THE CONTENTS AND THE DIFFERENCE BETWEEN THE TERMS „DESIGN“ AND „DEVELOPMENT“ IN THE QUALITY MANAGEMENT PROCESS „8.3 DESIGN AND DEVEL-OPMENT OF PRODUCTS AND SERVICES“ ACCORDING TO THE ISO 9001:2015 REQUIREMENTS

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Astract: The difference and relationship of the terms „Design“ and „Development“ are discussed. The content and main stages of activities in the practical implementation of the process „8.3 Design and development of products and services“ in the quality management systems of the organizations is con-sidered.

Key-Wordes: Design and development, design phase, development phase, stages and activities content.

1. Introduction

When explaining the concept and the differences between "Design" and "Development", you would usually have to begin with the questions: "What is Design and what is Development? Which of these concepts is broader?" For many years, rarely there were cases when some of the young professionals or students correctly answered these questions.

Unfortunately, a lot of people tend to think that these two terms are synonymous. There are a number of instances when the authors are using the terms "design" and "development" interchangeably in their scientific-research, experimental-design work, and even in scientific articles.

The explanation below illustrates the activities at each of the 14 stages during the two phases of the process "8.3 Design and development of products and services" in the quality management system according to requirements of ISO 9001:2015 [1].

2. The major phases and stages of the process “8.3 Design and development of products and services”

The process "8.3 Design and development of products and services" encompasses two major phases, the first can be called "First phase of Design" and the second - "Development – the second phase of Design".

2.1 The first major phase of Design on an example of the process “Design and development of information-measuring and control system (IMCS)”

The first major phase of the process "8.3 Design and development of products and services", includes the following six stages of work.

1. Clarification and finalization of technical specifications for the design of information-measuring and control systems (IMCS) and its coordination with the customer.
2. The study of lessons learned by previous generations of researchers and designers, preparation of literature review and patent search on the subject of performed research and development work.
3. The adoption of conceptual solutions (upon performing a literature survey and patent search) regarding what principle of action and what type of design will form the basis of products and systems design.
4. The creation of mathematical models of a product (unit, process, program or system), formulation of the objective function (functional), the definition of the optimization problem and its solution.
5. Implementation of tasks on tracing drawings:1) of assembly units and parts drawings, 2) of conceptual automation, electrical and wiring diagrams of electronic components, 3) technical means circuits of the host computer system, 4) as well as the creation of algorithms for processing of experimental data and for control of the projected IMCS processes functioning.
6. Approving estimates and the action plan required for the implementation of further works on prototype creation of the designed IMCS, in particular, determining the need to procure the necessary parts, units, tools, devices and software products.

After successful completion of the sixth stage of the work, completing the first major phase of

the Design, begins the second major phase of the process "8.3 Design and development of products and services" implementation. This phase, which consists of eight stages, is called "Development".

2.2 The Second major phase "Development" as part of the process "8.3 Design and development of products and services" on an example of the process "Design and development of information-measuring and control system (IMCS)"

7. The initial stage of the second major phase "Development" starts at the moment of time when (according to the approved work plans and cost estimates drawings, diagrams, mathematical models and algorithms) the project organization proceeds to the production processes, programming and procurement.The necessary parts, circuit boards, blocks, programs are produced and the necessary materials, raw materials, components, devices and means of automation, software, and other facilities are acquired at that stage.

8. At the next stage it's important to complete the following steps at the phase "Development" of the process "8.3 Design and development of products and services":

- assemble technical equipment units using the manufactured parts and purchased components, check their performance and, if necessary, perform debugging, and then the diagnostics of the assembled technical means (irrespective of other component parts of the future IMCS);
- assemble electronic blocks from purchased electronic components (resistors, diodes, relays, transistors, and circuits), and conduct the verification of their performance and, if necessary, perform debugging and diagnostics (separate from the other constituent parts of the future IMCS);
- perform debugging and diagnostics of the software based on the use of test cases and the previously developed mathematical models and algorithms, developed programs for collection and processing of experimental data and for the processes of the created IMCS control (regardless of the operation of the technical equipment and electronic blocks).

9. Perform the integration of the technical equipment, electronic blocks and software into a United information-measuring and control system (IMCS).

10. Perform debugging and a comprehensive diagnostics test of the above mentioned components joint operation as part of the United IMCS.

11. Complete the debugging and testing of the IMCS in the designer lab, using reference samples and devices in the process of measurements.

If the results of the IMCS tests did not fully comply with the requirements of technical specifications, the design organizations should identify the nature of inconsistencies in the technical, mathematical, algorithmic and software characteristics of the designed system, and then plan and perform the correction (remedial actions) on elimination of the revealed discrepancies, and then re-test the IMCS again.

Along with the correction implementation in the design organizations processes, it is nessecary to identify the reasons of the project inconsistencies, and then to plan and to implement the corrective action to eliminate the causes of nonconformities (in the processes of specialists of the project organization).

One can move on to the next phase of work after obtaining the convincing evidence that the output of the process "8.3 Design and development of products and services" correspond to the input data, formulated in the technical specification for the design (during the designer lab tests).

12. Perform the acceptance testing in real conditions of the IMCS operation that are sometimes done at the designer lab (in the presence of one or more representatives of the Customer), but, most often, at the Customer's organization.

The designer should perform system adjustments, resolve the detected inconsistencies, and then provide the modified IMCS for the re-acceptance testing if deficiencies are detected in the operation of the IMCS.

13 The Customer should receive a report with a set of drawings, diagrams, mathematical models, algorithms and programs upon successful completion of acceptance testing. Typically, the created IMCS prototype is also transferred to the Customer.

14. As a result of the 13th stage the act of acceptance for performed tasks is issued. The final financial settlement is reached between the Customer and the Contractor (designer) as a result of this act of acceptance.

3. Conclusion

The usage of the above recommendations for the implementation of the main stages of two major phases "Design" and "Development" in the frame-

work of the process "8.3 Design and development of products and services" demonstrates [2 - 4] positive results in the practical implementation of scientific research and development work.

4. Referances:

[1] ISO 9001:2015. Quality management systems – Requirements.

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