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Increasing Reliability of the Improved Machines and Equipment: Determination of Productivity Criteria

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ABSTRACT
The article first defined machines and equipment safety coefficient. The coefficient of reliability of machines is expressed by quality indicator machines and equipment. It is proposed to introduction to the science reliability coefficient as a quality indicator by the ratio for different environments the average value of the statistical probability of non-stop work for different environments with a maximum limit (i.e. in a lab environment)
Keywords: *reliability, workability, reliability coefficient, quality indicator, work's non-stopping, probability.*

INTRODUCTION

The cause of the accidents that occur during the operation of machinery and equipment results as an unexpected deterioration before the stipulated time period. These accidents conduce loss of people along with the loss statements. The main aspects standing in front of Industry's development is the creation of environmentally safe and economically efficient machines and equipment. Launching of planned equipment and machines that's selected based on the reliability of the equipment will make guarantee to run them as far as possible within the required time. Entirely, the indication of this reliability must be such a criterion that it should be kept its force in the different conditions along with the characterization of overall quality of machines and equipment.

METHODOLOGY

It is impossible to imagine the different areas of modern industry without machines and equipments. The foundation of development of the profitable economy is the existence of reliable, owning the highest of working capacity and durability of the machines and equipment. In different situations, and due to many causes of the equipment exposed to deterioration, friction, and so on out of order [2,3,4]. The causes of these out of orders are many different reasons depending on the parameters of working environment and their work. From being that these equipment and machines were formed from different nodes, the failure of these nodes results in failure of the whole equipment [4]. When operating the untimely out of order of the appointed time the equipment is economically unprofitable.

In the modern mechanical engineering the creation and introduction in the industry of new reliable designs with higher workability of machines and equipment is and will be an urgent task.

Reliability is a term of machines and equipment and depends on the trouble free of the nodes in separately. The basis of the reliability of the product of its quality.

To ensure the creation of reliability criterion for machines and equipment working in an any environment needs a predetermining of reliability criterion for this equipment. The main task of modern mechanical engineering is the creation of machines and equipments owning the highest reliability of indicators for working in different operational environments.

Machines and equipment of which requires the highest responsibility with the release of them on exploitation should ensure safe operation before the appointed time and it is their reliability. But we know that equipment reliability indicator for one on exploitation environment cannot justify itself with the same success in other operating environment.

At release of machines and equipment in operation is necessary the correct choice of their criterion of reliability and evaluate of these criteria for the different operational environments will give a guarantee for durable work of these equipments. So need such definition of the criteria reliability for this criterion characterized the quality of operation of machines and equipment in various operational environments.

For a correct solution of this problem is necessary to investigate the factors affecting the reliability indices mainly two directions:

1. Research in different operational environments causes a loss of working capacity of details and units of machines and equipments.
2. Searching the factors which resulted the loss of machines and equipment's parts and nodes workability in laboratory condition on the basis of the adopted regulations

Titled regulatory environment under obviously the condition like in these conditions, machines and equipment have a maximum reliability. In the same machines and equipment working in the laboratory accepted regulatory conditions reliability indices will be more than working in the operational conditions. This different attitude can be evaluated as a relative indicator of quality. Applying this experience to different conditions of operation we obtain various indicators of reliability with different values. So, if some factors affecting to the reliability are indicators of quality machines and equipment construction, the latter an indicator of the quality against the impact of environment depending on environmental parameters. Any machine in different environments has different reliability. Definitions for one environment reliability index should not be taken as a general criterion for machines and equipments.

The ratio of the average value of reliability index for different environments to the maximum limit of reliability (indicated reliability in the laboratory conditions) can be accepted as a critical coefficient, and with this determined the exact operational indicators of reliability of machines and equipments. With the help of operational reliability indexes characterized mainly the statistical probability of of nonstop work.

To solve the problem we use the laws of probability. Suppose that, in the N-rated number of Equipment set has been exploited in the laboratory to adopt normative condition and in the n-rated number of different conditions.

