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RESEARCH OF METROLOGICAL AND TECHNICAL CHARACTERISTICS OF FUEL DISPENSING LINES

The article substantiates the need to conduct a study of objects - fuel dispensers used at gas stations. A fuel dispenser is a unit of gas station equipment designed to dispense one or more types of liquid fuel and pour it into the fuel tanks of vehicles. A fuel dispenser can be equipped with any number of fuel dispensers. The fuel dispensed is measured by measuring vessels or volumetric meters and recorded by a control device. The dispensers can have manual, remote and combined control. On automatic control dispensers, fuel is dispensed after a key is inserted into the corresponding slot of the panel, a plastic magnetic card or a token is lowered. The most common fuel dispensers have a capacity of 5-40 l/min with a minimum fuel dispensing dose of 2 l.

All modern fuel dispensers are equipped with an electronic control system. This allows not only to activate the fuel supply remotely, from the operators workplace, but also to track the refueling process on the computer and display of the fuel dispenser. Mechanical devices are now practically not used. The article expands the capabilities of modern columns, outlines the principles underlying the functional capabilities. A detailed analysis is carried out to identify the optimal equipment for use in different climatic conditions. The choice of the type of fuel dispensers for further modernization of the gas station network is justified. The subject of the study will be the modernization of the technological equipment of fuel dispensers based on the metrological and technical characteristics of the object, and the object of the study is the fuel dispenser.

Keywords: research, control, accuracy, fuel dispenser, metrological support, gas station.

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ДОСЛІДЖЕННЯ МЕТРОЛОГІЧНИХ І ТЕХНІЧНИХ ХАРАКТЕРИСТИК ПАЛИВОРОЗДАВАЛЬНИХ КОЛОНОК

У статті обґрунтована необхідність проведення дослідження об'єктів - паливороздавальних колонок, що використовуються на автозаправних станціях.

Паливороздавальна колонка - це одиниця обладнання автозаправної станції, призначена для відпуску одного або декількох видів рідкого палива та його розливу в паливні баки транспортних засобів. Паливороздавальна колонка може бути оснащена будь-якою кількістю паливороздавальних пістолетів. Паливо, що відпускається, вимірюється мірними судинами або об'ємними лічильниками і реєструється контрольним пристроєм. Колонки можуть мати ручне, дистанційне та комбіноване керування. На колонках з автоматичним керуванням видача палива проводиться після того, як у відповідне гніздо панелі вставлено ключ, опущено пластикову магнітну картку або жетон. Найбільш поширені колонки продуктивністю 5-40 л/хв з мінімальною дозою відпуску палива 2 л. Усі сучасні колонки оснащені електронною системою керування. Це дозволяє не тільки активувати подачу палива дистанційно, з робочого місця оператора, але й відстежити процес заправки на комп'ютері та дисплеї паливороздавального агрегату. Механічні пристрої зараз практично не використовуються.

У статті розглянуто можливості сучасних колонок, окреслено принципи, що лежать в основі їх функціональних можливостей. Реалізовано детальний аналіз з метою виявлення оптимального обладнання для використання в різних кліматичних умовах. Обґрунтовано вибір типу паливороздавальних колонок для подальшої модернізації мережі автозаправних станцій. Предметом дослідження буде модернізація технологічного обладнання паливороздавальних колонок на основі метрологічних і технічних характеристик об'єкта.

Ключові слова: дослідження, контроль, точність, паливороздавальна колонка, метрологічне забезпечення, автозаправна станція.

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Introduction

Metrological support of gas stations is a complex of works that consists of organizational and technical measures, technical means, rules and

norms that ensure the unity and necessary accuracy of measurements during the operation of gas station equipment, quantitative accounting of petroleum products during reception, storage, release, as well as under the time of determination of oil product quality indicators.

The high-quality performance of these works is ensured in compliance with the requirements of standards, regulatory documents, taking into account quality criteria and established metrological standards of accuracy [1-4].

