A STUDY ON QUALITY ANALYSIS MEASURING PROCESS

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Abstract. *The paper presents the results of a study concerning the use of the Ishikawa diagram in analyzing the causes that determine errors in the measuring the sizes of the pieces of machine construction field. The studied problem was "errors in the measurement process" and this constitutes the head of the Ishikawa diagram skeleton.All the possible, main and secondary causes that could generate the studied problem were identified. The paper shows the potential causes of the studied problem, which were firstly grouped in fives categories, as follows: man/people methods, machines/ measuring devices, material/ piece of measured, environment. Performing the Ishikawa diagram in a more detailed form in order to determine the potential causes of a found defect has the advantage that it offers the possibility to identify and analyze all factors, which relate to the problem studied. The paper presented a formula for the Ishikawa diagram was determined, 4M+E.*

Keywords: measurement , errors, quality management, Ishikawa

1. INTRODUCTION

Measurement is a practical process by which it is determined the value of a physical measurement reported in a unit measurement using a standard means of measuring or work. The means of standard measurement using standard metrics and checking other means to measure. Work Means measured using the measurement operations performed during technological processes and laboratory measurements.

Practical determinations have shown that in case of measuring the same size several times, each time a different value may be obtained, although the measurements are under the same conditions with the same measurement and the same operator. By measuring it is not determined the true value of a quantity but determine a value close to true. It is said that it is determined the amount of size with some degree of accuracy, higher or lower.

The measurement error theory has a great importance because measurements made must be processed and compensated for the resulting actual value to be as close to the real value of that size.

An important issue in the measurement process is optimal accuracy. Thus, in practice measurements should be considered the necessary and sufficient optimal precision. A much greater precision imposed in the measuring operation, causes great expense undue operator training and the means of measurement with an insufficient low accuracy, causing a low quality of measurement results.

Measurements made over time have shown that insufficient precision measurements generated inconsistencies between theory and practice. Evolution of technology has led to the improvement and measurement devices as well as developing a proper theory of measurements and measurement errors. During the measuring operation of a size, there are carried out a minimum number of measurements and if necessary additional measurements to raise the measurement accuracy.

To raise measurement accuracy, can be made a quality analysis measuring process by identifying all the causes that can cause errors in this process. A suitable method in this case may be the use of a classic quality management tool, Fishbone diagram (Ishikawa diagram).

When talking about Ishikawa diagram, it must remember that Dr. Kaoru Ishikawa was a Japanese professor who had major contributions in terms of innovative developments in the field of quality management. Kaoru Ishikawa is best known for developing the concept of Fishbone diagram. The design is like a skeleton diagram of a fish, whose head is the problem studied, and the bones of the skeleton are what causes the problem.

In [13] it is shown that obtaining a correct diagram is possible only through working in a team with experience. An interesting model of Ishikawa diagram was studied in the case of some automotive defects [7], [8],[11].

In [9] it is presented a method for assessing the quality of welding by applying one of the classic instruments of quality management.

Ishikawa diagram application areas are continuously expanding. For example, nowadays the method is also being applied in the medical field [6].

In [10] it is presented a study for application the cause-effect diagram inpublic order field.

This paper presents the results of a study concerning the use of the Ishikawa diagram in analyzing the causes that determine a non-quality problem in the measurement process. The studied problem was “errors in the measurement process”.

The development of the Ishikawa diagram in a detailed form for determining the possible causes of a problem has the advantage of giving the possibility of identifying and analyzing all the factors connected to the problem.

2. STUDY CONCERNING THE USE OF THE ISHIKAWA DIAGRAM IN ANALYZING THE CAUSES THAT DETERMINE ERRORS IN THE MEASUREMENT PROCESS

The non-quality problemstudiedin this paperis"**errors in the measurement process**".The research method used to determine Ishikawa diagram is based on work steps proposed byDale [2], namely the following: It is defined very clearly the effect of the problem considered; It is written the effect in the right and it is drawn a line from right to left; It is checked if each team member has understood well the problem; They are determined the main categories of causes which are the main branches of the diagram; It is organized a brainstorming session to determine possible secondary causes; It is organized another brainstorming session in order to discuss in detail the causes and to determine those who have the major degree of probability for producing the studied effect; They are traced and recorded the appropriate sub-branches.

Following thebrainstormingsessionconductedwith thespecialists from technical measurementsand metrology field,potentialcauses were identifiedcoming from5main directions: Man/ operator, Methods, Machines/ Measuring devices, Material/ Measured piece and Environment. Next is shows potential secondary cause identified and grouped into 5 main categories of causes.

a. Man/ Operator: Tired and nervous operator;Inexperienced operator;Inadequate training; Inattention to readings; Wrong readings registration;Wrong calculations;Parallax error;Failing to detect a gross errors in a string of values; Not applying the corrections generated by errors.

b. Methods: Inadequate measuring method; Inaccurate measuring scheme; Misuse of measurement method; Error of the position of the measured object; Error of the position of the device; Failure of Abbe principle; Inaccurate regularization to the nominal size; Number n of

the realized measurements; Not applying the corrections generated by errors; Different measurement conditions for the n measurements; Methodwith large systematic errors; Rounding measurement results.

c.Machines/ Measuring devices: Errors of the device limiting the measurement force; Improper adjustment; Unsuitable probes; Improper position of the probe; Machines checked with inadequate standards; Imprecision of execution of machine components (imprecision dimensional geometric form and position); Wear the device components; Wear on contact surfaces; Fidelity, fairness, resolving power; Accuracy of the device; Errors of principle of operation; Correlation between allowed limit errors of measurement of the device and fabrication tolerance.

d.Material/ Measured piece: Deformation of the piece under the force measurement; The piece temperature; Imprecision of controlled area; Insufficient hardness of the surface; Variable orientation of the piece.

e. Environment: Temperature; Pressure; Humidity; Vibrations; Noise; Gravitational acceleration; Light.

