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# INFLUENCE OF WATER DISCHARGE USING THE „T", „Z", „O" AND „INVERTED U" LETTERS TECHNIQUE ON ITS DISTRIBUTION IN A CONFINED SPACE

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***Abstract:*** *Knowing how water is distributed after its discharging in a confined space is necessary to make firefighting more efficient. Using the „T", „Z", „O" and „inverted U" letters technique to discharge water inside a test room, on the opposite wall, in the absence of fire, several main conclusions can be drawn: near the wall diametrically opposite the area from which the water was discharged, the highest values of the water volume accumulated were recorded; from the smallest recorded water loss point of view, it is recommended to discharge the water in the form of the „Z" letter, followed by discharging in the form of the „T", „O" and „inverted U" letters.*

***Key words:*** *letter technique; water distribution.*

## 1. INTRODUCTION

The development of the field of building construction has led to a significant change in the dynamics of fires that occur in confined spaces. Thus, both the existence of synthetic materials in the rooms and the increase in the volume of the rooms, resulting with the appearance of open-space type rooms, lead to the much faster propagation of fires, the reduction of the evacuation time of people caught in the fire and the release of large amounts of smoke and toxic gases [1-3]. Also, there are rapid changes in the way the fire manifests itself through the occurrence of phenomena such as flashover, backdraft or rollover, which can lead to particularly serious consequences on the lives of building users and on the safety of firefighting crews [4-6]. Thus, it was found that the average value of the time measured from the moment of fire compartment ventilation to the occurrence of firefighter untenability conditions is 100 s for one-story buildings and 200 s for two-story buildings. It has been observed that the measured time from the appearance of these conditions to flashover is less than 10 s [7].

To prevent the occurrence of these phenomena, it is necessary to carry out extensive research on the efficiency of firefighting in enclosed spaces by analyzing the influence of water discharge mode, as well as its extinguishing mechanisms following the use of sprinkler installations (a), water mist (b) or nozzles (c) [8-13], the wood crib being widely used as a source of ignition in tests.

The efficiency of extinguishing can be achieved by knowing the distribution of water inside a closed space. This is a common parameter of water discharging using systems with different characteristics:

(a) Using the sprinkler system to extinguish a wood crib, a critical water distribution rate, [mm/min], was identified [14]; there are also a number of key parameters such as: size and speed of spray drops, spray angle, spray impulse and flame penetration [15].

(b) The water mist system is characterized by significant parameters in the efficiency of firefighting such as spray impulse, the mean of the discharging flux [16], the surface covered by

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spraying [17] and the discharge of the water mist, both at different angles to the horizontal plane and by the use of additives [18]; at high pressure, the water mist can cover larger areas of the fuel, with lower water consumption compared to the sprinkler system [19].

(c) Using the nozzle to extinguish a wood crib, the reduction of the maximum HRR value was directly proportional to the mass of the discharged water in the unit of time, the proportionality constant being approximately equal to 12 kJ/g [20]; at short distances from the wood crib, the straight stream leads to an increase in extinguishing efficiency [21]; when the water application rate is critical (sufficiently low) the reignition speed of the fire competes with the extinguishing speed [22]; with the increase in the flow rate of the discharged water, there is an improvement of radiative attenuation by up to 75 % for a flow value of 235 l/min [23], the water being successfully used in the absorption of thermal radiation in modern systems [24]; the smooth bore characteristics have been examined, determining on the one hand its shape and distribution, and on the other hand the flow, size and speed of the drop [25]; tests have been carried out to determine the coordinates of the jet trajectory pattern and the mean fields of the jet velocity vector [26]; the trajectory of a jet can be predicted, based on the fact that there is an optimal pressure and flow value of the discharged water [27].

There are different ways of discharging the water jet, namely, either by keeping the nozzle in a fixed position or by manipulating it in different ways: horizontally, vertically, in the shape of the letter eight, using the "spray and pray" technique, which involves handling the nozzle as quickly as possible without respecting a certain model, respectively using the letters technique [28]. The letters technique involves handling the nozzle in the shape of letters „T", „Z", „O" or „inverted U". This technique is used to extinguish fires that occur inside rooms with a floor area of up to 10 $m^2$, in the case of the letter „T", 10-20 $m^2$, in the case of the letter „O", respectively 20-30 $m^2$, in the case of the letter „Z" [29].

