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STANDARDIZATION OF NEW MOTOR-OPERATED TEST FOR FINDING OUT THE GROW PERFORMANCE OF FIRE RESCUE WORKERS

Key words:
Standardization, motoric test, movable efficiency, firemen-rescuers, rescue action

Introduction

Firemen jobs can be considered as special from the point of grow performance. Rescue activity is characterized thereby, that firemen are pressurized highly till their body boundaries with some psychical load. The mentioned activities lay on firemen special claim to body strength. Our aim was to design a test - a kind of motor chain, by which we can test firemen preparedness to rescue. In connection with building complexity of contemporary high buildings, we can assume, that firemen rescue activity in case of various accidents while fire in mentioned environment, demands high level of firemen preparedness.

Problematic

In connection with firemen rescue activities in difficult conditions of built-up area, clashed with focused on motor operated expression of firemen in high buildings fires. Among the negative factors that may raise the hazard, the negative influence of single rescue in a long time of salvage belongs to the fire high temperature, high humidity due to water by steam, dark environs, possible presence of toxic compounds, the big weight of technical resources used in action.

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In such a way, we could detail other working activities in the area. Those hazards have negative influence on the process of salvage. All activities, except firemen high grow performance, may pose a danger, because no rescue situation itself can be planned forward. Something dangerous can occur suddenly and unawares. Contemporary legislative conditions for fire rescue staff, force the firemen to verify, yearly, their grow performance through the motor operated testing. The motor tests discover the condition of firemen grow performance in the field of conditional and coordinative preparedness (velocity, endurance, kick and rush, motional accomplishment coordination).

Development of technical resources, rescue of persons in further demanding situations and conditions, point to constant need of raising firemen general preparedness. Knowledge verified by us from abroad in firemen preparation, verifying their grow performance, for the need of arrangements and supplement of diagnostic resources, will have the character of the most frequent working activities of firemen in rescue hit (Polakovič, 2003, 2008).

As we mentioned in the introduction, the mentioned problem is the solution of research grant task VEGA MS SR No. 1/0713/08 on which there cooperates the Board of Fire and Rescue Service of the Department of Home Affairs in SR, Technical University of Mine − Faculty of Safety Engineering Ostrava, Fire Rescue Service Moravsko-Sliezsky Region, Szkoła Główna Służby Pożarniczej Warsaw, Technical University in Zvolen, Fire Brigade in Budapest.

Aim, tasks of work

The aim of our research work was on the basis of the theoretic analysis of specific firemen activities in rescue, to propose and then to verify specific motor-operated test for gaining the firemen preparedness in high buildings rescue:

- to perform standardization;
- too apply it in firemen training the V − 4 countries.

Tasks:

- to identify the most characteristic job activities, that firemen perform during rescue activities;
- to assign representation motional conditional and coordinational accomplishment in individual working activities, with assignment of dominance of grow accomplishment;
- to create from the most characteristic activities motional chain, that will copy sequence of working activities in rescue;
- to create files of firemen in individual countries of V − 4 preparing conditions for testing;
- to improve outfit of firemen;

- to perform exact description of activities in test which are familiar with all testing files of firemen;
- to perform skill session of coordinators in countries of V − 4 who participate on problem solution;
- to create time frame testing file in individual countries of V − 4 (Hungary, Poland, Czech Republic in year 2008–2009, Slovakia at the beginning of 2010).

Methodology

Characteristics and description of test

This test is modeling for disturbances in high buildings, where during fighting the fire rescue of people is done.

The following phases of rescue were joined into the test:

- research – places of rescue (walk – inspection of an object – preparation hose transport system) – discipline No. 1 from the test;
- military development – discipline No. 2 (ascent up the stairs, bring out technical resources and hose forwarding rail);
- rescue – (discipline No. 3) – rescue of persons;
- secondary research (discipline No. 4), research space.

Description of the test:

As like it has already been said in the previous sections, the test consists of firemen working activities, in preparation and during the rescue. It is designed into 4 sections - disciplines. Firemen realize the mentioned test in full outfit just, as they do in rescue operation. Outfit weight is 22 kg (see table 1).

Table 1. Necessary outfit and equipment of fireman rescue worker in rescue activities

Outfit – equipment	**Notice Weight (g)**	**Notice**
Helmet	1400	Drager
RDST	450	
mufflers	300-350	
mask DT	750	Drager
Lamp into helmet	150-200	
coat	1950-2000	
trousers	1450-1500	
Ranger – footwear	1900 - 1950	
HAIX − footwear	2700	
lamp megalith commander	800	
briefcase with thermocamera commander	5500	

needs complements		
RDST	450	
muffler	300-350	
lamp	150-200	
Weight scope minimum		
complements	900	
helmet	1300	
trousers + coat	3400	
boots HAIX	2700	
DT + mask	11400	Drager PG 90
	19700	

Besides discipline No. 1, in the next three, firemen perform their activity in mask and use B.A. After over every discipline there is recorded reached meanwhile and fireman has 1 minute for break during which he passes to another discipline. Measuring of achieved times is done in individual disciplines but also whole time after logoff.

Doing of motional grow activities in mask in mentioned test (besides discipline No. 1) it is from the case of possible occurrence smoke-quarts, toxic cloth presence. Arrangement of individual discipline must be such as, the distance between individual disciplines isn't bigger than 10 m, from the case of minimalize walk between disciplines.

