

# THE ROLE OF CHEMICAL PRODUCT IDENTIFICATION IN THE AVIATION INDUSTRY QUALITY MANAGEMENT SYSTEM

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**Abstract:** the article review the identification of chemical products as one of the important steps in the process of ensuring the quality and safety of chemical products. Without due attention to this process, there are risks of missing a lot of factors affecting the quality of both the material used and the product manufactured using chemical products. The use of standardized approaches, such as the method of identification proposed by the authors, makes it possible to provide additional reliability when confirming the compliance of chemical products with the requirements and, accordingly, to minimize these risks. Some aspects of the application of the proposed identification method in practice are also considered.

**Keywords:** identification of chemical products, aviation industry, specification of materials, standardization, distributed testing center.

## РОЛЬ ИДЕНТИФИКАЦИИ ХИМИЧЕСКОЙ ПРОДУКЦИИ В СИСТЕМЕ МЕНЕДЖМЕНТА КАЧЕСТВА В АВИАЦИОННОЙ ПРОМЫШЛЕННОСТИ

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**Аннотация:** статья рассматривает идентификацию химической продукции как один из важных этапов в процессе обеспечения качества и безопасности химической продукции. Без должного внимания к данному процессу существуют риски упустить множество факторов, влияющих на качество как используемого материала, так и изделия, изготавливаемого с применением химической продукции. Применение стандартизованных подходов, таких как предлагаемая авторами методика идентификации, позволяет обеспечить дополнительную надежность при подтверждении соответствия химической продукции предъявляемым требованиям и соответственно минимизировать указанные риски. Также рассмотрены некоторые аспекты применения предлагаемой методики идентификации на практике.

**Ключевые слова:** идентификация химической продукции, методика идентификации, авиационная промышленность, спецификация материалов, стандартизация, центр распределенных испытаний.

There are the highest requirements for product safety in aviation industry. The implementation of a quality management system in accordance with the national standard GOST R ISO 9001-2015 is insufficient, it is necessary to implement other industry-specific standards, as well as other tools to ensure product quality and safety. The main industry-specific standards containing requirements for quality management systems include national standards prepared on the basis of European standards developed by the Aerospace and Defense Industries Association of Europe - Standardization (ASD STAN):

GOST R EN 9100-2011 Quality management systems of organizations of aviation, space and defense industries. Requirements [1];

GOST R EN 9120-2011 Quality management systems of organizations of aviation, space and defense industries. Requirements for distributors of production [2].

Separately, it is worth mentioning the recently approved national standard, which establishes the general requirements for the management of service providers for the implementation of research and development, development, maintenance and repair, services for the implementation of technological operations in the creation of aviation equipment, materials, semi-finished products and components GOST R 58175-2018 «Aviation equipment. Management of suppliers in the creation of aircraft. General requirements» [3].

The existence of a separate standard with product suppliers' requirements confirms the fact that for the high-tech industries, the aviation industry is a prime example, there is highly complex supply chains specificity. Not always, there is a possibility to apply products of enterprises that have QMS, corresponding to industry-specific standards. So, most of the responsibility is imposed on the manufacturer of the final product. The quality and safety of the final product consists of a combination of indicators and characteristics of many components. Characteristics of the chemical products, materials and substances used in the design or operation of the final product lie at the basis of all this set. For example, GOST R EN 9120-2011 contains requirements for keeping a register of suppliers, including the status of approval and the scope of approval.

To ensure safety requirements compliance for the material used for various purposes, it is necessary to confirm that the material meets certain characteristics. The process of confirming material characteristics, for example structural characteristics or lifetime performance characteristics, is a complex of complicated analyzes and tests. Often the test set includes destructive tests, or tests that require significant time and cost, which give no opportunity to test every material, or every detail on which the safety of an aircraft depends. Two main approaches in test planning for a specific material or article control can be identified: final product quality control and production process quality control, each of which has its own advantages and disadvantages.

In the case of final product quality control, we have direct evidence of quality after the tests in the form of relevant tests protocols, but it is not possible to test each product for compliance with all the characteristics, therefore, in any case there remain risks of obtaining inappropriate products, material or product of the entire lot used.

Production process quality control allows to obtain indirect evidence that material or product meet required characteristics. The peculiarity of the considered production approach is that in the process and material specifications detailed technological process that takes into account all the parameters that can affect the quality of the final product, including specific equipment and tools that should be used in this technological process should be described. This fact gives us a confidence that all products manufactured according to the process specification from materials meeting the material specification will have similar physical and mechanical properties. Thus, in the case where raw materials with proven characteristics are used to produce the material or product under the technological process with strictly observed parameters, the result should be expected. It can be concluded that, if there is reliable information that the production process was performed correctly and the raw materials meet all the requirements, then it is permissible to talk about a significant reduction in the test program or reject inappropriate materials before the finished product is formed.