Several studies have been carried out on the discharge of water in closed spaces in the absence of fire, both by designing the water jet keeping the nozzle in a fixed position and using the technique of the "T", "Z", "O", "inverted U" letters. One of the studies [30] consisted of the water distribution analysis on the test room floor resulting from the projection of the water jet in the middle of the ceiling, using the "T", "Z", "O" and "inverted U" letters technique, respectively on the wall opposite the door, using the "O" letter technique. Other studies [31-34] consisted of the analysis of the volume of air entrained by the discharge jet by handling the nozzle in different ways.

Thus, according to an American study [30], the influence of the type of jet, the different directions of jet discharge (regarding the ceiling and one of the walls), respectively the way of handling the nozzle on the water distribution were analyzed. It was found that the angle at which the water jet comes into contact on the surface on which it is pushed has a significant role in the way the water is distributed in the room. *The type of jet* influences the distribution of the water, namely: (i) by discharging the water using the straight stream and narrow fog nozzles; (ii) by using the smooth bore nozzle. In case (i) the water was accumulated more in the corners of the room related to the wall diametrically opposite to the area next to which it was discharged, and in case (ii) more water was accumulated along the walls parallel to the jet propagation direction [35-37]. Regarding *the influence of jet discharge directions on water distribution*, the following were found: by keeping the nozzle in a fixed position and turning the jet at a maximum angle to the ceiling, more water was accumulated along the perimeter of the room; by projecting the jet in the middle of the ceiling and on the wall opposite the door, the water was accumulated more along the wall opposite the area from which it was expelled [38]. Analyzing how *the nozzle handled the water distribution*, the following emerged: the water distribution resulting from the mid-ceiling discharge by keeping the nozzle in a fixed position was more uniform compared to the experimental tests where the nozzle was handled in the shape of the letters „T", „Z", „O" and „inverted U" [39-41]. In all cases, in the immediate vicinity of the wall located on the opposite side of the area from which it was

discharged, the highest values of the volume of accumulated water were recorded, these being several times higher than in the case of using a sprinkler [42-43].

To analyze the influence of water discharge using the letters technique on the efficiency of fire extinguishing, a study [44] was carried out regarding the implementation of an automatic fire extinguishing system. This automatic system is characterized by the precise handling of the nozzle in the form of both the letters „T", „Z", „O" and „inverted U" and in the form of other letters.

The aim of this work is to analyze the distribution of water after its discharge using the technique of the letters „T", „Z", „O" and „inverted U". This goal is to be achieved by fulfilling the following objectives: identifying the areas where high values of discharged water accumulate, the average speed of making a letter, respectively the comparative analysis between the volume of water accumulated at the floor level and the volume of water lost following the discharge of an equal amount of water using the technique of the letters „T", „Z", „O" and „inverted U".

The novelty brought by this paper in relation to the American study [30] consists in discharging the water from the door of the test room on the opposite wall not only in the shape of the letter "O" but also in the shape of the letters „T", „Z" and „inverted U".

## 2. THE EXPERIMENTAL PROCEDURE

In this article, 12 water discharge tests were performed using the letters "T", "Z", "O" and "inverted U" technique inside a test room, 3 tests for each displacement technique.

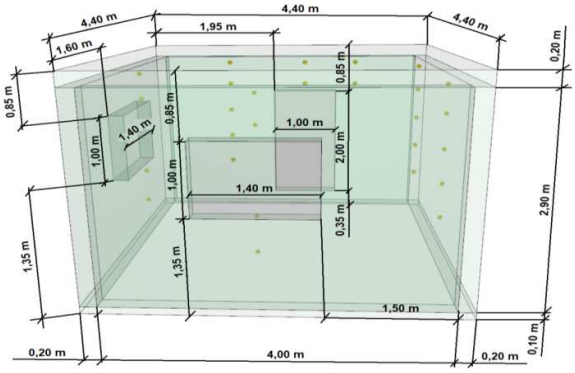


**Fig. 1** Dimensions of the test room

The test room is in the premises of the Fire Department within Police Academy, being made of aerated concrete (B.C.A.) walls, the pillars, the ceiling and the floor being made of reinforced concrete. The test room, equipped with one door and two windows, has an internal floor area of 16 $m^2$ and a height of 2.90 m, its dimensions being shown in figure 1.