Intensity of grow activities of firemen in applying the provision test is submaximal. Duration of rescue activities, from the point of time can be from several minutes till even few days.

We have decided that we join to test the job activities, which are expected from firemen, so they do them with high intensity. It is about activities (object inspection, hose system generation, rescue of persons, secondary research), that firemen do in mixed anaerobic-aerobical energic regime covering energic pretensions for mentioned job activities.

Description of individual disciplines:

Discipline No. 1

− introduces in fact inspection of an object in which firemen have to do rescue preparation for development and connection of hose transport system.

Activity: fireman starts at his command's start, on road of length of 25 m from one end to another and individually transfers 1 × hose C, 1 × hose B, 1 × distributor, 1 × streamline. At the end of the last sector, after transfer of all 4 sections hose system connects:

− distributor with hose B,

− streamline with hose C (together completes 8 × 25 m = 200 m).
After over the first discipline fireman in motion during 1 minute puts mask on because he completes other three disciplines with mask on breathing air from breathing apparatus.

Discipline No. 2
− introduce in fact additional bringing out bins with hoses and technical means up the stairs in high buildings.
Activity: at command's start, fireman goes up and down on stepper (stair) in height of 0,25 m, weidth 0,40 m, length 1 m which introduces simulation activity on stairway building. In both arms he carries 2 canisters, every in weight of 20 kg. Both of them are filled with sand. Timekeeper counts to fireman number of achieved repeated ascents and descents on stepper. In this discipline fireman ascents and descents 40 × on stepper with mentioned load, at which (1 repetition – ascent by both legs from the ground on stepper and descent by both legs from stepper to ground on his feet). After the last repetition he puts off canister on marked place.

Discipline No. 3
− introduces rescue and evacuation of injured persons from the place of fire on safe-deposit.
Activity: fireman at his command starts to transfer single 4 sacks, each filled with sand in weight of 40 kg. He must carry sacks not to drag them. He transfers sacks on distance of 10 m from one end to another.

Discipline No. 4
− introduces secondary research of searching injured persons by (Louhevara, 1991).
Activity: fireman at his command starts to seize canister to his hands in weight of 5 kg, which in fact presences thermocamera and overcomes barriers, that introduce (small gates in height of 0,6 m, width of 1m). There are 3 barriers and they are arranged every 2 m.
So the road has the following form. Aim (from which fireman starts), from it on distance 2 m the first obstacle, from it on distance the second obstacle, from it on distance 2 m the third obstacle, from it on distance 2 m aim.
First obstacle toadies down, second obstacle transgresses, the third obstacle toadies, arounds aim and he performs equal activity backward. He puts off canister on the level of startup aim and runs distance of 25 m, where he uncouples forwarding hose system. Here timekeeper terminates (measures) closing activity in test.

Test measures following kinetic accomplishment and motional skills:

– discipline No. 1

velocity kinetic accomplishment and motional skill (connection of hose system)

– discipline No. 2

velocity accomplishment, endurance in power

– discipline No. 3

velocity accomplishment, endurance in power

– discipline No. 4

velocity accomplishment, grow skillfulness (motion in difficult condition with thermocamera − simulated by canister in weight of 5 kg), motional coordination.

Characteristics of search file

Search files introduced accidentally by chosen firemen from fire units from Warsaw, Ostrava, Budapest at the age of 19 − 51. Young and old firemen, those are testers, are in fire units that do rescue activities. Young and old testing firemen passed testing grow performance sanctions motor-operated test in year 2009. Except other they had valid medical examination and valid skillfulness for work with breathing apparatus.

Description of search situation

Testing was done in months April to June 2009, in natural conditions of fire stations in the place of mobile technique with concrete floor, from where after of sliding (space in space barn into place of garage) they go into rescue activities. Firemen were informed about making test and about individual parts of the test.

Testing has been done during working shift in time from 10 a.m. – 1 p.m. Firemen were tested in whole outfit as they are in rescue activities.

Measuring attributes:

– anthropometric indiates /stature (cm) – weight (kg);
– B.P. before doing test (TK);
– B.P. after 1 min perfect test;
– volume lactate in blood (mmol.l-1) 2 min after over test;
– heart frequency before test (TF);
– heart frequency having finished test;
– time in individual disciplines (min);
– total time (min);
– general course heart − vascular activities on load (through the medium sport-tester) – physiological curve;

measuring weighted, body tremble:

– measuring anthropometric index are measuring through personal electronic digital scales with hypsometer of mark (EU 522 HR),

measuring B.P.:

– B.P. in tested firemen before test and one minute after doing test, we measured by digital barometer (Visomat comfort 20/40),

measuring lactate:

– volume of lactate in tested firemen we measured through the medium apparatus (Accutrend plus) consumption blood from finger on lactate stripe – 2 min after over test,

measuring replyings heart on load:

– measuring replyings heart frequency and whole response heart on load (physiological curve), we mearused through the medium sporttester (Polar 625 ×)

time measurement:

– time measurement of individual disciplines and whole time was noticed hand by digital stalk (Rucanor),
– near every discipline after its over we registrated meanwhile,
– every following discipline began after a minute rest, preparation subtraction 5 s before start (5-4-3-2-1 start),
– every tested fireman understood, how much time he got till the start of the following discipline.

