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Automated Innovative Method of Fire Extinguishing at Car Fuel Stations

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Abstract: *In the Republic of Uzbekistan, road transportation accounts for more than 90% of all cargo and passenger movements. In turn, this necessitates safe vehicle operating. The quantity and quality of gasoline and lubricants used in transportation vehicles have a significant impact on their economic and economical performance. Modern Car Fuel Stations with high-speed, self-service pumps will be on-site to enable consumers to refuel their automobiles more quickly than ever before in order to do this. The Car Fuel Stations, however, has a higher risk of fire. The Car Fuel Stations needs to install an automated, round-the-clock fire extinguishing system as a result.*

Keywords: *gas station, hazard, safe operation, protected investment, fire, flammability, flammable liquid, automated system, reservoir capacity, experimental parameter, assimilation, flow.*

Purpose of the research. In the Republic of Uzbekistan, road transportation accounts for more than 90% of all cargo and passenger movements. In turn, this necessitates safe vehicle operating. The quantity and quality of gasoline and lubricants used in transportation vehicles have a significant impact on their economic and economical performance. Modern Car Fuel Stations with high-speed, self-service pumps will be on-site to enable consumers to refuel their automobiles more quickly than ever before in order to do this. The Car Fuel Stations, however, has a higher risk of fire. The Car Fuel Stations needs to install an automated, round-the-clock fire extinguishing system as a result.

Designing an innovative fire extinguishing system at gas stations. The following preliminary data should be available for the technological calculation of Car Fuel Stations:

- branch's mission, work order and daily hours;
- number of daily refuelings;
- average amount of fuel per vehicle;
- 1-hour flow capacity of the fuel tank;
- storage period of fuels and oils;
- the number of types of fuels and oils distributed;
- reservoir capacity.

In order to carry out the technological calculation of the research, we received the following normative data of Car Fuel Stations:

- organization of work in two shifts and evening duty during the year and day;

- average amount of refueling - 50 l, and for oil - 2 l;
- capacity of fuel tanks - 25 m 3;
- capacity of reservoirs for oil products - 5 m3;
- the number of types of fuel is 3 - 4, the number of types of oil products - 2-3;
- In 1 hour, the throughput of the fuel tank is 15 cars, and the oil tank is 20 cars.;

Technological calculation of Car Fuel Stations. The average consumption quantities for each category—cars, trucks, buses, and special equipment—are calculated technologically at gas stations for private automobiles in populous locations.:

$$q_{or} = \frac{A_1 * q_1 + A_2 * q_2 + \ldots + A_n * q_n}{A_1 + A_2 + \ldots + A_n},$$

Here A_1, A_2, ... A_n - the number of cars belonging to this category that are close to each other in terms of engine capacity and fuel consumption, units;

q_1 q_2 ...q_n - A_1 A_2 ... A_n - average fuel consumption for buses grouped into microgroups (for local climate and road conditions), liters/100km.

The average daily fuel consumption of a group of cars grouped into one category

$$Q_{gr} = A_i * \alpha * l_{o'r} * q_{o'r} * 10^{-3}, \text{ming litr}$$

here A_i - the number of cars in the group $A = A_1 + A_2 + \ldots A_n$

α - coefficient of departure of cars, for private cars α - between 0.8/0.9 is acceptable.

$L_{o'r}$ - the average path traveled was accepted through studies. This in turn,

Average for cars ~ 80 - 100km.

Average for trucks ~50 - 80km.

Average for buses ~ 200km can be accepted.

Daily fuel consumption for all classes of cars:

$$\sum_i^n Q_{gr}^i = Q_1 + Q_2 + \ldots + Q_n, \text{ thousand liters/day}$$

This quantity of gasoline is not dispersed evenly throughout the day. For instance, 4–10 times as many automobiles stop to refuel during the morning and evening rush hours than they do at other times of the day. The peak period is taken into consideration by the coefficient E, which is introduced as a result. The following formula is then used to determine how long each fuel type's distribution period lasts in an hour.

$$Q_{\max}^s = \frac{\sum_i^n Q_{gr} * E}{j}, \text{ litr/soat,}$$

in this case, the value of the coefficient E is taken as E = 10 if the number of cars in a densely populated area is more than the average, and E = 4 if it is less.

J is the working hours of the branch and it can be accepted in j = 8, 12, 18, 24 hours.

The probability of the need for fuel distribution columns is determined as follows:

$$K_{yo} = \frac{Q_{\max}^s}{N_k * K_t * \beta * 60_t},$$

K_{yo} - number of fuel dispensers, pcs;

$Q^{s}_{\max}$ ...- volume of refueling in one hour (peak time), liter;

N_k - one column's fuel injection capacity per minute (throughput) 40,50,60 l/min;

K_t - the technical readiness of the columns, the average coefficient of technical adjustment, $K_t \sim 0{,}85$;

β - technological efficiency coefficient of the casting line.