The metrological support work at gas stations must comply with:

- creating the necessary conditions for obtaining reliable measurement information when determining the quantity and quality indicators of petroleum products;
- organization and provision of metrological maintenance of measuring instruments: accounting, storage, verification, calibration, adjustment, repair, adjustment;
- analysis of the state of measurements;
- requirements for verification and calibration of measuring instruments;
- the requirements of the measurement technique to ensure the accuracy of the measurements being performed;
- metrological examination of design and technological documentation;
- supervision of control, measuring and testing equipment in real operating conditions, in compliance with established metrological rules and norms;
- ensuring reliable accounting of costs of material, raw materials and fuel and energy resources;
- development and implementation of modern methods and means of measurement, automation of control and measurement equipment, measurement systems;
- assessment of technical and economic consequences of the results of inaccurate measurements;
- organization of staff training.

The main element of a gas station is a fuel dispenser. The entire activity of gas stations depends on the quality of its work. The question of choosing a dispenser during construction, reconstruction or replacement of old equipment comes to the fore. Fuel dispensers are always in front of customers, so not only the technical side is important, but also the appearance.

Fuel dispenser - a unit of equipment at a gas station designed to dispense one or more types of liquid fuel and dispense it into the fuel tanks of vehicles or into consumer containers. A fuel

dispenser is installed at a gas station, oil depot or at filling stations. The dispenser can be equipped with 10 dispensing nozzles and up to 5 types of fuel. The fuel dispensed is measured by measuring containers or volumetric meters and recorded by a control device.

Fuel dispensers can have manual, remote and combined control. The most common are fuel dispensers with a capacity of 5-40 l/min with a minimum fuel dispensing dose of 2 l. All modern fuel dispensers are equipped with an electronic control system. This allows not only to activate the fuel supply remotely, from the operators workplace, but also to track the refueling process on the computer and display of the fuel dispenser itself. Mechanical devices are now practically not used.

Analysis of recent achievements

First of all, metrological equipment should have such characteristics as quality and reliability. An essential condition for its operation is strict compliance with all applicable norms and standards.

From January 2023 to January 2024, a series of experimental data was obtained based on the operation of fuel dispensers depending on climatic conditions. To study the issue in detail, Tokheim Quantum 510 and Dresser Wayne Hellix 6000 series dispensers manufactured in the USA were used at gas stations in the southern region of Ukraine.

Every month for 12 months, the staff of gas stations carried out the pouring of fuel dispensers using a measuring device at different temperatures, the data obtained as a result of the pouring were recorded in the Acts of the pouring of the fuel dispenser in electronic form in accordance with the instructions [5]. For the experiment, columns with a service life of no more than 5 years and the same A-95 fuel consumption in liters were used.

The purpose of the study

Research into the influence of climatic conditions of southern Ukraine on the metrological and technical characteristics of fuel dispensers.

Research questions

The research considered the following issues:

- analysis of the designs of modern fuel dispensers and determination of their functional capabilities;
- comparison of the metrological and technical characteristics of these dispensers;
- determination of the most optimal design of fuel dispenser equipment in terms of metrological indicators for the climatic conditions of southern Ukraine.

Research Methods. Review of Tokheim Quantum series fuel dispensers.

On picture 1 shows the external view of the Tokheim Quantum Q510M remote control.



Figure 1 – External view of the Tokheim Quantum Q510M control panel.

Tokheims history began with a hardware store in Iowa over a century ago. Merchant John J. Tokheim was looking for a way to improve the delivery of gasoline. In 1898, he invented a pump for distilling petroleum products from a buried tank ("Tokheim Dome Oil Pump"), for performing work. The popularity of his invention led to the organization of the company "Tokheim Manufacturing Company" in Cedar Rapids, Iowa (USA) in 1901 and the further development of fuel dispensers. At facilities in the southern region of Ukraine, Tokheim Quantum Q510 pressure fuel dispenser for 5 types of fuel, 10 fuel dispensers are used. Productivity is 50 l/min. Table 1 presents the main technical characteristics of the dispensers [6].