Table 2. Example calculations of time measurement in testing of firemen by the test

	Discipline No. 1	**discipline No. 2**	**discipline No. 3**	**discipline No. 4**
		meanwhile	meanwhile	thick time
time	0,56 min	3:02 min	4:57 min	8:57 min
	(actual time)	(actual time)	(actual time	(actual time)
	0,56 min	1:06 min	0:55 min	3:00 min

Legend:
start in the second discipline − 1:56
start in the third discipline − 4:02
start in the fourth discipline − 5:57
general thick time: ? (t) = 8:57 min
Clean time: general thick time – 3 min rest = 8:57 – 3 = 5:57 min
Calculation time individual discipline:
The first discipline time = 0:56 min
The second discipline time = 3:02 min – 1:56 min (start in the second disc.).
The third discipline time = 4:57 min – 4:02 min (start in the third disc.).
The fourth discipline time = 8:57 min – 5:57 min (start in the fourth disc.).

Results
Valuation of firemen file (Polish Republic, Czech Republic, Hungarian Republic)

Average age of firemen from Poland 34,2, Hungary 27,4, the youngest file was from the Czech Republic – 26.6.

From the point of grow fastidiousness of individual disciplines of the test, the most difficult were the second and the third discipline. So ascent in stair from load and persons rescue. In mentioned activities of maximum, the average attributes of heart frequency in mentioned activities in Hungarian firemen 192 pulses/min, in Polish firemen 180 pulses/min and Czech firemen 177 pulses/min. Best average results in values of lactate time in individual disciplines, but also whole evaluation of entire test reached the Czech firemen. Behind them were the Polish firemen and the weakest were the file of Hungarian firemen. Exact results of all measured values are shown in tablets (see tablet 3−8).

Table 3. Testing of firemen from Warsaw (anthropometric index, lactate, heart frequency after warm-up TF 1, maximum TF 2)

	State	Name	Age	weight (kg)	heigth (cm)	lactate (mmol/l)	TF 1	TF 2
1	PL	P. W.	33	86	176	11,9	134	**189**
2	PL	W. K.	35	77	178	2,9	98	**186**
3	PL	K. K.	29	74	180	8,8	119	**181**
4	PL	Z. K.	51	67	172	15,8	118	**168**
5	PL	T. K.	25	80	176	17,6	106	**181**
6	PL	B. P.	51	96	186	11,6	115	**175**
7	PL	K. M.	26	83	186	10,4	110	**184**
8	PL	B. B.	25	86	182	12	95	**178**
9	PL	K. P.	51	86	170	14,8	98	**168**
10	PL	P. K.	32	67	178	14,9	139	**192**
11	PL	T. P.	39	72	172	11,9	119	**186**
12	PL	T. B.	29	76	175	10,7	108	**184**
13	PL	A. Z.	39	97	176	8,4	119	**181**
14	PL	M. G.	25	105	182	12,6	102	**186**
15	PL	S. P.	30	89	180	10,7	98	**174**
16	PL	J. M.	26	80	180	12,5	112	**179**
17	PL	A. Z.	31	78	176	8,9	95	**184**
18	PL	Z. S.	21	100	170	9,1	104	**188**
19	PL	Z. O.	34	80	180	10,2	92	**181**
20	PL	Z. K.	43	96	180	14,2	100	**175**
21	PL	S. P.	43	94	175	15	120	**182**
22	PL	P. M.	34	72	175	12	106	**179**
23	PL	J. S.	40	87	176	12,6	100	**172**
24	PL	M. M.	29	93	184	13,8	106	**178**
Ø			**34,20833**	**84,208333**	**177,7083**	**11,80417**	**109**	**180,458333**

Table 4. Testing of firemen from Warsaw, results of measurings of time in individual disciplines and whole time

