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# Machine-building organization production using quality management methods

# Introduction

**Russian economy: it accounts for about 20% of all industrial production in Russia and 1/3 of industrial employment. Machine-building plants in Russia produce a wide range of products, the range of manufactured products is counted in hundreds of positions. Among the main problems of the sector in the conditions of modern realities in Russia, there is a high depreciation of fixed assets and a low level of innovation. As a result, the low competitiveness of domestic machine-building products in the world market. First of all, competitive advantages can be achieved by improving the quality of manufactured products. Prompt solution of problems related to product quality is achieved by implementing various methods aimed at preventing the appearance of defects. The list of such methods is quite diverse. In mechanical engineering, and in particular in the automotive industry, the 8D method is often used to solve quality problems .**

# Steps of the 8D method

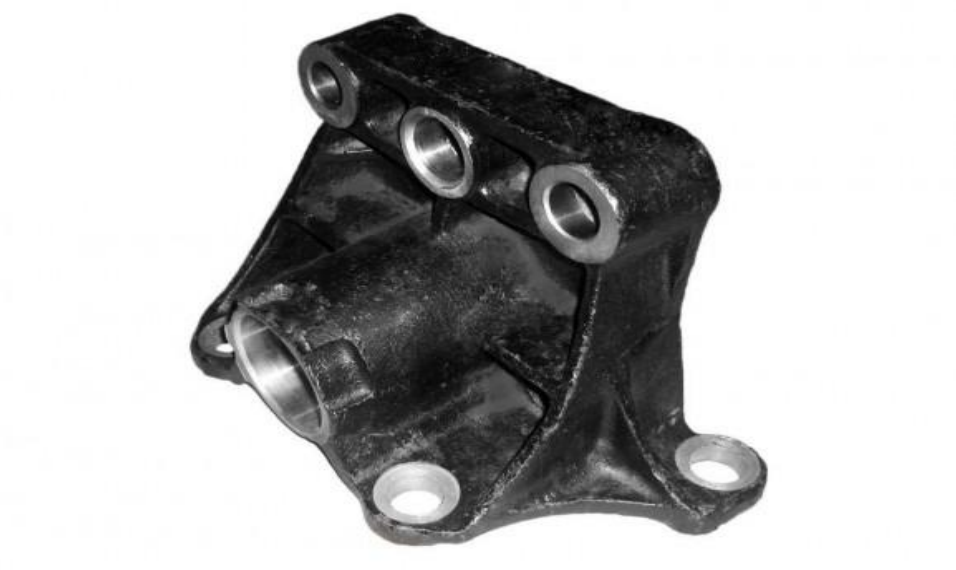
- **D0** • making a decision to start the procedure according to the 8D method
- **D1** • forming a team to solve a problem
- **D2** • defining the essence of the problem
- **D3** • elaboration of temporary / urgent deterrent actions
- **D4** • determining the cause of the problem
- **D5** • identification of long-term corrective actions and their verification
- **D6** • implementing long-term corrective actions
- **D7** • warning actions
- **D8** • summing up

**Methodology 8D-a step-by-step orderly process aimed at solving problems in a methodological and analytical way, by identifying the root causes of nonconformities, applying corrective and preventive actions aimed at preventing problems from occurring in the future. The 8D technique means an eight-step approach to problem solving. Each step is denoted by a «D» with the corresponding number.**

**Figure 2.** a) Balancer axis bracket; b) Enlarged fragment of the casting of the balancing axis bracket with a gas shell.

# The object of research

**As the object of research, the balancing axis bracket for the rear suspension of the KAMAZ car was selected (figure a). The rear suspension of trucks has a balancing device with a single axle pressed into the bracket. The balance suspension ensures the stability of the car, that is, it prevents strong tilts. During the inspection of the finished product, the quality control department controller (QCD) revealed such a discrepancy as a gas shell in the casting of the bracket, which can cause a decrease in the quality and safety of the product (figure b).**



a)

b)

# Description of the «5W+1H» method

| | |
|---|---|
| **Who?** | • *Who discovered the problem first?*<br>• **QCD Controller**<br>• *Who is responsible for what happened?*<br>• **Quality Assurance Department**<br>• *Who does the problem concern?*<br>• **Finished product** |
| **What ?** | • *What happened?*<br>• **A defect was detected in the casting of the balancing axis bracket**<br>• *What type of problem?*<br>• **Gas shell**<br>• *What happens if the problem persists?*<br>• **Infringement of the leakproofness of the connections** |
| **Where?** | • *Where is the problem detected?*<br>• **After manufacturing (on final inspection)**<br>• *Where did the problem occur?*<br>• **At the stages of the production process** |
| **When?** | • *When was the problem first discovered?*<br>• **Detected by QCD controller** |
| **Why?** | • *Why is there a problem?*<br>• **Foundry defect (operator's mistake; equipment breakdown)**<br>• *Why wasn't the problem detected earlier?*<br>• **The control over the finished products was not strict enough**<br>• *Why didn't you try to solve the problem earlier?*<br>• **As soon as the defect was detected, the 8D process was started** |
| **How?** | • *How was the problem recognized?*<br>• **The presence of a defect in the form of a gas shell in the casting was confirmed by inspection through a magnifying glass**<br>• *How does it affect the work of the enterprise?*<br>• **The defective product could get to the consumer**<br>• *If this is a long-standing problem, how has it been dealt with in other cases?*<br>• **Identified for the first time** |

# The main reasons for the discrepancy

| THE MAIN REASON | ROOT CAUSE |
|---|---|
| Methods | – Low temperature of the poured metal |
| Personnel | – Non-compliance with modes, instructions, established procedures |
| Working conditions | – Non-compliant workplace |
| Technology | – Infringement of steelmaking technology<br>– Incorrect choice of product processing methods |
| Materials | – High gas content in the cast workpiece composition;<br>– No ventilation system in the molding mixture;<br>– Gas tightness of the molding mixture |
| Equipment | – Damaged appliances;<br>– Equipment wear and tear |

# Conclusions

**Based on the results of stages D1-D4, the mechanism of the defect occurrence was analyzed and consistently shows how the root cause develops into a specific defect. It was revealed that molds and rods without ventilation channels were used in the manufacture of casting molds (the root cause). Intensive gasification of the combustible components of the mold and rod begins when pouring metal. Excessive gas pressure is created in the mold and rod. It was revealed that the reduction of the gas pressure in the mold was not provided. The total pressure of the gases from the rod and the mold was greater than the pressure of the metal-static head. As a result, a gas shell was formed in the metal (defect). Also, a refrigerator with an oxidized surface was used to cool the casting. Oxides decomposing, form a gas when the melt comes into contact with such a surface. Gas shells appear in the solidifying metal of the casting.**