To measure the pumped water, 81 boxes (40 sets of boxes, each set consisting of two boxes and one box) made of sheet metal with a thickness of 2 mm were placed on the floor of the test room, according to figure 2.

**Fig. 2** Location of water collection boxes

In order to reduce as much as possible, the values of the volume of pumped water lost, on the one hand in the spaces between the boxes, respectively in the spaces between the boxes and the side walls of the room, and on the other hand due to its evaporation, the previously mentioned spaces were filled with foam polyurethane. Also, in order to reduce as much as possible, the values of the volume of water absorbed in the wall made up of B.C.A., located diametrically opposite the door, this wall was protected with sheet metal.

Figure 3 shows the dimensions of a set of boxes used for water collection.

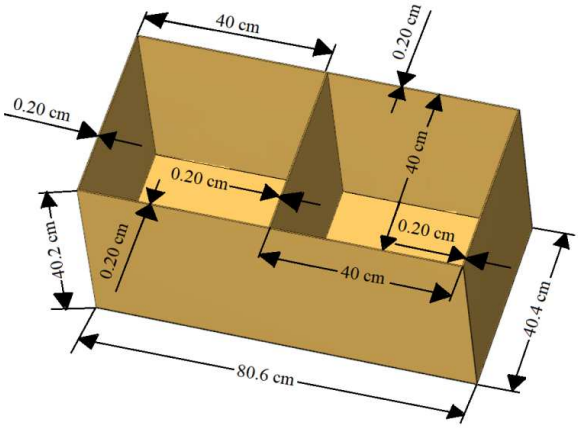


**Fig. 3** Assembly consisting of two boxes for water collection

The discharge consisted of handling the nozzle by means of models made in the form of the letters „T", „Z", „O" and „inverted U", located at a distance of approximately 1 m from the door of the test room, outside this one. The water jet was projected onto the wall diametrically opposite the door, in its center. During the tests, the window located on the wall diametrically opposite the door was closed, the other two ventilation openings being open. In each test, the same volume of water was pumped out, approx. 640 L, at constant pressure of approx. 4 bar. The mock-ups that have the shape of the letters „T", „Z", „O" and „inverted U" are shown in figure 4. They are made of wood, each letter having a width and height of 30 cm. The thickness of the letters „T", „Z", and „inverted U" is 30 cm, and the diameter of the letter „O" is 30 cm.

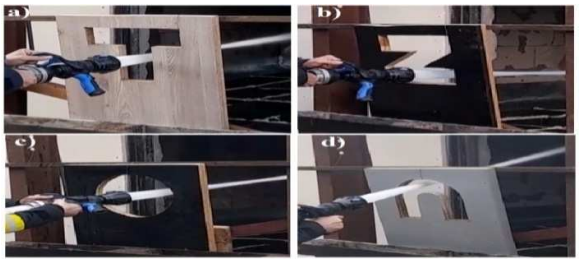


**Fig. 4** Mock-ups for handling the nozzle in the form of the letters: a) „T"; b) „Z"; c) „O"; d) „inverted U"

In the tests, the fire-truck Volvo FLL 4x2 was used [45, 46], equipped with two-stage pump unit MPH 230AN FPN 10-2000/FPH 40-250 – IVECO MAGIRUS. The low pressure stage was also used, characterized by the flow rate of 2000-2500 l/min at 8-10 bars.

## 3. MEASURING EQUIPMENT

During the 12 tests, the same value of the water volume was pumped out, which was equal to 640 L.

**Fig. 5** Akron flow meter

Thus, a flow meter [47] was used, located within the water pumping device at about 1.5 m from the nozzle. The flow meter is shown in figure 5, the water volume value being expressed in gallons.