To solve these problems for composite materials NASA, FAA and the aerospace industry jointly developed an effective method for evaluating systems of composite materials. Using common databases, the manufacturer can choose an approved composite material system for the manufacture of the required parts and control them with a small number of tests.

To be taken into these common databases materials have to be manufactured in accordance with the material specification that establishes control of the main characteristics (physical, chemical and mechanical properties) and have to be processed in accordance with the process specification that controls the key characteristics (processing parameters).

For composite materials, it is necessary to take into account the dependence of the final composite material on the raw materials used for its production - polymer resin and reinforcing fibers for the fibrous polymeric composite material. However, as practice shows, it is difficult to maintain the consistency of the raw material characteristics, and even if there is an established supply chain from reliable producers, it may be necessary to rebuild it, for example, to find a new supplier to increase production volume.

When product of a new supplier assessment needed or when we have information about changes of the raw material base, a method of identifying chemical products joint with materials and substances identification characteristics databases used can be a useful tool. To evaluate the final product, when materials are to be used in structural components, usually develop a program that evaluates the performance of the structure before use. Process of confirming composite components structural and lifetime performance characteristics usually consists of a complex combination of tests and analysis. The volume of necessary tests to confirm the physico-mechanical characteristics of composite materials and products from them includes a lot of samples, which leads to considerable costs. Usually methods of analysis don't give adequately results of prediction with each set of conditions, but with reliable information on the identification of materials and substances used in production, as well as data about the manufacturing process assessment, it is possible to combine testing and analysis of available information to reduce the overall cost and improve reliability.

Reliable information should be considered as information obtained with the help of analysis methods that allow an objective assessment of the materials used.

The existing huge variety of test methods offers the possibility of solving the necessary task of identification, often there are even several possible options of solving. But it is necessary to understand that the task is to reach our aim by the most accessible methods, methods used should be maximally unified so that it would be possible to compare the test results obtained in different laboratories or by different organizations. One of the approaches

to solve these problems is the creation of unified methodological basis to materials and chemical substances identification and their implementation in methodological documents, such as product identification procedure [4].

So, scrutinize the requirements for such identification techniques.

The identification procedure should cover and give opportunities to control the full cycle of the identification process - from planning and testing to the presentation of results and, if necessary, entering results into the relevant databases. As a result, identification procedure for chemical products should include:

- gathering and analysis of information about identification objects;
- planning of tests, measurements and researches;
- organization, carrying out and control of carrying out of the required tests, measurements, researches;
- processing results.

The final result of the identification process should be a list of identification object characteristics, but in order to understand what list of characteristics will be sufficient, it is necessary at the initial state to determine this list based on a variety of factors, primarily on the purpose of the identification object. The indicators that make up this list and the range of their values is the identification profile of a chemical substance or material. If a chemical or material corresponds to an identification profile, then it can be approved as one, which meets the requirements. If several chemicals or materials correspond to one identification profile, then we can talk about their identity.

In addition to the final result, it is also important to show how we received it. In most cases, separately the results of the tests (measurements, studies) do not guarantee a correct identification. Often a preliminary analysis of methods and test procedures is required to provide complete and reliable confirmation of the conformity of chemical products to the identified identification parameters in the form of a clear consecutive logical chain. It is also important formalize in documents all the tests performed, which should also be provided in the identification method.

Carrying out identification studies involves a comprehensive test program that can require a huge number of test resources, so new approaches to test organization are needed to apply it. Here we can use the model called "distributed test center", which uses existing resources to carry out identification tests and to guarantee the quality of the results of the process. The main idea of such a center is that the solution of a complex complicated task is distributed for solving smaller problems by several test resources under the control of the expert center, thereby enabling the optimal solution to the task at hand.

The introduction of identification procedure in the enterprises QMS which deals with materials and chemical substances processes will allow:

- to detect the defective products at the stage of raw material testing;
- to obtain information for forecasting the properties of the final product;
- to use this information for a rationale reduction of the test program and thereby reduction of production costs.

#### *References / Список литературы*

1. ГОСТ Р ЕН 9100-2011 Системы менеджмента качества организаций авиационной, космической и оборонных отраслей промышленности. Требования.
2. ГОСТ Р ЕН 9120-2011 Системы менеджмента качества организаций авиационной, космической и оборонных отраслей промышленности. Требования к дистрибьюторам продукции.
3. ГОСТ Р 58175-2018 Авиационная техника. Управление поставщиками при создании авиационной техники. Общие требования.
4. *Косоруков И.А., Рахманов М.Л., Муратова Н.М.* Методика идентификации химической продукции // Компетентность, 9-10/140-141/2016. С. 18–21.