.	State	Name	1.disciplíne	2. disciplíne		3. disciplíne		4. disciplíne		Total time	
			VC	mean-while	VC	mean-while	VC	mean-while	VC	thick	clean
1	PL	P. W.	1:42	4:22	1:40	6:10	0:48	7:40	0:30	7:40	4:40
2	PL	W. K.	1:33	3:59	1:26	5:49	0:50	7:26	0:37	7:26	4:26
3	PL	K. K.	1:24	3:49	1:25	5:33	0:44	7:01	0:28	7:01	4:01
4	PL	Z. K.	1:39	4:31	1:52	6:37	1:06	8:21	0:44	8:21	5:21
5	PL	T. K.	1:28	3:54	1:26	5:37	0:43	7:03	0:26	7:03	4:03
6	PL	B. P.	1:46	5:04	2:18	7:05	1:01	8:49	0:44	8:49	5:49
7	PL	K. M.	1:33	4:03	1:30	5:45	0:42	7:05	0:20	7:05	4:05
8	PL	B. B.	1:39	4:09	1:30	5:59	0:50	7:29	0:30	7:29	4:29
9	PL	K. P.	2:18	5:41	2:23	8:01	1:20	10:03	1:02	10:03	7:03
10	PL	P. K.	1:33	4:01	1:28	5:45	0:44	7:08	0:23	7:08	4:08
11	PL	T. P.	1:51	4:31	1:40	6:41	1:10	8:13	0:32	8:13	5:13
12	PL	T. B.	1:49	4:25	1:36	6:14	0:49	7:48	0:34	7:48	4:48
13	PL	A. Z.	1:37	4:12	1:35	6:09	0:57	7:42	0:33	7:42	4:42
14	PL	M. G.	1:28	4:06	1:38	6:02	0:56	7:43	0:41	7:43	4:43
15	PL	S. P.	1:22	4:06	1:44	5:53	0:47	7:27	0:34	7:27	4:27
16	PL	J. M.	1:20	3:48	1:28	5:41	0:53	7:14	0:33	7:14	4:14
17	PL	A. Z.	1:43	4:19	1:36	6:03	0:44	7:31	0:28	7:31	4:31
18	PL	Z. S.	1:41	4:03	1:22	5:46	0:43	7:17	0:31	7:17	4:17
19	PL	Z. O.	1:26	4:02	1:36	5:45	0:43	7:13	0:28	7:13	4:13
20	PL	Z. K.	1:34	4:15	1:41	6:11	0:56	7:51	0:40	7:51	4:51
21	PL	S. P.	1:31	4:03	1:32	5:50	0:47	7:23	0:33	7:23	4:23
22	PL	P. M.	1:32	4:03	1:31	6:16	1:13	8:07	0:51	8:07	5:07
23	PL	J. S.	1:27	3:59	1:32	5:42	0:43	7:23	0:41	7:23	4:23
24	PL	M. M.	1:28	3:50	1:22	5:47	0:57	7:21	0:34	7:21	4:21
Ø			**1:36**		**1:37**		**0:52**		**0:34**	**7:40**	**4:40**

Legend:
VC – clean time

Table 5: Testing of firemen from Warsaw (anthropometric index, lactate, heart frequency after warm-up TF 1, maximum TF 2)

	State	Name	Age	weight (kg)	heigth (cm)	lactate (mmol/l)	TF 1	TF 2
1	CZ	V. U.	33	86	176	11,9	113	179
2	CZ	L. J.	35	77	178	2,9	121	166
3	CZ	J. S.	29	74	180	8,8	97	177
4	CZ	J. L.	51	67	172	15,8	97	179
5	CZ	R. V.	25	80	176	17,6	125	179
6	CZ	M. T.	51	96	186	11,6	87	187
7	CZ	V. Č.	26	83	186	10,4	73	175
8	CZ	R. A.	25	86	182	12	111	174
9	CZ	O. L.	51	86	170	14,8	73	175
10	CZ	M. G.	32	67	178	14,9	102	177
11	CZ	M. Š.	39	72	172	11,9	78	168
12	CZ	J. T.	29	76	175	10,7	86	170
13	CZ	M. H.	39	97	176	8,4	115	190
14	CZ	L. M.	25	105	182	12,6	89	184
15	CZ	O. H.	30	89	180	10,7	91	178
16	CZ	R. P.	26	80	180	12,5	103	181
17	CZ	M. B.	31	78	176	8,9	112	176
18	CZ	V. V.	21	100	170	9,1	105	181
19	CZ	R. B.	34	80	180	10,2	92	179
20	CZ	T. P.	43	96	180	14,2	115	184
ø			**33,26316**	**83,10526**	**177,6316**	**11,35263**	**98,42105**	**177,6316**

Table 6. Testing of firemen from Warsaw, results of measuring time in individual disciplines and whole time

			1. disci-pline	2. disciplíne		3. disciplíne		4. disciplíne		Total time	
	State	Name	VC	M	VC	M	VC	M	VC	thick	clean
1.	CZ	V. U.	1:08	3:19	1:21	5:05	0:46	6:34	0:29	6:34	3:34
2.	CZ	L. J.	1:20	3:50	1:30	5:45	0:55	7:15	0:30	7:15	4:15
3.	CZ	J. S.	1:19	3:38	1:19	5:35	0:57	7:06	0:31	7:06	4:06
4.	CZ	J. L.	1:31	4:02	1:31	5:54	0:52	7:24	0:30	7:24	4:24
5.	CZ	R. V.	1:16	3:16	0:60	4:54	0:38	6:20	0:26	6:20	3:20
6.	CZ	M. T.	1:13	3:32	1:19	5:19	0:47	6:50	0:31	6:50	1:50
7.	CZ	V. Č.	1:15	3:37	1:22	5:24	0:47	7:02	0:38	7:02	4:04
8.	CZ	R. A.	1:20	4:00	1:40	5:55	0:55	7:26	0:31	7:26	4:26
9.	CZ	O. L.	1:26	3:45	1:19	5:45	1:00	7:17	0:32	7:17	4:17
10.	CZ	M. G.	1:19	3:43	1:24	5:37	0:54	7:04	0:27	7:04	4:04
11.	CZ	M. Š.	1:09	3:20	1:11	5:01	0:41	6:35	0:34	6:35	3:35
12.	CZ	J. T.	1:58	4:35	1:37	6:52	1:17	8:23	0:31	8:23	5:23
13.	CZ	M. H.	1:36	4:05	1:29	6:08	1:03	7:44	0:36	7:44	4:44
14.	CZ	L. M.	2:05	4:26	1:21	6:26	1:00	8:10	0:44	8:10	5:10
15	CZ	O. H.	1:26	3:52	1:26	5:50	0:58	7:25	0:35	7:25	4:25
16.	CZ	R. P.	1:50	4:28	1:38	6:33	1:05	8:15	0:42	8:15	5:15
17.	CZ	M. B.	1:23	3:42	1:19	5:29	0:47	6:59	0:30	6:59	3:59
18.	CZ	V. V.	1:13	3:13	1:00	4:54	0:41	6:23	0:29	6:23	3:23
19.	CZ	R. B.	1:05	3:20	1:15	5:08	0:48	6:39	0:31	6:39	3:39
20.	CZ	T. P.	1:14	3:20	1:06	4:50	0:30	6:20	0:30	6:20	3:20
ø			**1:24**		**1:25**		**0:52**		**0:32**	**7:09**	**4:03**

