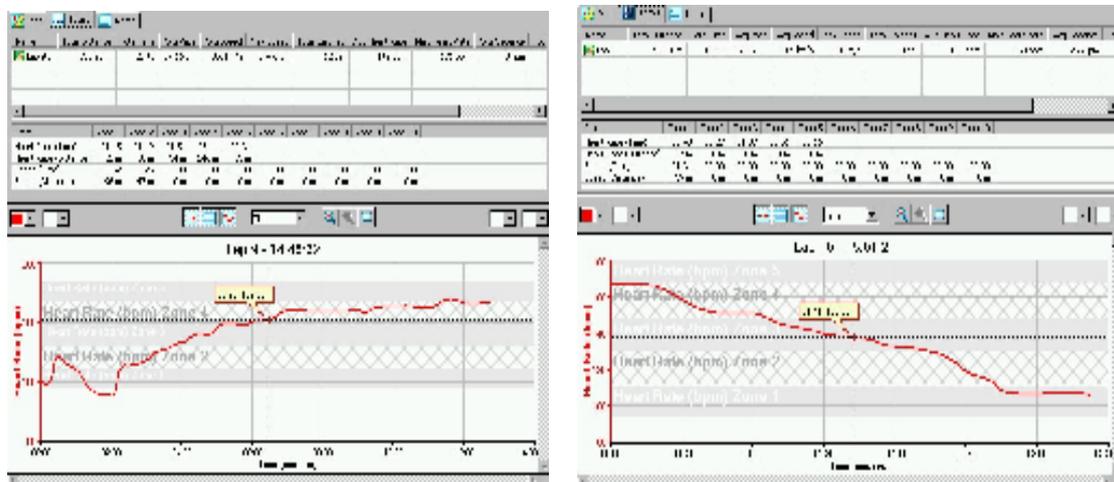


Monitoring the physiological parameters of firefighters in action and analyzing and comparing the test results to each other make it possible to assess their physical fitness and determine the optimal duration of labor with their breathing apparatus on.

In order to assess their abilities, we used a FIRE DRAGON III container to make it possible for the firefighters to work in pairs wearing protective equipment such as protective clothing (Bristol), and self-contained breathing apparatus (6-liter Draeger PSS cylinders filled with compressed air at a pressure of 300 bars, weighing 10.6 kilos) providing air supply for about 10-12 minutes to carry out the tasks.

Firefighters tested, had been fitted with heart monitors (Garmin Forerunner 301 and 305) that send heart-rate signals through a device to analyzing software that helped us watch the changes in their heart rate in relation to their work load during the entire test.

The following diagrams show heart rate and antropometric values determining the zones of work load classified by age, the time scale for each zone, and values compared to the maximum determined heart rate based on these pieces of data.



Based on the amount of consumed air we can measure the amount of oxygen used each minute of the test ( $VO_2$ ) and proportionately calculate the intensity of work from how much the firefighters weigh in order to find out precisely how fit each of them is. Three minutes after the end of the test, capillary blood samples were taken, lactic acid levels and blood pressures were checked.

To judge the level of physical fitness just by monitoring the changes of heart rate during the test is not enough, as it only shows the momentary condition of the person. That is why simultaneous monitoring of performance, inhalation of oxygen, and the amount of lactic acid produced by the muscles is all necessary to determine the stamina.

The subjects were allowed to discover the „plain” area and familiarize themselves with the tasks. Following that, each couple of firefighters put on their protective clothing, and before they could climb up to the entrance on the top of the container, the pressure of compressed air in each cylinder was checked. Then the firefighters tested the nozzles by making different patterns of water stream, and after connecting the regulators to the facepieces, the test began.

Describing our experiment we outlined a modern procedure used to test the physical fitness of firefighters that is suitable to monitor them in extreme circumstances that they often have to face on duty.

### **References:**

[1] Dr. Malomsoki, Dr. Martos, 15. Methodology Letter, OSEI, Budapest 1994, HU ISSN 1215-2234

[2] <http://www.topendsports.com/testing/tests> (2008. 03. 28.)