Also, the water was pumped out at a pressure of approx. 4 bar, this being measured with the help of a manometer [47], located within the water discharge device, approx. 1 m from the discharge pipe, between the pipe and the flow meter. The pressure gauge is shown in figure 6, the water pressure value being expressed in psi.

**Fig. 6** Akron pressure gauge

Water was extracted from the boxes with the help of two pumps, depending on their level in the boxes:

- if the water accumulated in a box reached a height of less than 10 cm, a 12 V Raider type water pump was used, with a flow rate of 4 L/min, the operating pressure being 6.2 bar;
- if the water reached a height greater than 10 cm, a Standard Pump Europe pump, type SPE 250, of 230 V – 50 / 60 Hz, with a power of 250 W, was used.

## 4. ANALYSIS OF RESULTS

Following the three tests carried out for pumping water by manipulating the nozzle in the shape of the letter „T", the following average values of the volume of water accumulated in each box were recorded, these are presented in Table 1.

*Table 1*

**The average of the water volume values (l) accumulated in each of the 81 boxes of water discharge using the „T" letter technique in the 3 tests**

| Wall diametrically opposite the door | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 41.3 | 22.1 | 29.4 | 28.1 | 39.6 | 38.3 | 40.8 | 29.6 | 57.7 |
| 9.1 | 3.1 | 3.7 | 3.1 | 4.4 | 3.5 | 4.8 | 5.4 | 20.4 |
| 3.7 | 0.9 | 0.6 | 0.8 | 1.0 | 0.7 | 1.0 | 1.6 | 10.0 |
| 1.4 | 0.2 | 0.1 | 0.2 | 0.2 | 0.1 | 0.2 | 0.4 | 4.1 |
| 0.7 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 1.7 |
| 0.2 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| The wall on which the door is located | | | | | | | | |

Based on the values of the volume of water accumulated in the boxes located at floor level by manipulating the discharge pipe in the shape of the letter „T", the following graph of the distribution of water in the test room was obtained, according to Figure 7.

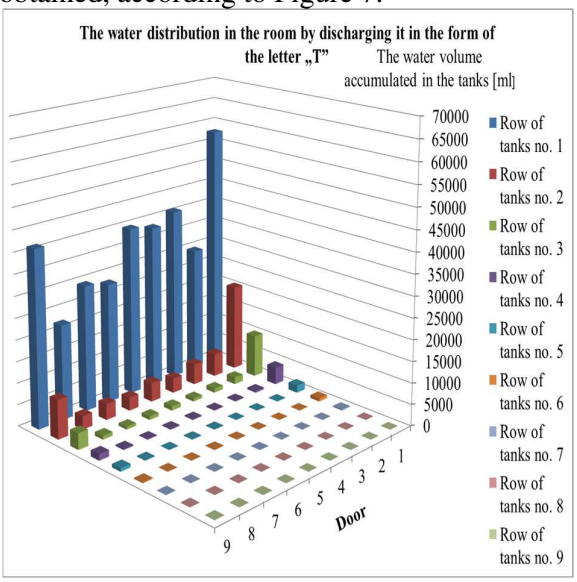


**Fig. 7** Water distribution in the test room following discharging using the „T" letter technique

Following the three tests carried out for pumping water by manipulating the nozzle in the shape of the letter „Z", the following average values of the volume of water accumulated in each box were recorded, these are presented in Table 2.

*Table 2*

**The average of the water volume values (l) accumulated in each of the 81 boxes of water discharge using the „Z" letter technique in the 3 tests**

| Wall diametrically opposite the door | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 55.5 | 35.4 | 33.1 | 29.6 | 28.6 | 28.8 | 31.8 | 30.5 | 57.8 |
| 16.5 | 1.9 | 2.1 | 1.7 | 2.3 | 2.3 | 2.9 | 3.9 | 28.9 |
| 3.1 | 0.7 | 0.6 | 0.6 | 0.6 | 0.6 | 0.7 | 1.4 | 8.5 |
| 1.7 | 0.3 | 0.2 | 0.2 | 0.1 | 0.1 | 0.3 | 0.6 | 5.4 |
| 0.7 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 2.6 |
| 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| The wall on which the door is located | | | | | | | | |

Based on the values of the volume of water accumulated in the boxes located at floor level by manipulating the discharge pipe in the shape of the letter „Z", the following graph of the distribution of water in the test room was obtained, according to Figure 8.