Table 7. Testing of firemen from Budapest (anthropometric index, lactate, heart frequency after warm-up TF 1, maximum TF 2)

	State	Name	Age	weight (kg)	heigth (cm)	lactate (mmol/l)	TF 1	TF 2
1	HU	V. L.	21	85	185	12,7	118	185
2	HU	S. A.	20	76	181	12	109	183
3	HU	S. J.	22	89	177	12,1	125	192
4	HU	S. S.	26	74	187	13,2	123	209
5	HU	S. T.	26	70	172	12,8	130	201
6	HU	S. M.	35	97	176	9,8	119	187
7	HU	P. A.	32	80	186	14,2	115	187
8	HU	R. A.	28	96	178	12,6	108	188
9	HU	P. S.	34	90	183	13,3	100	174
10	HU	N. V.	19	72	170	14,5	150	201
11	HU	L. A.	26	96	188	12,7	108	181
12	HU	K. K.	34	67	174	10,7	133	185
13	HU	K. A.	33	115	188	13,4	120	185
14	HU	K. T.	28	83	178	13,1	136	189
15	HU	I. M.	19	85	176	12,9	100	193
16	HU	H. M.	21	82	182	11,5	110	184
17	HU	G. A.	25	61	179	14,2	120	203
18	HU	F. S.	35	81	175	13,4	101	191
19	HU	C. P.	32	97	179	13,8	115	185
20	HU	C. M.	34	110	183	14,9	112	212
21	HU	B. M.	22	70	173	15,2	101	201
22	HU	B. F.	32	73	172	13,6	100	190
23	HU	B. G.	23	75	185	12	104	190
24	HU	B. M.	35	78	174	11,7	105	205
25	HU	B. A.	23	81	174	6,4	99	205
ø			**27,4**	**83,32**	**179**	**12,66**	**114,44**	**192,24**

Table 8. Testing of firemen from Budapest, results of measuring time in individual disciplines and whole time

			1. discipline	2. discipline		3. discipline		4. discipline		Total time	
	State	Name	VC	M	VC	M	thick	thick	VC	thick	clean
1	HU	V. L.	1:28	3:54	1:26	5:40	0:46	7:29	0:49	7:29	4:29
2	HU	S. A.	1:24	3:10	0:46	4:56	0:46	6:33	0:37	6:33	3:33
3	HU	S. J.	1:36	4:10	1:34	6:02	0:52	7:42	0:40	7:42	4:42
4	HU	S. S.	1:24	3:49	1:25	5:44	0:55	7:21	0:37	7:21	4:21
5	HU	S. T.	1:24	3:55	1:31	5:57	1:02	7:38	0:41	7:38	4:38
6	HU	S. M.	1:22	4:09	1:47	5:27	1:18	8:41	1:14	8:41	5:41
7	HU	P. A.	1:44	4:12	1:28	6:19	1:07	8:13	0:54	8:13	5:13
8	HU	R. A.	1:47	4:27	1:40	6:26	0:59	8:15	0:49	8:15	5:15
9	HU	P. S.	1:35	4:19	1:44	6:09	0:50	7:53	0:44	7:53	4:53
10	HU	N. V.	1:17	4:19	2:02	6:53	1:34	8:40	0:47	8:40	5:40
11	HU	L. A.	1:33	3:47	1:14	5:28	0:41	7:12	0:44	7:12	4:12
12	HU	K. K.	1:26	5:24	2:58	8:11	1:47	10:08	0:57	10:08	7:08
13	HU	K. A.	1:35	4:16	1:41	6:15	0:59	7:21	0:36	7:21	4:21
14	HU	K. T.	1:19	3:41	1:22	5:16	0:45	6:54	0:38	7:07	4:04
15	HU	I. M.	1:47	5:22	2:35	7:33	1:11	9:21	0:48	9:21	6:21
16	HU	H. M.	1:31	3:47	1:16	5:41	0:54	7:28	0:47	7:28	4:28
17	HU	G. A.	1:24	3:56	1:32	6:40	1:44	8:23	0:43	8:23	5:23
18	HU	F. S.	1:49	4:43	1:54	7:02	1:19	9:03	1:01	9:03	6:03
19	HU	C. P.	1:57	4:27	1:30	6:31	1:04	8:29	0:58	8:29	5:29
20	HU	C. M.	1:33	4:18	1:45	6:05	0:47	7:58	0:53	7:58	4:58
21	HU	B. M.	1:18	3:56	1:38	5:59	1:03	7:38	0:39	7:38	4:38
22	HU	B. F.	1:17	4:19	2:02	6:53	1:34	8:40	0:47	8:40	5:40
23	HU	B. G.	1:15	3:46	1:31	5:31	0:45	7:10	0:39	7:10	4:10
24	HU	B. M.	1:11	3:41	1:30	4:32	0:51	7:17	0:45	7:17	4:17
25	HU	B. A.	2:01	5:09	2:08	8:00	1:51	10:24	1:24	10:24	7:24
ø			**1:31**		**1:40**		**1:04**		**0:48**	**8:03**	