Table 1 Technical characteristics

Producer	Tokheim
Type of FD	Pushy
Number of sleeves	10
Productivity	50 l/min
Article	Q510 5-10
Orientation	Linear
Piston gauge	TQM with built-in pulsator MR T1
FD with standard speed	40 l/min
High-speed FD	80 l/min
Model	Bilateral and unilateral
Volume meter	TQM piston meter with built-in MR T1 pulsator
Calculator	The WWC T1 or TQC calculator combines all the main available communication protocols
Information board	LED backlit LCD display with 6 characters for price and volume and 4 characters for unit price

Ambient conditions
External temperatures: from -25°C to +55°C
Cold climate: from -40°C to +55°C
Liquid temperature: from -25°C to +25°C
Liquid viscosity: <10-4 m ² /s
Relative humidity: from 5% to 95%
Height above sea level: up to 2000 m
Key options
ECVR vapor selection system
Several taps for the selection of steam
Display of the status of the selection of vapors with the help of an LED
Electronic calibration
Programming switch
Preset keyboard
Compatible with infrared remote control
Mechanical counters
Electromechanical counters
40/80 speed selection button
filter outlet for TQP pump
Serviceable reusable filters
Satellite connection for one or two sides
Compliance with E85
Additional anti-corrosion protection for painted surfaces
Stainless steel panels

Dresser Wayne Series Fuel Dispensers Review

Picture 2 shows the external view of the Dresser Wayne Helix 6000 PRC.



Figure 2 – Appearance of the Dresser Wayne Helix 6000 control panel.

Wayne, a global manufacturer of fuel dispensers for retail and transportation companies,

leads the way in technological innovation for a variety of applications, from green fuel solutions and pay-at-the-pump security systems to multimedia marketing and innovative facility management systems.

Wayne has come a long way since the first fuel pump in 1891, and we continue to focus on the future with ever-expanding capabilities. Dresser Wayne was founded in the USA in 1870. Dresser Wayne products have been present on the markets of Eastern Europe since 1994. All equipment supplied for this zone is produced by the company's European branch at the Malmö plant (Sweden). Rich production experience, level of service and a balanced approach to solving problems that arise during the operation of equipment helped Dresser Wayne to quickly adapt to work in Ukraine. The concern once again proved to the whole world that it is a manufacturer of the highest quality equipment. Operation of Dresser Wayne fuel dispensers confirmed their high reliability, maintainability and metrological accuracy. Today, Wayne A.

GE Energy Business is the largest international corporation, which is the only company that presents a complete model range of fuel dispensers for all types of fuel on the market [7].

Table 2 shows the main technical characteristics.

Monthly verification of the accuracy of dispensing petroleum products through a fuel dispenser is carried out by determining the column error for each dispensing tap [8], [12]. The error of a fuel dispenser gun is taken to be the largest value obtained when measuring the doses of fuel dispensed by the gun, according to the readings of a sample (reference) gauge of the II category and calculated taking into account the temperature of petroleum products.

The integrity of the sealing of fuel dispenser control units is checked by the head of the gas station and the metrology control departments and auditors.

The head of the gas station is obliged to:

- check the compliance of the sealing with the schemes described in the passport for the fuel dispenser, when checking the accuracy of dispensing petroleum products through the fuel dispenser and when verifying the column;

- check the condition of the seals - seals bearing the verification stamp: intact, securely pressed, have a clear, legible imprint of the notary's stamp, firmly attached to the fuel dispenser nodes with a wire (cord).

The imprint on the notary's seal corresponds to the actual date of the column verification. Procedure for checking the accuracy of dispensing petroleum products through a fuel dispenser.

Table 2 Technical characteristics

Producer	Dresser Wayne
Type of FD	pressure
Number of sleeves	10
Productivity	120 l/min
Article	Helix 6000
Orientation	Linear
Piston gauge	Wayne iMeter
FD with standard speed	40 l/min
High-speed FD	120 l/min
Model	Bilateral and unilateral
Volume meter	Wayne Piston Gauge
Calculator	iMeter
Information board	Dresser calculator
Ambient conditions	
External temperatures: from -40°C to +60°C	
Liquid temperature: from -25°C to +25°C	
Liquid viscosity: <10-4 m ² /s	
Relative humidity: from 5% to 95%	
Height above sea level: up to 2000 m	
Key options	
Data exchange protocol RS485 - DART 2 wires	
Wayne iMeter High Piston Volumetric Meters	
Proportional valves	
Execution for cold climatic zones	
Elaflex low-temperature hoses are black	
Elaflex low-temperature guns with colored nozzles	
Elaflex split couplings	
Additional heating of the FD electronic unit	
High-contrast display with indication of amount and volume (on each side)	
Separate product price display (on each side)	
Independent power source for saving data (30 min)	
Pressure filter for gasoline/diesel fuel	
Sound accompaniment of events (start/end of product release)	
Threaded nozzles (Pressure FD)/Flexible bellows (Suction FD) for connecting the supply pipeline	
Painting of FD parts using the electrostatic method with standard colors according to the RA catalog	
Data exchange protocol RS485 - DART 2 wires	