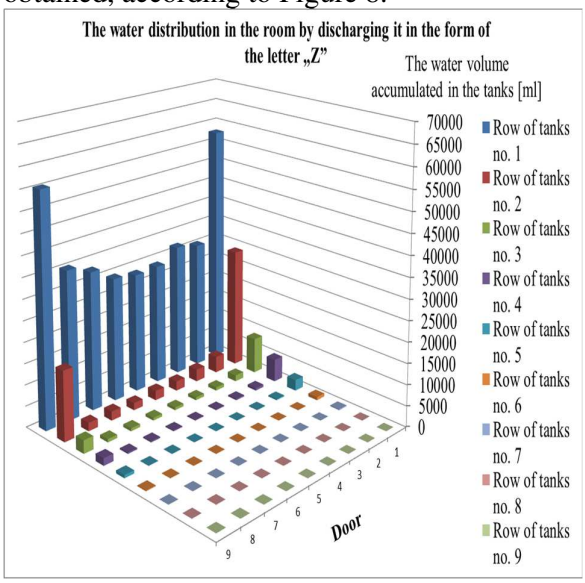


**Fig. 8** Water distribution in the test room following discharging using the „Z" letter technique

Following the three tests carried out for pumping water by manipulating the nozzle in the shape of the letter „O", the following average values of the volume of water accumulated in each box were recorded, these are presented in Table 3.

*Table 3*

**The average of the water volume values (l) accumulated in each of the 81 boxes of water discharge using the „O" letter technique in the 3 tests**

| Wall diametrically opposite the door | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 54.0 | 30.2 | 25.5 | 21.6 | 18.8 | 18.6 | 24.4 | 31.0 | 54.7 |
| 9.7 | 2.5 | 2.9 | 2.4 | 2.9 | 2.6 | 2.9 | 2.5 | 24.8 |
| 4.5 | 1.1 | 0.7 | 0.7 | 0.7 | 0.8 | 0.8 | 0.9 | 7.7 |
| 2.7 | 0.5 | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 0.4 | 4.1 |
| 1.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 1.8 |
| 0.5 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| The wall on which the door is located | | | | | | | | |

Based on the values of the volume of water accumulated in the boxes located at floor level by manipulating the discharge pipe in the shape of the letter „O", the following graph of the distribution of water in the test room was obtained, according to Figure 9.

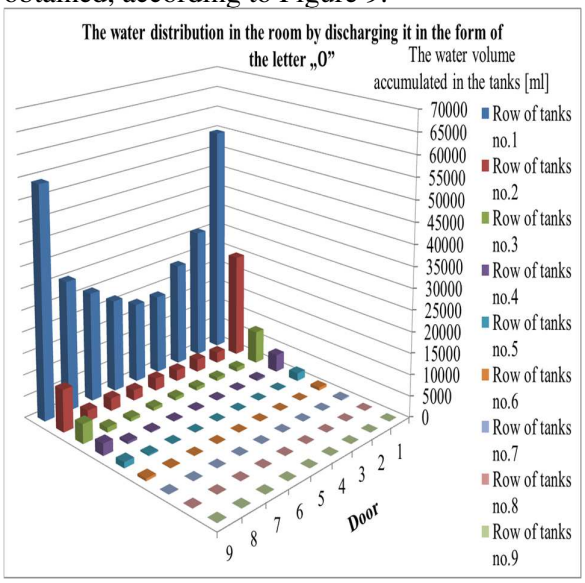


**Fig. 9** Water distribution in the test room following discharging using the „O" letter technique

Following the three tests carried out for pumping water by manipulating the nozzle in the shape of the letter „inverted U", the following average values of the volume of water accumulated in each box were recorded, these are presented in Table 4.