Calculation specification (temporal limits) for single discipline and whole fire performance in test of V – 4

The norm goes out from measured performance of 70 fire rescue workers, we measured in years of 2008 and 2009 (Warsaw, Ostrava, Budapest). In all three files we practised at first the first measuring (test), after two weeks the second measuring (retest). Tables performance of firemen from retest measuring in individual

files from the point of maximal permission area articles in this part are not mentioned.

If measuring certain performance on the basis of measuring by test on file of group probands, thus we assume normal division of values performance in whole group. In normal division performance it is expected, that the best performance is average power minus three authoritative anomalies (x – 3 s). the worst performance is average power plus three authoritative anomalies (x + 3 s).

In calculation of norm in individual disciplines and whole performance are followed acording to methodologist Kasa and Baláž (2002), single statistical performance chart ushered by (Starší, Gorner, 1995).

Mentioned methodology divides entire group on five subgroups (see table 9):

- markedly extraordinary group, that has achievements from interval (x – 3 s; x – 1,5 s);
- extraordinary group, with performance from interval (x – 1,5 s; x – 0,5 s);
- group of average creates firemen with performance of values from interval (x – 0,5 s; x + 0,5 s);
- below-average group creates firemen with performance, those attributes are from interval (x + 0,5 s; x + 1,5 s);
- group markedly below-average creates achievements of firemen (x + 1,5 s; x + 3 s);
- Kasa and Baláž (2002), divide last group marked below-average of firemen on group sufficient (x + 1,5 s; x + 2,5 s) a group insufficient (x + 2,5 s; x + 3 s).

Besides arithmetic average and directive anomalies there are calculation of single quartile, that divide entire group of firemen on four equally subgroups (see table 10):

- Q0 = the best performance,
- Q1 = norm for 25% the best,
- Q2 = x – norm for good half,
- Q3 = norm 75%,
- Q3 – Q4 = interval time – the fourth part the worst performance,
- Q4 = the worst performance.

In tables of correlations (see table 11, 13, 16) we judge statistic confidence resp. dependence relationship between five variable (discipline No. 1, No. 2, No. 3, No. 4 and whole fire performance – HV). Among individual disciplines and whole fire performance (HV) fall 1% − level of significance we found out that every dependence is significant which means that all partial disciplines show the tightest relation with HV.

The tightest relation with HV damning discipline T2 a T3. Nethermost relation proves with discipline T1.

Regression − step by step we searched the most valid variables that influence variability HV (dispersion performance).

Gambit:

the first step: input of regression analyses in all partial disciplines T1 – T4, their division on variability HV we can see in place graph No. 11.

Second step:

regression − step by step we excluded discipline T4. In regression inputed T1 till T3 and by them it explains variability model with 0,9478% × 100 = 94,78% by Havlicek (1971). Through the medium recollection model we can predict, average worth HV 10,0 with mistake of prognose 63,4 dot (see table 14).

The most valid variables showed disciplines T2 a T3. On picture 1 there is the illustration of decomposition performance in individual disciplines and whole performance in test. On picture 2 puts on the stage percentage of disciplines on overall output in test.

Table 9. Specification for fire performance and partial disciplines

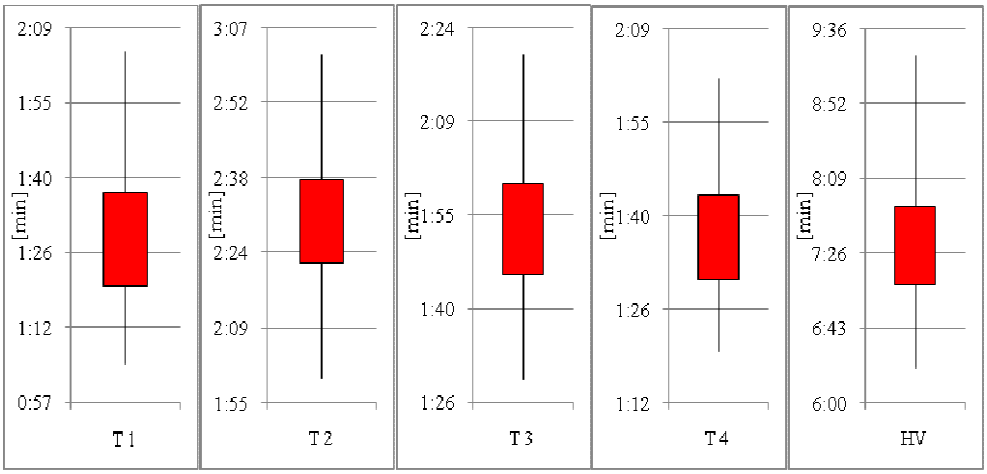
	Items	**T 1** [min]	**T 2** [min]	**T 3** [min]	**T 4** [min]	**HV** [min]
markedly extraordinary	**5**	1:10	2:11	1:37	1:23	**6:34**
overaverage	**4**	1:23	2:23	1:48	1:33	**7:13**
average	**3**	1:37	2:36	1:58	1:42	**7:52**
below-average	**2**	1:50	2:48	2:09	1:51	**8:31**
markedly below-average	**1**	2:03	3:01	2:20	2:01	**9:09**
insufficient	**0**	>2:03	>3:01	>2:20	>2:01	**>9:09**