The head of the gas station is obliged to:

- instruct everyone who works (gas station employees and service organization employees who participate in conducting technological dispensing for the meter) on the necessary safety measures specified in the current labor protection instructions;
- entry in the Logbook of gas-hazardous work carried out without a permit;
- prepare a schedule "Control of the error of the gas station at the gas station" with a frequency of checks of the accuracy of dispensing petroleum products through the fuel dispenser at least once a

month (if necessary, the frequency of checking the column may be changed).

The head of the gas station is obliged to:

- check the availability of a valid certificate of verification of measuring instruments:

- meter;
- fuel dispensers (presence of a mark on verification in the passport (form) of the columns or a certificate of their verification);
- thermometer.

Prepare and check the thermometer – serviceable, clean and dry. Prepare and check the measuring cylinder - clean and dry, without cracks.

Prepare and check the meter - sealed with the seal of the trustee (the impression on the seal of the state trustee corresponds to the actual date of verification of the meter), without external damage (deformation) of the case, the inspection glass is clean and without cracks, the ampoule of the level is functional.

When checking the accuracy of dispensing petroleum products through a fuel dispenser, sample/reference measuring instruments of the 2nd category with a capacity of 10, 20, 50, 100 or 200 l with a basic relative error of no more than $\pm 0.1\%$ according to DSTU 7219:2011 [9].

The procedure for using measuring instruments is described below. Figure 3 - 5 shows the main measuring instruments for checking the operability of the dispensers. The staff of gas stations checks the error of fuel dispensers using a meter included in the list of measuring instruments of the station (or issued as a substitute).



Figure 3 – Hydrometer for measuring fuel

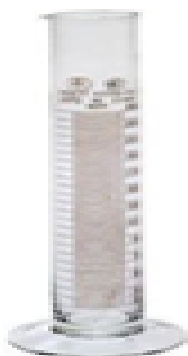


Figure 4 – Measuring cylinder



Figure 5 – Measurer (Calibration tank)

Specialists of the service organization can use both the station meter and the meter of the service organization.

Conduct an external inspection of the fuel dispensers and check:

- compliance of the serial number on the fuel dispenser nameplate with the number indicated in the passport (form);
- absence of damage to the casing lining, assembly units and communications of the column;
- clarity of the image of the inscriptions on the nameplate, as well as numbers and marks on the indicators of one-time and total accounting;
- absence of stains and cracks on the display that prevent reading of information;
- absence of dirt on the glasses of the indicators of one-time (total) accounting;
- absence of leaks at the joints and seals during test switching on;
- tightness of the column, having inspected the joints (the column is considered to be tight if no traces of fuel leakage are found during the inspection of the column joints and the dispensing valve). If there has been no oil product release from the fuel dispensing "gun" scheduled for inspection for a long time (several hours or more), conduct a preliminary spill of PRP in the volume of 20 liters.

Stop the sale of oil products of the brand being tested at the fuel dispensing column being tested by covering the side of the column with a signal cone (if two guns have a volume meter, then do not release this brand of oil products at the column being tested).

To thermostat the gauge, fill and empty the gauge to bring the temperature of the gauge to the temperature of the oil products:

Insert the nozzle of the column dispensing valve into the neck of the gauge.

Fill the gauge with oil products in the volume of - 20 liters.

Completely drain the oil product from the measuring cup through the funnel into the drain device pipeline only into the tank from which the oil product was taken. Wait for at least a minute for the drops to drain. The funnel must be made of a material that does not accumulate static electricity and does not spark when struck. When emptying the measuring cup, it is allowed to use an intermediate container (bucket or canister) only for oil products and from a material that does not accumulate static electricity and does not spark when struck, in order to reduce the downtime of the column. Drain oil products from a bucket or canister into the tank only through a funnel.