For laboratory conditions statistical probability of nonstop work is characterized by ratio between the amount of work pieces, with the total amount of product being under control [1,2].

$$P^*(t_l) = \frac{N(t_l)}{N(0)} = \frac{N(0) - n(t_l)}{N(0)} = 1 - \frac{n(t_l)}{N(0)} \tag{1}$$

Here n (tl) - in the laboratory conditions, the amount of product stop due to problems at a working time t, N (0) - t = 0 is the number of work pieces, for laboratory and operation environments, the number of work pieces are equal; N (tl) -in laboratory conditions the number of work items, $i-$ number of operational environments

Determining $i-$

$$P^*(t_{m1}) = 1 - \frac{n(t_{m1})}{N(0)}$$

$$P^*(t_{m2}) = 1 - \frac{n(t_{m2})}{N(0)}$$

$$(2)$$

$$P^*(t_{mi}) = 1 - \frac{n(t_{mi})}{N(0)} \tag{2}$$

We determine from the formula (2) - the average value of the statistical probability of nonstop work

$$P_{or}{}^*(t_{mi}) = i - \sum_{n=1}^{i} \frac{n(t_{mn})}{N(0)} = i - \frac{1}{N(0)} \sum n(t_{mi}) \tag{3}$$

The ratios of the average value of reliability for different environments statistical probability of nonstop work between the maximum limit under laboratory conditions is called a coefficient of reliability and is denoted K:

Then for quality indicator

$$K_e = \frac{P_{or}^{*}(t_{mi})}{P_l^{*}(t_l)} = \frac{i \cdot N(0) - \sum_{n=1}^{i} n(t_{mn})}{N(0) - n(t_i)}$$

(4)

We will obtain a formula (4)

According to formula (4) can be calculated safety coefficient for any machines and standardizing make the table. On the basis of this table, you can select machines and equipment complies with safety, to ensure safe and trouble-free operation in the operation of the selected design in a required time period.

RESULT
1. Determined the quality coefficient reliability index of machines and equipments for different environments.
2. Obtained the analytical presentation for determining the coefficient of reliability machines and equipment

DISCUSSION
Research work has been carried out in the department of "Oil and Gas equipment". The Research Work has been dedicated to the reliability of machines and equipment as well as the ones use in oil and gas sector.

The source of interest and discussion of presented work is inclusion of reliability coefficient to quality criteria.

Scientific research work was discussed during the meeting and scientific seminars of "Oil-gas Equipment" department at Azerbaijan State Oil and Industrial University and recommended for publication in the popular press [3].

Determination of machines and equipment reliability based on a specific environment can not completely characterize its quality indication. Because, climatic conditions, the variety of working parameters and the instability of these parameters prevent the reliability to be same in 2 different conditions. Based on a reliability indication of machines and equipment for a specific condition can not accurately characterize the quality indication

Ratio of average estimation of reliability indicator for the different conditions to the maximum level of reliability value what means the ratio of reliability that's calculated in the laboratory conditions based on the accepted standards (references) can be accurately determined the machines and equipment's reliability indication like a concept of adopting a critical factor.

The exploitation reliability indication mainly characterizes statistical probability of work's non-stopping [1].

In this scientific research Work, the ratio of non-stopping statistical probability's average value for the different conditions of machines and equipment's running to the standard value suggested to call reliability coefficient" and include as a new concept to science.

For the calculation of reliability coefficient, following formula was appointed:

$$K_e = \frac{i \cdot N(0) - \sum_{n=1}^{i} n(t_{mn})}{N(0) - n(t_i)}$$

Machines and equipment quality indicators will be completely characterized by above mentioned formula

CONCLUSION
Determination of reliability in different conditions based on the possibility of working without rejection for each kind of equipment and machines will define the quality of equipment. Making a reference to this point during the exploitation of machines and equipment will be the guarantee to the provision of running of machines and equipment without the rejection within the required duration.

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