Legend:

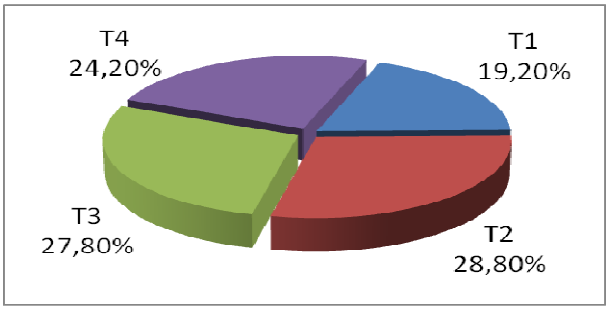
T1 – discipline No. 1; T2 – discipline No. 2; T3 – discipline No. 3; T4 – discipline No. 4; HV − general fire performance

Table 10. Statistical performance chart partial disciplines and whole fire performance [n = 69; min]

	T 1	**T 2**	**T 3**	**T 4**	**HV**
Average	1:30,9	2:30,8	1:53,4	1:37,8	7:32,9
Directive anomalies	0:13,4	0:12,9	0:10,6	0:09,3	0:38,4
Max Q4	2:05,0	3:02,0	2:20,0	2:02,0	9:21,0
Min Q0	1:05,0	2:00,0	1:30,0	1:20,0	6:20,0
Q1 - 25 percentile	1:20,0	2:22,0	1:46,0	1:31,0	7:08,0
Medium Q2	1:28,0	2:30,0	1:52,0	1:36,0	7:27,0
Q3 - 75 percentile	1:38,0	2:38,0	2:00,0	1:44,0	7:53,0
Interqartilove span Q3-Q1	0:18,0	0:16,0	0:14,0	0:13,0	0:45,0



Little picture 1: *Box graph discipline and whole fire performance (Q4, Q3, Q1, Q0)*



Little picture 2: *Percentage of partial disciplines on general fireman performance*

Table 11. Correlation tablet partial disciplines and of the total fire performance p<0,01**
(p 0,05 = 0,235; p 0,01 = 0,303)

	T1	**T2**	**T3**	**T4**
HV	0,656**	0,838**	0,838**	0,805**
T1	x	0,319**	0,371**	0,435**
T2		x	0,685**	0,577**
T3			x	0,538**

Table 12. Forward stepwise regression partial disciplines to general fire performance

	Steps			
indices	**1**	**2**	**3**	**4**
T 1		28,42	24,05	19,20
T 2	70,21	58,64	37,96	28,80
T 3			32,77	27,80
T 4				24,20
increase step		**16,85**	**7,72**	**5,22**
R^2	**70,21**	**87,06**	**94,78**	**100**

Table 13. Multiple correlation and regressive analysis of three selected partial performance to whole fire performance (items)

					$\bar{x}$	s_y	s_y^2
HV	β_{1k}	b_{1k}	$\beta_1 * r_{1k}$	r_{1k}	10,00	2,712	7,353
T2	0,453	1,318	0,3796	0,838	2,45	0,932	0,869
T1	0,366	1,252	0,2405	0,656	2,58	0,793	0,630
T3	0,391	1,179	0,3277	0,838	2,45	0,900	0,810
		R^2	0,9478				
		R	0,9735				
		SEa	0,634				
		bo	0,653				

Table 14. Regressive quotation on prediction operator of coordinative performance with average performance 10,00 values with three debug criterion

$$Y = 0{,}653 + 1{,}318 * X_{(T2)} + 1{,}252 * X_{(T1)} + 1{,}179 * X_{(T3)} \; (SEa \pm 0{,}634 \text{ boda}) \; R^2: 94{,}78\%$$

Legend:
Y – general fire performance [items];
X(T2) − performance in test T2 [items]; X (T1) − performance in test T1 [items]; X(T3) − performance in test T3 [items];
SEa – mistake of predict quotation; R2 − reliability predict quotation.

