

## EVALUATION OF A TEST DRILL FOR THE ASSESSMENT OF THE FIREFIGHTERS' WORK ABILITY

Veikko Louhevaara<sup>1</sup>, Sirpa Lusa<sup>1</sup>, Jouko Soukainen<sup>2</sup>, Mikko Tulppo<sup>2</sup>, Petri Tuomi<sup>3</sup> and Timo Kajaste<sup>3</sup>

1) Institute of Occupational Health,

Topeliuksenkatu 41 a A,  
SF-00250 Helsinki, Finland

2) Merikoski Research and Rehabilitation Centre,

Nahkatehtaankatu 3,  
SF-90100 Oulu, Finland

3) Fire and Rescue Brigade of Oulu City,

Pikkukankaantie 2,  
SF-90100 Oulu, Finland

### INTRODUCTION

The demands on physical work ability are high in fire-fighting and rescue tasks (eg. smoke-diving) which require the use of protective clothing and a self-contained breathing apparatus (SCBA) (1). In Finland, there is no generally accepted follow-up procedure to ensure that the physical work ability of the firefighters is sufficient throughout their occupational career. Recently a submaximal job-related test drill, which is possible to carry out in fire stations, was developed for the assessment of the firefighters' physical work ability for the smoke-diving tasks (2). The aim of the present study was to evaluate firefighters' circulatory strain in the test drill.

### METHODS

The subjects were 53 male firefighters with the mean (range) age of 40 (27-53) years. Correspondingly, their absolute maximal oxygen consumption ( $\dot{V}O_2\text{max}$ ) and  $\dot{V}O_2\text{max}/\text{body}$  weight were 3.85 (2.70-5.20) l/min and 46.9 (26.0-68.9) ml/min/kg, respectively. The submaximal test drill consists of five common fire and rescue tasks, done wearing the fire protective suit and the SCBA (total weight 25 kg). The tasks are: 1. Walking and carrying of two hoseroles, 2. Stair climbing, 3. Hammering, 4. Over and under bars, and 5. Hose rolling. There is a fixed maximal work time of 14.5 min for the drill and each task varying from 2 to 4 min (Table 1). The tasks are performed at habitual work rate. If the task is done faster than allowed by the given time, the rest of the work time is used for recovery in a standing position. A firefighter's heart rate (HR) is measured in the test drill for the estimation of his physical (aerobic) work ability for smoke diving.

For the evaluation of circulatory strain in the test drill, the subjects' HR was continuously recorded (Sport Tester PM 3000) with the intervals of 5 s. Their individual strain was calculated by relating HR in the drill ( $HR_{\text{work}}$ ) to individual maximal HR ( $HR_{\text{max}}$ ), which was measured in association with the determination of the subjects'  $\dot{V}O_2\text{max}$  on a bicycle-ergometer.

### RESULTS

In the tasks of the drill, the range of HR was 93-184 beats/min, and that for %HR<sub>max</sub> was 49-99 % (Table 1). The HR results of the test drill correlated significantly (4.53 and -0.58,  $p < 0.001$ ) with  $\dot{V}O_2\text{max}$  whereas the correlations with the repetitive tests for the assessment of muscle strength and endurance were not significant.

In Table 2 there are the results of three subjects who completed the drill with the lowest values for  $\dot{V}O_2\text{max}/\text{body}$  weight. Their mean %HR<sub>max</sub> varied from 82 to 99 % in the tasks of the drill. The subjects' mean body weight was 113 kg. None of the firefighters belonging to the present sample of the firefighters (half of the operative staff of a medium-sized fire-brigade) failed to pass the test drill.

Table 1. The subjects' heart rate in the drill (HRwork) and its relative proportion of their maximal heart rate (%HRmax)

Task	Time (min)	(n=51-53)		(n=42-43)	
		HRwork (beats/min)		%HRmax (%)	
		Mean	Range	Mean	Range
walking & carrying	4	123	93-166	67	49-87
stair climbing	3.5	135	101-174	74	53-92
Hammering	2	152	112-184	83	63-99
Over & under bars	3	157	113-184	86	64-99
Hose rolling	2	148	100-182	81	59-99
All	14.5	140	100-182	77	59-93

Table 2. Heart rate in the drill (HRwork) and its relative proportion of maximal heart rate (%HRmax) of three subjects who passed the test drill with the lowest values for the maximal oxygen consumption ( $\dot{V}O_{2max}$ , ml/min/kg).

Subject	$\dot{V}O_{2max}$ (ml/min/kg)	HRwork (beats/min)		%HRmax (%)	
		Mean	Range	Mean	Range
1	26.0	138	126-153	90	82-99
2	30.5	163	149-176	92	84-99
3	31.6	163	157-174	83	80-88

## CONCLUSIONS

The evaluated test drill efficiently sorted out the subjects with low aerobic work capacity which showed near maximal HR values. On the other hand, the submaximality of the test drill is an important feature preventing health and safety hazards. Also with a skilful work performance a firefighter seems to be able to reduce in some extent the aerobic strain due to his low  $\dot{V}O_{2max}$ . According to the results and the opinions of the subjects, the present practical and simple test drill is reliable and suitable for the assessment of the aerobic work capacity of the young and elderly firefighters. The results provide useful additional information for the occupational health services. The results can be used by the fire-chiefs when they have to select firefighters for actual physically demanding operations, being also responsible for the safety of the men.

## REFERENCES

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