*Table 4*

**The average of the water volume values (l) accumulated in each of the 81 boxes of water discharge using the „inverted U" letter technique in the 3 tests**

| Wall diametrically opposite the door | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 62.05 | 30.2 | 20.8 | 16.5 | 15.8 | 12.9 | 16.1 | 19.9 | 63.11 |
| 11.9 | 2.5 | 2.9 | 2.6 | 3.4 | 3.2 | 3.5 | 3.5 | 28.8 |
| 3.7 | 1.4 | 0.9 | 0.9 | 1.0 | 1.0 | 1.6 | 2.0 | 9.4 |
| 2.2 | 0.6 | 0.4 | 0.3 | 0.2 | 0.2 | 0.4 | 0.6 | 4.7 |
| 1.3 | 0.3 | 0.1 | 0.0 | 0.1 | 0.1 | 0.1 | 0.2 | 2.1 |
| 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.6 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| The wall on which the door is located | | | | | | | | |

Based on the values of the volume of water accumulated in the boxes located at floor level by manipulating the discharge pipe in the shape of the letter „inverted U", the following graph of the distribution of water in the test room was obtained, according to Figure 10.

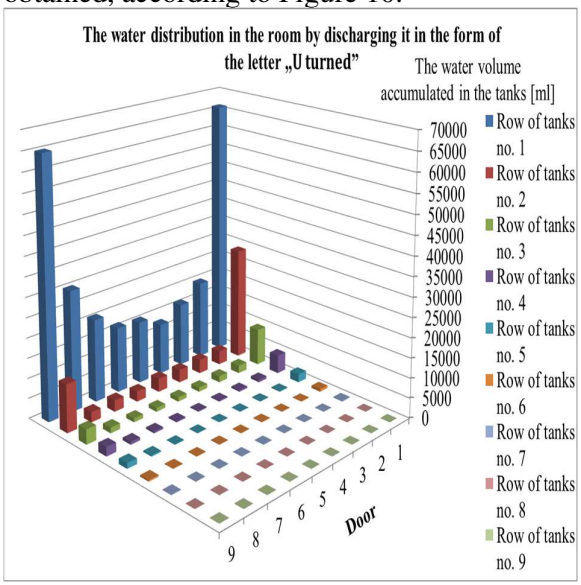


**Fig. 10** Water distribution in the test room following discharging using the „inverted U" letter technique

After pumping water by manipulating the nozzle using the "T", "Z", "O" and "inverted U" letters technique, in all 12 tests, it was found that the highest water volume values were recorded in the first two rows of tubs, located near the wall diametrically opposite the door. Thus, Figure 11 shows the percentage values of the volume of water accumulated in this case.

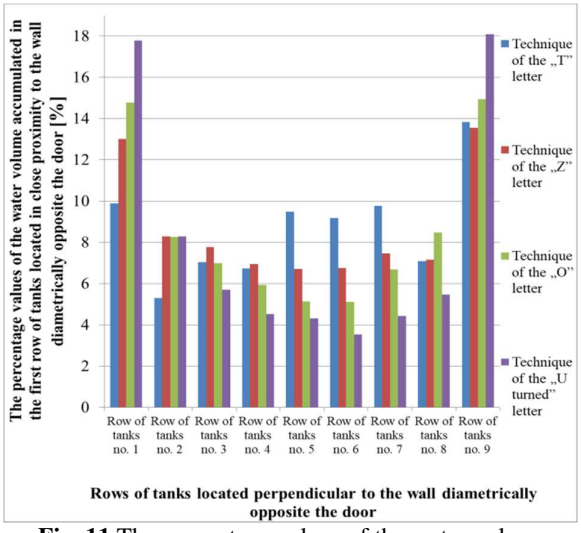


**Fig. 11** The percentage values of the water volume accumulated in the first row of boxes located in close proximity to the wall diametrically opposite the door

Figure 12 shows the percentage values of the water volume accumulated in the second row of boxes located near the wall diametrically opposite the door.

