THE EFFECTIVENESS OF THE QUALITY SYSTEM MANAGEMENT
IN THE SPHEROIDAL IRON FOUNDRY

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Abstract
The results of researches that was conducted in the iron foundry in 1999 – 2004 years were presented in the paper. The researches were based on the assessment of effectiveness of the production quality system management of the spheroidal iron casts. The determinants of three groups of estimation criterion were characterized. In technological criteria required values of dimensional tolerance, the value of required hardness, raggedness, required values of the coefficients’ of scatting process and also acceptable fraction of the products were taken under consideration. In the economical criteria: assumed values of internal and external costs of product defects. The exploitation criteria can include required level of the reliability or durability and required value of products repairability. The obtained results point on too high costs of lacks in technological criteria. The undertakings were proposed in order to decrease them..

1. INTRODUCTION
The quality assurance systems present the necessity and standard in a company, their analysis and effectiveness assessment have even greater meaning. Reparation activities conducted in the company won’t bring the positive changes and results if the quality system effectiveness assessment doesn’t present correct estimation and diagnosis of the real quality system. The quality system effectiveness assessment is necessary for identification of the differences between the real quality system and planned one[1].

Assessment system of the quality system effectiveness consists of the following systems:

- Assessment system,
- Diagnostic system
  - Quality service,
  - Finanse service,
  - Analitical centre,
- Operational results use system.

System using the assessment results initiates the assessment procedure, it formulates the estimation problems for the diagnostic system. Elaboration of estimation characteristics corresponding with the estimation problem presents the aim of the diagnostic system. System using the assessment results basing on the quality system effectiveness estimation conducted makes decision about implementing the changes in the estimation system. The structure of assessment system of the quality system effectiveness in the casting foundry is shown at fig.1.
In technological criterion the following features can be taken into consideration: required measurement tolerance value, required hardness or roughness value, required process scatter coefficient or process centring values, admissible part of the products. In economic criterion: assumed values of internal or external product fault costs. Operational criterion may include required reliability or durability level and required product maintainability value. The examples of criterion of estimation of the quality assurance system efficiency in choose stages of realization of cast were introduced on fig. 2.

Figs. 2. Chosen estimation criterion of estimation of the quality system efficiency
2. QUALITY SYSTEM EFFECTIVENESS ASSESSMENT METHODS

Among many other methods cost account and statistic methods seem to be particularly effective. Thanks to statistic methods using the estimation period is shortened and estimation results reliability is obtained. In case of mass and numerous populations statistic methods are the only admissible effectiveness estimation methods. Quality system effectiveness estimation methods in the production stage are cost account, seven QC tools, investigated measurable characteristic trial methods. Effectiveness estimation methods can be used in the particular stages of casting form production, beginning from the marketing through the project, purchase and delivery production stage to the operation stage, where reliability investigation methods can be used. In investigations two criteria were used: economic criterion, costs of defects and incompatibilities of produced casting articles (serial and individual) were used here and they were referred to assumed acceptable level. In technological criterion using X-R, X-S cards [4,5] three the most essential features: meeting dimension tolerance, strength properties Rm and hardness HB were considered. In selection of methods as well as parameters of estimation it is essential that estimation allows achievement of credible results.

3. ESTIMATION OF QUALITY SYSTEM EFFECTIVENESS IN THE IRON FOUNDRY.

Basing on the data of the casting foundry quality system effectiveness was estimated in aspect of the casting form faults costs in years 1999-2002. Data used for the means of analysis are shown in table 1. Graphic analysis is shown in fig. 3

Table 1- Iron foundry data

<table>
<thead>
<tr>
<th>YERS</th>
<th>Coast%</th>
<th>Delivery faults</th>
<th>Internal faults</th>
<th>Guarantied repairs</th>
<th>Faults cumulated costs</th>
<th>Faults planned costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>0,70</td>
<td>0,20</td>
<td>0,60</td>
<td>1,50</td>
<td>0,90</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>0,65</td>
<td>0,17</td>
<td>0,65</td>
<td>1,47</td>
<td>0,80</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>0,26</td>
<td>0,14</td>
<td>0,28</td>
<td>0,68</td>
<td>0,70</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td>0,20</td>
<td>0,08</td>
<td>0,20</td>
<td>0,48</td>
<td>0,60</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td>0,50</td>
<td>0,40</td>
<td>0,30</td>
<td>1,20</td>
<td>0,50</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>0,20</td>
<td>0,02</td>
<td>0,20</td>
<td>0,42</td>
<td>0,40</td>
<td></td>
</tr>
</tbody>
</table>

The cast forms faults cumulated costs were taken for estimation characteristic R(t) and planned admissible faults costs were taken for the estimation criterion P(t).

Analysis conducted shown that the quality system of iron casting foundry was ineffective till the the year 2001 R(t) – P(t) > 0. By that time the iron foundry were implementing new procedures and new solutions in the field of quality management. Mentioned solutions contributed to achieving the state where faults planned costs proved to be higher than the real ones R(t) – P(t) < 0. Since the year 2001 value of assumed quality system effectiveness estimation characteristic has been within the area of effectiveness.

In year 2003 in the firm large investment connected with extension of assortment of produced casts onto precise casts for motor industry was made. The new machines and technologies were bought what in first period decidedly influenced on destabilization of the process. The cumulated costs of defects - mainly internal, as well as in smaller degree external (guarantee repairs) decidedly increased anticipated costs of defects.
Fig. 2. Assessment characteristics of iron cast.

The introduction of new technology of machines and procedures, change of organization of production faced large resistance of workers connected directly with the production. Even the cases of sabotage from side of workers happened rarely. Only informative campaign of middle level management joint with intensive program of trainings brought to improvement of the situation. After moved correcting workings the character of quality policy criteria of the firm were established newly and expected costs of defects were qualified newly. The increased defects costs were caused by technological factors mainly no meeting requirements of dimension tolerance and mechanical requirements. For above factors estimation of the quality system effectiveness was also moved. Two levels of estimation can be distinguish: first level - cost for managers personnel and chief management, second level - technological criteria for management of production section and for workers directly connected with production department. The estimation of the quality system effectiveness turned out to be necessary and indispensable for improvement of the firms and adaptations to competitive struggle at the market.

BIBLIOGRAPHY