The technological efficiency coefficient of the pouring method is determined by the following formula

$$\beta_e = \frac{t_n}{T_{um}},$$

In turn, the total time required to refuel a car is equal to the sum of the following components:

$$T_{um} = t_t + t_{tsh} + t_n + t_{yi}\text{ , soniya,}$$

t_t - preparation time, the time it took to place the car next to the fuel dispenser, to open the tank cover, to install the tap, sec.

t_{ish} - time spent on organizational work, sec. The moment of actions such as counting money from the customer, handing it over to the treasury, getting permission to pour, and returning to the tap.

t_n - time taken to open the tap, sec

t_{yi} - after pouring the indicated amount of fuel, the time taken to put the tap back in place, close the tank cap and allow the driver to walk, to walk out of the place occupied by the car, sec.

Calculated fuel reserve, in liters:

$$З_{yo} = H_s \cdot в_{yo} \cdot Д_z$$

here:

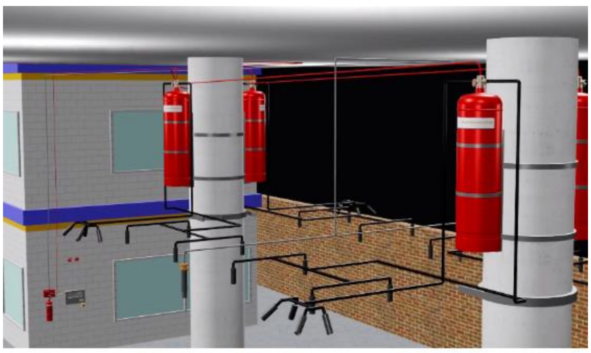
H_s - number of refuelings per day;

$в_{yo}$ - amount of one fuel injection, l;

$Д_z$ - fuel reserve period, days.

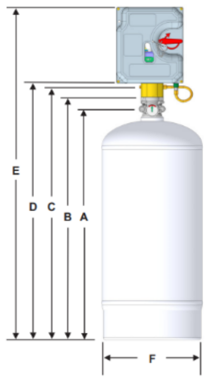
The ratio of the fuel reserve to the capacity of the typical tank determines the number of tanks.

When estimating the requirement for car fuel stations, consider locations 20–40 kilometers from major cities. It should be noted that 90% of the vehicles moving in the distance are vehicles traveling on suburban routes for work. It should be expected for the calculations that around 50% of vehicles will require refueling at this distance. As a result, it is expected that the coefficient of the requirement to refuel cars is equal to $K = 0{,}5$



1-rasm. Yong'inni aniqlash va avtomatik o'chirish innovatsion tizimi

100 kilometers further down the road from these cities. not more than 75% of the traffic speed when it comes to the percentage of automobiles in each segment that need to refill. In this instance, the adjustment factor is equal to -0.75. This makes it evident that modern technology is needed to replace any potential fire extinguishing at petrol stations. Due to the significant risk of fire at car fuel stations, an innovative fire-fighting system with fire detection and automatic extinguishing was created in order to decrease the number of man-made catastrophes and avoid human fatalities. (Fig. 1).



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Cylinders containing wet carbon chemical media are placed under nitrogen pressure (1207 kPa at 21 °C). (Fig. 2). In turn, this enables rapid and efficient fire suppression, cooling of the surface, and re-ignition prevention. use dry nitrogen to pressurize. A manometer can regulate the cylinder's operational state.

The mechanical actuator, which pushes propellant gas into the fire extinguisher cylinder pneumatically and mechanically, is a stainless steel box with a fixed cover on the front.

A plate on the lid that displays the condition of the device moves when it gets a signal from a heat-sensing sensor. This system is 100% accurate and operates around the clock. In the time it takes the fire department to arrive, an automatic fire extinguishing system puts out the fire, greatly limiting the damage.

Fire protection requirements.

1. According to fire safety rules, car fuel stations need to include fire extinguishers. Every fire extinguisher in the Car Fuel Stations' buildings and on their property is constantly ready for use. must be prepared and tweaked.
2. In line with current regulations, the area around car fuel stations must be lighted at night with lamps that do not explode in the event of a fire.
3. Special clothing, footwear, and personal safety equipment must be given to operators at car fueling stations.
4. During a thunderstorm, it is illegal to refuel automobiles at car gasoline stations and to spill petroleum products into reservoirs.
5. Non-sparking equipment must be used while performing work in areas where there is a risk of explosion.

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