Algorithms development of making special techniques in APQP manufacturing process of automotive components

D T Safarov, K A Fedorov and A I Ilyasova

Kazan Federal University, Naberezhnye Chelny Institute
Pr. Mira 68/19, Naberezhnye Chelny, Republic of Tatarstan, Russia, 423812

Abstract. Special techniques algorithms are worked out, such as MSA, preparation of management plans, SPC in the preparation of manufacturing automotive components that improve its effectiveness.

Features of automotive industry are large volumes of products. The vehicle is a structurally complex object. Head factory itself is not able to produce many automotive components and is forced to work with no less than 500 suppliers. And if one of them fails to supply (not provide the quality or hamper deadlines), problems can arise in the entire corporate system. The complexity of working with suppliers is determined not only by their number, but also by a variety of automotive components. These are both large aggregates and all electronic components and a variety of materials, standard products. Therefore, the headquarter plant is extremely important to work with any supplier by one and the same technique. Now this is a production part approval process (PPAP) [1].

American motor corporations developed it in the early 1990-s, and today it is standardized on the global scale. The supplier must submit a package of 19 documents and samples (Fig. 1) to the consumer after completing pre-production of automotive components previously not supplied, as well as in the event of provider significant changes in the production. The data set should confirm to the consumer the quality of the components, the stability of its production processes, as well as the effectiveness of the quality assurance system supplier. A standardized version of the procedure is fairly common. All the world's leading corporations develop on its own corporate system based on the approval of the production, that is, require suppliers to provide more detailed information.

Unfortunately, Russian motor corporations continue to operate facing mainly to the domestic market. From the time of administrative economy it inherited tradition to accelerate the start of series production without paying attention to the quality of its preparation.

The basis for production management in our enterprises is still the Taylor system, which was enough to assign standardized requirements and monitor their implementation. And long-running managers and specialists, and current students, who are still trained with the same Soviet educational standards that are designed to train future plans for batch production performers.
For our corporation this procedure has not yet been worked out. The owners of the main plant are not sure of the prospects for development. They are important only for today's high profitability. Main factories do not pay enough attention to the objectivity of the data set. Russian specifics of preparation kit are that all suppliers do not concern about the objectivity of the data set. Instead of cooperation to strengthen the position of consumers in a competitive market environment they solve a simpler problem: to stay at any cost among the existing suppliers. And for this is considered valid to cover existing problems in the production by the formal report, not bothering tracking information from the technical documentation in the form of PPAP.
If the pre-production made with omissions, (it is studied in most universities only as a branch of the discipline “Production and Management”), then the process documentation and maintenance of PPAP documents in fact cannot reflect the real state of production.

For a small enterprise specialized in manufacturing parts when PPAP situation occurs, it is suggested for the representative consumer (he provides interaction) to prepare a work plan agreed with the customer.

On the plan basis order form is prepared for each performer. In the context of a small business it is likely to be a representative of the consumer itself, technologist, quality management representative. Technical work on the design of the kit can be performed by the assistant director.

Fig. 2 Algorithm analysis of measurement processes.
Fig. 3 Algorithm of technological process capabilities analysis.

To increase understanding of information value by professionals to manage quality it is proposed to consider a set of PPAP in relation to the reconciliation of mandatory detention of all documents on management of production processes. The fact that it is quite often to do this, it is important to do this as quickly as possible, avoiding mistakes that could lead to a denial of production approval. During pre-production a number of special procedures is done in accordance with [1, 2, 3, 4]. В том числе особенное на это этапе особое внимание следует уделить проектированию специального инструмента, повышающего производительность [5].

Let’s consider algorithms which perform the most complex practical commissioning (Fig. 2.3). So procedures confirm the suitability of the measurement of quality key indicators which are accomplished in the following sequence: stability is investigated and then displacement of the measurement process is estimated and only in case of success of both procedures of convergence and repeatability is analyzed and then a protocol analysis and registration is issued.

Another procedure is a confirmation of statistical quality (stability) of technological process (SPC). It requires initial alignment of the content of routings, management planning, briefing operator registration process conditions - the failure of which may result in the impossibility of the determination of corrective actions in case of discrepancies.

Наибольшую результативность в улучшении качества продукции можно достичь применяя одновременно с SPC - методику диагностирования по показателям технологической точности, когда степень идентификации обрабатываемой детали значительно повышается [6, 7]. С применением методик непосредственного диагностирования состояния узлов оборудования [8].
Algorithms and other mandatory procedures are developed, such as the development of process flow charts, plans of quality management, action on a result of the production approval by the consumer.

The entire set of algorithms are the basis of existing management processes in enterprises, which reduce errors and improve the effectiveness of the procedures for the preparation of production.

References:
[1] State standard R 51814.5-2005. Quality management system in automotive industry. Analysis of measuring and control processes. (Moscow, Publishing of standards) 63p.
[2] State standard R 51814.3-2001 Quality systems in the automotive industry. Methods for statistical process control. (Moscow, Izdatelstvo standartov) p.35.
[3] State standard R 51814.4-2004 Quality management systems in the automotive industry. Production approval of automotive components. (Moscow, Izdatelstvo standartov) p.43.
[4] State standard R 51814.6-2005 Quality management systems in the automotive industry. Quality management in planning, development and manufacture of automotive components. (Moscow, Izdatelstvo standartov) p.42.
[5] Kondrashov A G, Safarov DT, Davlethina G K 2015, Bit for the core drilling of nonmetals (Article) Russian Engineering Research, Volume 35, Issue 8, 26 August Pages 617-618
[6] Kas'yanov S V, Safarov D T. 2004 Diagnosis of technical state of equipment and tools according to indices of technological accuracy (Article) Avtomobil'naya Promyshlennost Issue 5, Pages 24-28.
[7] Balabanov I P, Balabanova O N, Groshev A V, Formation of initial data of the workpiece batch in simulation modeling precision forming, IOP Conference Series: Materials Science and Engineering, Volume 86, Issue 1, 26 June 2015,
[8] Khusainov R M, Belov S A, Chukhontseva O V 2014, Diagnosis of cnc machine tools in terms of circular interpolation’s accuracy figure/R M Khusainov, S A Belov, IOP Conference Series: Materials Science and Engineering. Volume 69, Issue 1