The accuracy of dispensing petroleum products through the fuel dispenser is carried out for each fuel dispenser "gun" of the column. The upper end of the receiving nozzle of the meter should not be higher than a meter from the ground level. Install the meter on a flat, rigid surface at its own level. Empty the fuel dispenser gun being tested and the meter from the petroleum product residues into a container (bucket), holding for at least 1 minute. Insert the nozzle of the gun into the neck of the meter. Set the volume of the petroleum product dose on the predial panel or in the automated control system. Press the gun lever and start dispensing the dose. Wait for the end of dispensing the dose into the meter (it stops automatically and is considered completed after the fuel stops flowing out of the gun nozzle). Return the fuel dispenser gun lever to its original position. Wait for the upper level of the oil product in the measuring device to settle. Determine the volume of the actually dispensed dose of oil product: Subtract the reading of the measuring device from the level of the oil product that has set on the neck from the zero mark of the error scale with an accuracy of 0.01 l.

Completely drain the oil product from the measuring device through the funnel into the pipeline of the drain device into the tank from which the oil product was dispensed into the measuring device.

Wait for the drops to drain - 1 minute. The limits of the permissible error of the fuel dispenser are $\pm 0.5\%$;

If the deviation is within the norm during the first measurement, and the second - there is an excess of the norm, then a third measurement of the dose volume is made, and the second measurement is taken as the error value.

If there is a deviation from the norm in the first measurement and there is a deviation from the norm

in the second measurement, then the third volume measurement is not made, the largest error value is taken as the error value.

If there is a deviation from the norm in the first measurement, and there are no deviations in the second measurement, then a third measurement must be made.

And, if there is a deviation from the norm in the third measurement, then the largest error value is taken as the error value.

Monthly monitoring of the operation of fuel dispenser meters is carried out when monitoring the accuracy of dispensing petroleum products through the column. The manager is obliged to:

When monitoring the error of the fuel dispenser, visually record the operation of the meter. Monitor the entry of meter readings into the service sheet by an employee of the contracting organization.

Enter readings into the fuel dispenser forms and the column operation log [5].

During the inventory at the gas station, the inventory commission draws up an Act of total meter readings and signs it with the manager. In case of a discrepancy of more than 100 liters, official inspections are carried out (if necessary).

Received data

Comparative analysis of metrological and technical characteristics of fuel dispensers Tokheim Quantum 510 and Dresser Wayne Hellix 6000

To analyze the characteristics of the dispensers, we will indicate the main criteria by which the assessment will be conducted:

1. Accuracy
2. Reliability
3. Repairability
4. Price
5. Ease of operation

A comparative analysis of the metrological and technical characteristics of the Tokheim Quantum 510 and Dresser Wayne Hellix 600 dispensers was conducted.

Table 3 presents a comparative analysis of the technical characteristics of the fuel dispensers.

Table 4 analyzes the operation of the fuel dispensers under changing climatic conditions when pouring the dispensers onto a meter.

To analyze the operation and failure of the technological equipment of the fuel dispensers, specialized software was used based on the database from the automated system for managing technical equipment and repairing equipment of the gas station.

Equipment failures were analyzed and qualified based on the data of the fuel dispensers.

Table 3 Comparative analysis of technical characteristics of fuel dispensers

№	Technical characteristics	Tokheim Quantum 510	Dresser Wayne Hellix 6000
1	Maximum performance	120 l/min	130 l/min
2	Temperature range	-40C to +55C -40C to +60C	-40C to +55C -40C to +60C
3	Mechanical counters	For each RC	General for the type of fuel
4	Relative humidity	From 5% to 95%	From 5% to 95%
5	Information board	LCD display with LED backlight with 6 characters.	
6	Volume meter	TQM (serviceable)	iMetr (not serviceable)
7	Data exchange protocol	RS 485	RS 485
8	Preset keyboard	Available with FD	An additional module is required
9	Electronic counters	In stock	In stock
10	Steam selection system	ECVR	
11	Setting the release dose	Mechanical/Electronic	Electronic
12	Counting calculator	QM	Dresser