Table 15. Percentage representation of firemen in v normative groups

	Classes	**T1**	**T2**	**T3**	**T4**	**HV**
markedly extraordinary	5	4,35	8,70	5,80	2,90	7,25
overaverage	4	**26,09**	17,39	**34,78**	**36,23**	**21,74**
average	3	**42,03**	**40,58**	**26,09**	**28,99**	**40,58**
below- average	2	17,39	**20,29**	17,39	20,29	18,84
markedly below- average	1	5,80	4,35	10,14	7,25	4,35
insufficient	0	4,35	8,70	5,80	4,35	7,25

Table 16. Multiple correlation of a regressive analysis duo selection partial performance to whole fire performance (items)

					$\bar{x}$	s_y	s_y^2
HV	β_{1k}	b_{1k}	$\beta_1 * r_{1k}$	r_{1k}	10,00	2,712	7,353
T2	0,700	2,036	0,5864	0,838	2,45	0,932	0,869
T1	0,433	1,480	0,2842	0,656	2,58	0,793	0,630
		R2	0,8706				
		R	0,9330				
		SEa	0,4880				
		bo	1,195				

Table 17. Regressive quotation on prediction operator of coordinational performance with average performance 10,00 values with two debug criteria

$$Y = 1{,}195 + 2{,}036 * X_{(T2)} + 1{,}480 * X_{(T1)} \text{ (SEa} \pm 0{,}488 \text{ boda) } R^2\text{: } 87{,}06\%$$

Legend:
Y – general fire performance [items];
X(T2) − performance in test T2 [items]; X (T1) − performance in test T1 [items];
SEa – mistake predict quotation; R2 − reliability predict quotation,

Operating of measured data

Level motional accomplishment interprets basic statistic characteristics master tendency (average, medium – Q2) and measures of diffuseness (standard deviation, dispersion, maximum, minimum; qartily, interqartilove span).

Near identification of extreme of frame values: within the frame individual file motional accomplishment was used method propping the size interquality span

(Hendl, 2004, p. 103). Normalization composition file was arbitrated by Kolmogorov-Smirnov test.

Creation of 5-graded norm in firemen of V − 4 at the age of 19 till 51 was realized by methodologist Kasa and Baláž (2002) with usage of values of average and directive anomalies (see table 9). Consequential norms specification is presented by graphic and numeric form.

Table 18. Creation of five levels norms by methodologist Kasa and Baláž (2002)

Qualitative valuation	items	principle of norms
markedly extraordinary	5	$\bar{x}$ - 1,51 directive anomalies and less
overaverage	4	$\bar{x}$ - 0,51 directive anomalies till 1,5 directive anomalies
average	3	$\bar{x}$ ± 0,50 directive anomalies
Below average	2	$\bar{x}$ + 0,51 directive anomalies till 1,5 directive anomalies
markedly below-average	1	$\bar{x}$ + 1,51 directive anomalies and more

Dependencies among variables we expressed by correlation index by Pearson. Statistic confidence of relations we judge on 5% and 1% significance level. In text we mark important changes by asterisks $p < 0,01$** and $p < 0,05$*.
On reduction independent variables (partial disciplines) we used, except logical progresses, single step operation regression.

Dependence (r1k) and share (b1*r1k) partial disciplines on variability of the total fire performance we estimated technology manifold correlation and regressive analyses (Chajdiak, 2002). Besides manifold correlation index (R) we calculated determinant manifold correlation (R2), authoritative mistake regression (SEa), coeficient „b0", indices partial regression „b" (b1k – b4k), standardized indices partial regression „b" (b1k − b4k).

Calculations were realized by available mathematical-statistic functions in a program MS Excel and SPSS (Brodáni, 2002; Brož – Bezvoda, 2006; Chajdiak, 2005; Štastný, 1999).

Fire rescue worker testing in countries of V − 4 will continue after meeting with coordinators (that have been carried out in months October and November 2009). In years 2010 there arrive at row at first file of firemen from Slovakia and further will be continued testing of file firemen from smaller countries where there isn't such assumption frequency of rescue activities like in big towns.

Conclusion

Motor-operated test V − 4, just researches collective called it, will be the contribution at drill of firemen in rescue activities. Here are several realia:

- test content create weightiest activities, that are executed by firemen during rescue,
- activities, that are needed to execute by intensity on frontier anaerobic threshold (ANP), let us say above its' frontier,
- test measures not only kinetic accomplishment, but also motional crafts,
- firemen execute test at outfit they use in rescue activities,
- test verifies also facts how fireman knows to breathe through respiratory techniques in motional activities executed by high intensity.

There exist maximum effort, that having finished closing work on test there could be jointed test in training condition of firemen.

S U M M A R Y

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STANDARDIZATION OF NEW MOTOR-OPERATED TEST FOR FINDING OUT THE GROW PERFORMANCE OF FIRE RESCUE WORKERS

Authors deal in their articles with analysis of rescue actions of firemen in difficult conditions of agglomeration from the point of view of using of technical means and their preparedness. They suggest specific solution like the complex test, due to it will be possible after doing the standardization to verify better firemen's preparedness into rescue action.
Firstly the test will be the focus on verifying of the firemen's preparedness in rescue action in high buildings. Test is standardized on the unit of firemen of countries of V – 4. This problem is solution of grant research task of VEGA MŠ SR No. 1/0713/08 with cooperation of countries of V − 4.

Autorzy zajmują się analizą działań ratowniczych w trudnych warunkach aglomeracji, biorąc pod uwagę użycie środków technicznych, jak również gotowość ratowników. Proponują rozwiązanie polegające na kompleksowym teście, który po standaryzacji umożliwi sprawdzenie gotowości strażaków do prowadzenia akcji.
Na początku test będzie skupiał się na weryfikacji gotowości strażaków do akcji ratowniczych w wysokich obiektach. Test jest standaryzowany dla strażaków krajów V − 4.

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