Knowing all causes that can lead to measurement errors can be calculated the total limit error of the measurement method using analytical methods and / or experimental methods. If the total measurement error limit isn't considered, the measurement results will have a high degree of uncertainty. This may produce undesirable effects to accept that some good songs improper parts or scrap pieces to reject as some pieces that are executed properly.

3. A MODEL (4M+E)FOR ISHIKAWA DIAGRAM

We determined main possible causes and potential sub-causes. For each of the 5 categories of causes there were distributed potential secondary causes on groups of 4M+E (man/ operator, methods, machines/ measuring devices, material/ measured piece, environment). This diagram is presented inthe paper, in figure 1.

On the left side of the diagram are shown all identified secondary causes, which are categorized by main causes. On the right side of the chart is written the effect, the problem for which the specific causes have been determined. The problem presented in the study is "errors in the measurement process."

4. CONCLUSIONS

Quality management tools help organizations to increase efficiency and quality assessment and analysis of industrial processes.

Therefore, the use of such instruments should be a basic practice in organizations that want to work at high quality standards ..

The development of Ishikawa diagram in a more detailed form, has the advantage of being able to identify and analyze the factors that cause a negative issue (a defect).

The use of Ishikawa diagram for quality analysis measuring process has the advantage that it provides a complete picture of all possible causes that generate errors in the measurement process.

It is important to correctly calculate the total measurement error limit to reduce measurement uncertainty, to take into account all the factors that cause measurement errors.

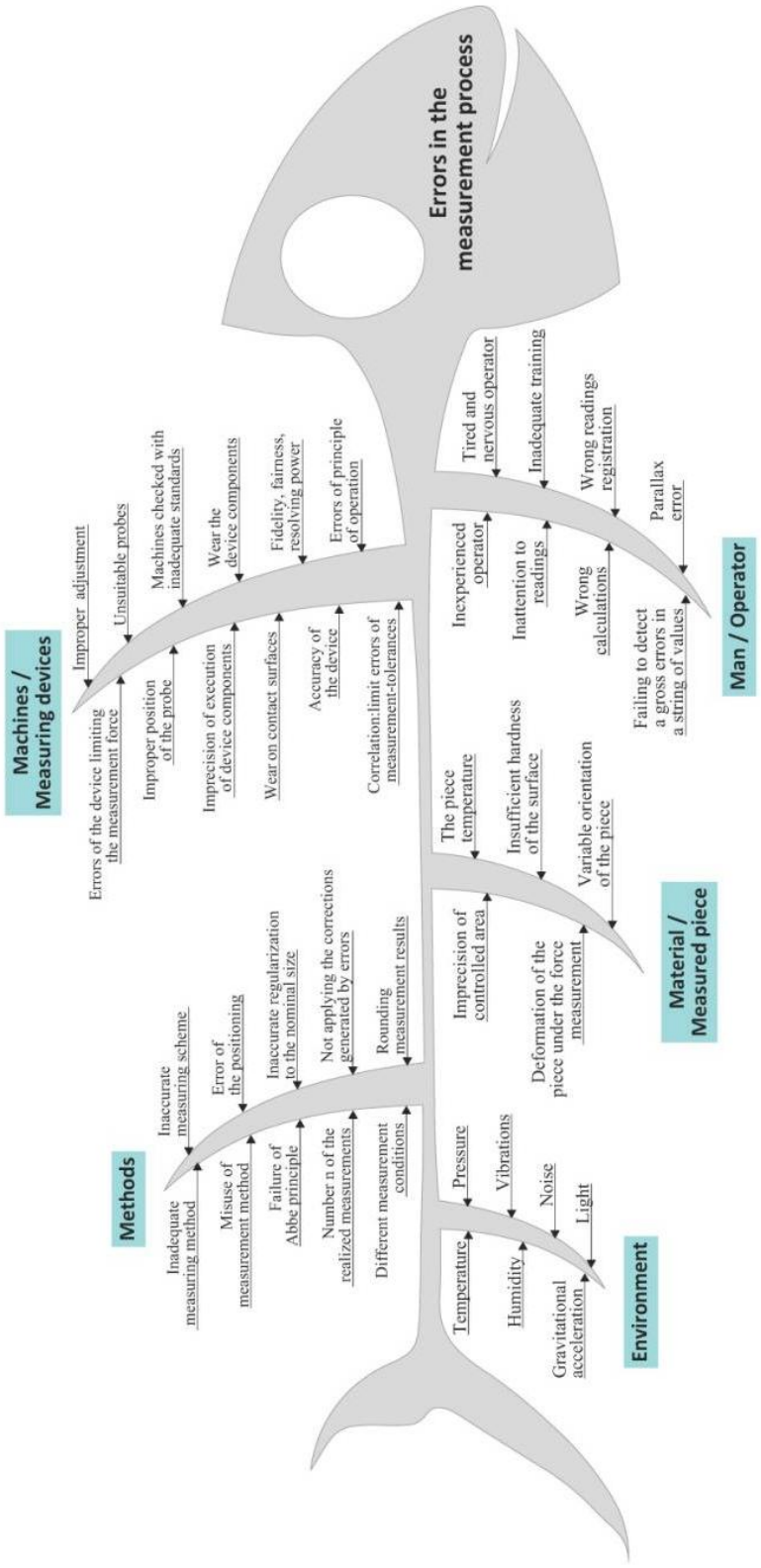

Fig. 1. *Ishikawa diagram*

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