Table 4 Analysis of fuel dispenser operation under changing climatic conditions

	Model FD	Temperature Environment °C	Temperature fuel °C	Accuracy FD %	Permissible accuracy %
1	Tokheim Quantum 510	-5-15	-1	0,45	±0,5
2		-5-10	-1	0,42	±0,5
3		0+10	6	0,4	±0,5
4		+10+15	10	0,38	±0,5
5		+15+25	15	0,35	±0,5
6		+25+30	22	0,3	±0,5
7		+25+40	26	0,3	±0,5
8		+30+35	22	0,24	±0,5
9		+15+25	17	0,26	±0,5
10		+5 +15	11	0,25	±0,5
11		0 -5	+1	0,33	±0,5
12		-5 -10	-1	0,32	±0,5
1	Dresser Wayne Hellix 6000	-5-15	+1	0,33	±0,5
2		-5-10	+3	0,35	±0,5
3		0+10	12	0,30	±0,5
4		+10+15	17	0,31	±0,5
5		+15+25	22	0,28	±0,5
6		+25+30	22	0,26	±0,5
7		+25+40	23	0,23	±0,5
8		+30+35	-5	0,26	±0,5
9		+15+25	-8	0,28	±0,5
10		+5 +15	-6	0,3	±0,5
11		0 -5	-8	0,33	±0,5
12		-5 -10	-7	0,32	±0,5

Table 5 analyzes the operation and failure of the technological equipment of the Tokheim Quantum 510 and Dresser Wayne Hellix 6000 fuel dispensers.

The classification of failures was carried out

according to two main criteria:

- Mechanical component of the dispensers;
- Electronic component of the dispensers.

Table 5 Analysis of the operation and failure of the technological equipment of the Tokheim Quantum 510 and Dresser Wayne Hellix 6000 Fds

№	Model FD	Temperature environment °C	Failure of technological equipment of FD in %					
			Mechanical component of FD			Electronic component of FD		
			Volume meter	Valve double action	Pump	Engine	Display	Pay management
1	Tokheim Quantum 510	-5-15	80%	10%	10%			
2		-5-10						
3		0+10						
4		+10+15						
5		+15+25						
6		+25+30						
7		+25+40	40%	30%	30%			
8		+30+35						
9		+15+25						
10		+5 +15						
11		0-5	40%	10%	20%	30%		
12		-5 -10	50%	30%	0	20%		
1	Dresser Wayne Hellix 6000	-5-15	50%	30%	20%			
2		-5-10						
3		0+10						
4		+10+15						
5		+15+25						
6		+25+30						
7		+25+40						
8		+30+35						
9		+15+25						
10		+5 +15						
11		0 -5						
12		-5 -10	30%	40%	20%	10%		

Figure 6 shows the failure of the Tokheim Quantum 510 technological equipment.