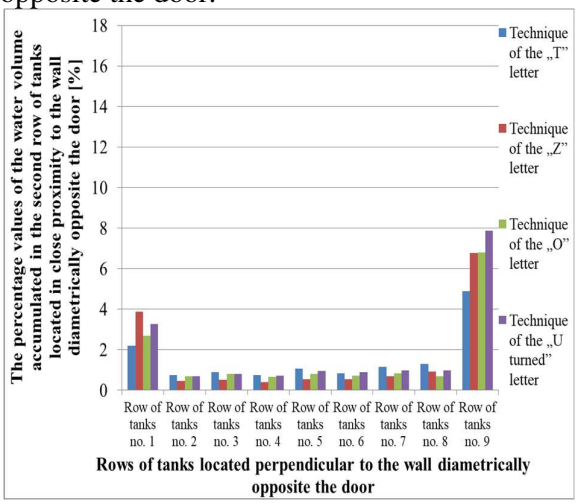


**Fig. 12** The percentage values of the water volume accumulated in the second row of boxes located in close proximity to the wall diametrically opposite the door

Table 5 shows the average values of the speed of making the letters „T", „Z", „O" and „inverted U" after handling the nozzle. The speed of „drawing" is obtained by identifying the number of actions of the nozzles handling in the form of a letter in one minute.

*Table 5*

**The average values of the „drawing" speed of the „T", „Z", „O" and „inverted U" letters following the handling of the nozzle**

| The letter technique used for discharge | The average water discharge time (640 l) | The average value of the letter "drawing" repetitions | The values of the average letter „drawing" speed [number of pipe handling actions in the form of a letter /min] |
|---|---|---|---|
| „T" | 3.36 | 28.33 | 8.41 |
| „Z" | 3.28 | 23.33 | 7.09 |
| „O" | 2.72 | 24.66 | 9.07 |
| „inverted U" | 3.15 | 37 | 11.73 |

Figure 13 shows the percentage values of both the volume of water accumulated in the boxes located on the test room floor and the volume of water lost.

A certain amount of the discharged water volume is lost due to the leakage between the boxes respectively between the boxes and the walls of the room, due to infiltrations through the wall of the aerated concrete located diametrically opposite the door, as well as due to evaporation of water.

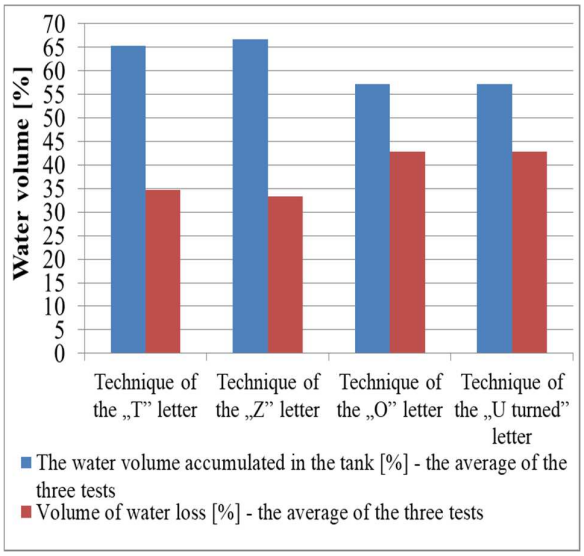


**Fig. 13** The percentage values of the water volume accumulated in the tanks respectively lost after discharging using the "T", "Z", "O" and "inverted U" letters technique

## 5. CONCLUSIONS

Following the water discharge using the "T", "Z", "O" and "inverted U" letters technique, inside a room, a series of conclusions can be drawn.

### 5.1. Identification of areas where large amounts of discharged water accumulate

What is similar, in the case of water discharging using the „T", „Z", „O", „inverted U" letters technique, is the following:

a) The values of the volume of water distributed inside the room are higher at the level of the first 3 rows of boxes near the wall, perpendicular to the direction in which the water jet is projected. Thus, the highest value of the water volume was recorded decreasing in the row of boxes located in the immediate vicinity of the wall diametrically opposite the door, followed by that of the volume of water accumulated in the boxes located on the next two rows.

b) The value of the volume of water accumulated in the rows of boxes located

parallel to the direction of the discharged water jet was recorded in the lateral extremities of the room, namely in the row of boxes located in close proximity to the wall to the right of the door, where the maximum value was obtained, respectively in the row of boxes located in close proximity to the wall to the left of the door.