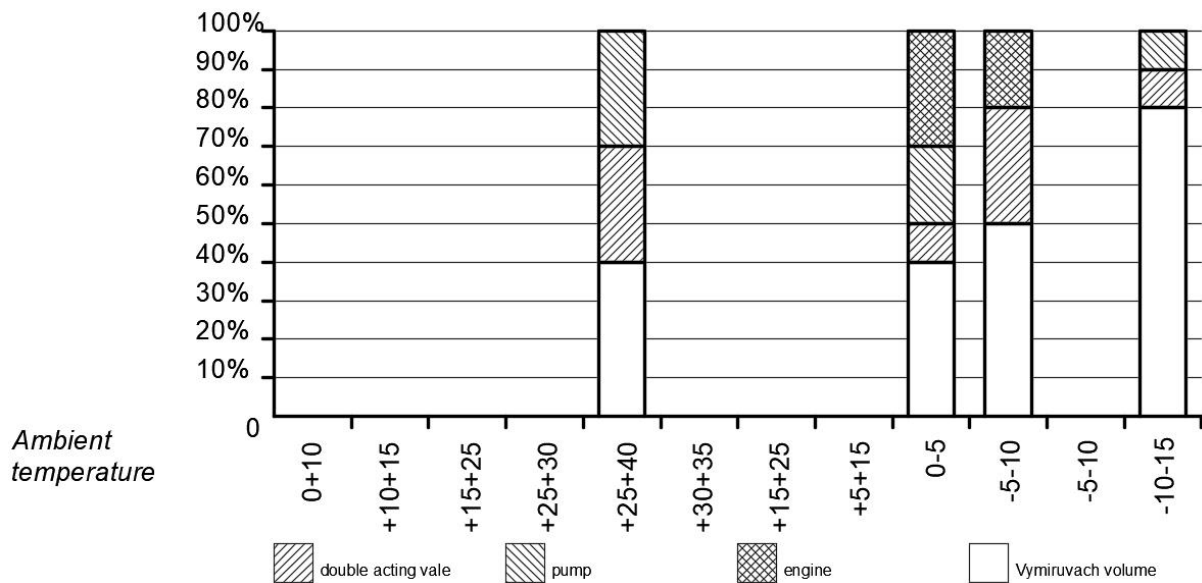


Figure 6 – Failure of the technological equipment of the Tokheim Quantum 510 FD

Figure 7 shows the failure of the Tokheim Quantum 510 technological equipment.

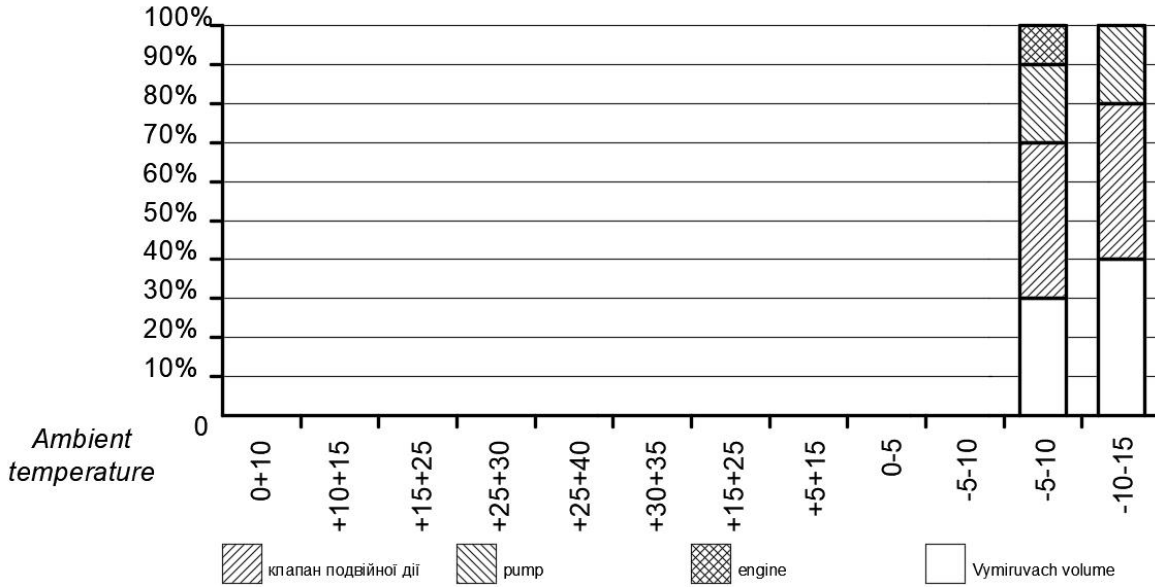


Figure 7 – Failure of the technological equipment of the Dresser Wayne Hellix 6000 FD

Comparative analysis of the verification of fuel dispensers Tokheim Quantum 510 and Dresser Wayne Hellix 6000

According to the Technical Regulations [11], fuel dispensers undergo conformity assessment according to the relevant module and periodic verification, which is carried out in accordance with the DSTU 8912:2019 methodology [8]. In case of need for adjustment or repair, an extraordinary

verification is carried out. In case of a positive verification result, seals with the seal of the verifier are installed in accordance with the sealing schemes given in the description of the dispenser. It is not allowed to refuel vehicles and dispense petroleum products through unverified and unsealed fuel dispensers. Table 6 presents the sealing of the main components on the Tokheim Quantum 510 and Dresser Wayne Hellix 6000 fuel dispensers

Table 6 shows the sealing of the main nodes on the Tokheim Quantum 510 and Dresser Wayne Hellix 6000

Model FD	Volume meter	Sensor impulse	Pay management	Summary counter	Regulatory screw	Spending time, min.
Tokheim Quantum 510	+	+	+	+	+	98
Dresser Wayne Hellix 6000	+	+	+	+	-	72

Lets analyze the data obtained in Picture 5 on the basis of the Pareta chart of Dresser Wayne Hellix 6000 FD.