The different aspects found following the water discharge using the „T", „Z", „O", „inverted U" letters technique are as follows:

c) Using the technique of the letter "T", the highest value of the volume of water accumulated in the row of boxes in the immediate vicinity of the wall diametrically opposite the door was recorded from the middle of the row to the wall to the right of the door. This is explained by the fact that from the wall to the left of the door to the middle of the row of boxes the jet is directed only once, while from the middle of the row of boxes to the wall to the right of the door the jet is directed twice, having two races. Also, in the first box located at the junction between the wall to the left of the door and the wall diametrically opposite the door, the largest volume is recorded in the left half of the boxes located near the wall diametrically opposite to the door because, from the moment the nozzle is opened until the moment the jet is directed a few seconds passed.

d) Using the technique of the letter "Z", the highest value of the volume of water accumulated in the boxes was recorded in the extremities of the room, in the row of boxes located near the wall diametrically opposite the door. The water accumulated in the boxes in the middle of the wall diametrically opposite the door has similar volume values, which are approximately half the value of the water accumulated in the extremities of the wall diametrically opposite the door.

e) Using the "Z" letter technique, the highest value of the water volume accumulated in the boxes was recorded at the extremities of the room, in the row of boxes located near the wall diametrically opposite the door. The water accumulated in the boxes in the middle of the wall diametrically opposite the door has similar volume values, which are about half the value of the water accumulated at the ends of the wall diametrically opposite the door.

f) Using the technique of the letter "O", the highest value of the volume of water accumulated in the boxes was recorded in the extremities of the room, in the row of boxes located near the wall diametrically opposite the door. The values of the volume of water accumulated in the boxes in the row located near the wall diametrically opposite the door decrease symmetrically, from the extremities to the center, where they reach the minimum value.

g) Using the „inverted U" letter technique, the highest value of the volume of water accumulated in the boxes was recorded in the extremities of the room, in the row of boxes located near the wall diametrically opposite the door. Compared to the other letters, using the letter „inverted U" technique, the highest values of the volume of water accumulated in the extremities are obtained. The values of the volume of water accumulated in the boxes in the row located near the wall diametrically opposite the door decrease symmetrically, from the extremities to the center, where they reach the minimum value, compared to the discharge of water in the form of the other letters.

h) By discharging the water in the shape of the letter „inverted U", the first box that reaches the maximum volume is recorded, namely the box located in the right corner of the test room, at the junction between the wall to the right of the door and the wall diametrically opposite the door.

- the results of water discharging in the form of the letter "O" are also validated by the tests performed in the American study [30], the shape of the graphs being similar.

### 5.2. Identification of the average speed of „drawing" a letter

The highest value of the handling speed of the nozzle is obtained in the case of the letter „inverted U", being followed by the values of the speeds recorded in the case of the letters „O" and "Z". The lowest speed is obtained in the case of the letter „Z".

### 5.3. Comparative analysis between the volume of water accumulated at the floor level and the volume of water lost

Pumping the water in the form of the letters „O" and „inverted U", registers the lowest value

of the volume of water accumulated in the boxes, respectively the highest water losses, compared to the pumping of water in the form of the letters „T" and „Z".

It is thus found that, from the point of view of the lowest recorded water losses, it is recommended to discharge the water in the form of the letter "Z", followed by the discharge in the form of the letter "T", "O", respectively „inverted U".

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## Influența refulării apei folosind tehnica literelor „T", „Z", „O" și „U întors" asupra distribuției acesteia într-un spațiu închis

Cunoașterea modului în care apa este distribuită în urma refulării acesteia într-un spațiu închis este necesară pentru eficientizarea stingerii incendiilor. Folosind tehnica literelor „T", „Z", „O" și „U întors" de refulare a apei în interiorul unei încăperi de testare, în absența focului, pe peretele diametral opus, se pot extrage câteva concluzii principale: în apropierea peretelui diametral opus zonei din care a fost refulată apa s-au înregistrat cele mai mari valori ale volumului apei acumulate; din punctul de vedere al celor mai mici pierderi de apă înregistrate, se recomandă refularea apei în forma literei „Z", fiind urmată de refularea în forma literei „T", „O", respectiv „U întors".

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