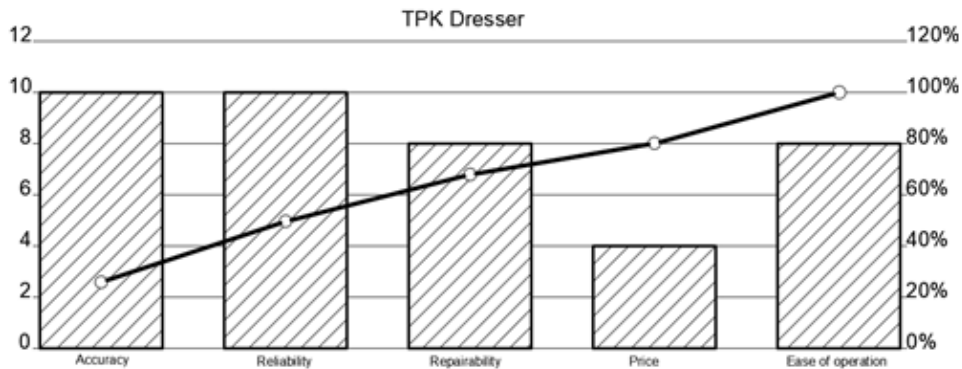


Figure 8 – Dresser Wayne Hellix 6000 PRC Pareto diagram

Lets analyze the data obtained in Picture 9 on the basis of the Pareto diagram.

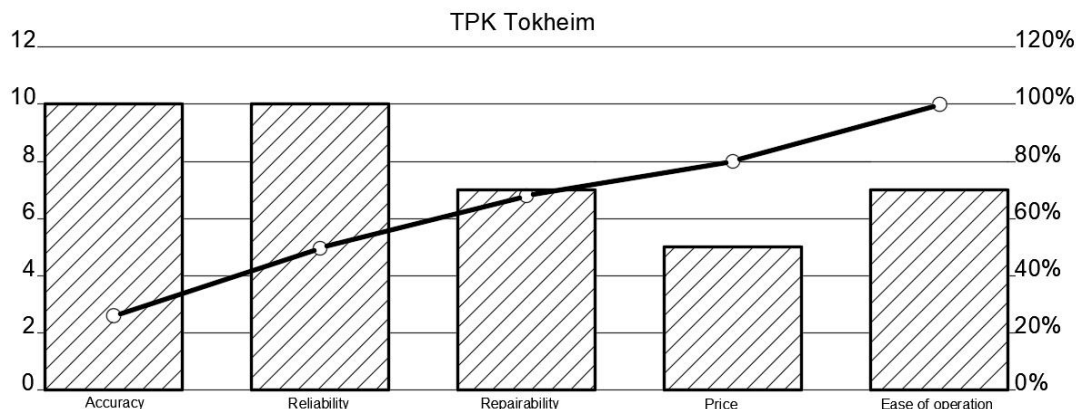


Figure 9 – Pareto diagram of Tokheim FD

Conclusions

The article examines modern fuel dispensers used at Ukrainian gas stations; a comparative analysis of their functional capabilities, metrological and technical characteristics is conducted.

Based on the data of experimental studies of the designs of fuel dispensers of different companies in the climatic conditions of southern Ukraine, it can be concluded that fuel dispensers of the Dresser Wayne company have pronounced advantages over the columns in terms of "Repairability" and "Ease of operation", while fuel dispensers of the Tokheim company significantly win in terms of pricing. However, the weight of the criterion in terms of "Repairability" and "Ease of operation" is more significant in relation to the price. Therefore, it can be stated that the columns of the Dresser company are more optimal equipment for use at gas stations in the southern region of Ukraine.

It should be noted that the metrological equipment of gas stations is a necessary component of the entire process of quality control and quantity of products. The control and measuring instruments of this line are responsible for the efficiency and safety of petroleum product supply facilities.

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