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**Performance improvement of
management systems —
Guidelines for quality function
deployment**

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law.

JIS Q 9025: 2003 has the following appendices.

Annex 1 (informative) *Quality Function Deployment Procedure*

Annex 2 (informative) *Example of Required Quality Deployment Table*

Annex 3 (informative) *Example of Quality Characteristic Deployment Table*

Annex 4 (informative) *Example of Quality Table*

Annex 5 (informative) *Example of Quality of Planning Chart*

Annex 6 (informative) *Example of Transformation of Order of Importance*

Annex 7 (informative) *Example of QA Chart*

Annex 8 (informative) *Example of QC Process Chart*

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Performance improvement of management systems — Guidelines for quality function deployment

0 Introduction

0.1 General For an organization to fulfill its mission and achieve sustainable growth while maintaining competitiveness, it is essential that the organization enhances its significance of existence by gaining the satisfaction of customers and other interested parties with value of products that the organization offers. For this purpose, it must respond with agility to environmental changes, improve overall performance effectively and efficiently, respond to the needs and expectations of customers and other interested parties and create higher customer value.

With diversification of customer needs and increase in the number of competing products, the importance of the differential new products is rising. At the same time, assurance of product quality is now regarded common practice that does not require special mention. For this reason, development today requires development of new products in view of function, performance and design, together with assurance of value including quality.

These two aspects of development share in common the fact that the point of departure is assessment of market needs. However, the pressure for shorter lead time in development is increasingly pressing development to focus attention more on the technical aspects of design and development and not satisfying the needs in the marketplace. Therefore, there is growing need for methodology in implementing effective and efficient product development with customer focus.

The methodology for agile response to environmental changes and realization of products that appropriately meet the needs and expectations of customers and other interested parties may impact the following:

- Customer satisfaction;
- Simultaneous improvement of quality, cost and product cycle time; and
- Improvement of performance such as profits and market share
- Optimization of the management system in its entirety, rather than partially.

0.2 Consistency with other standards This Standard was drafted for use independent of **JIS Q 9023 Performance improvement of management systems — Guidelines for management by policy** and **JIS Q 9024 Performance improvement of management systems — Guidelines for procedures and methodology for continual improvement**, but may be used in mutually complementary form as harmonized standard. Moreover, this Standard was drafted for use also as supporting technique for items described in **TR Q 0005 Quality management system — Guidelines for sustainable growth**.

0.3 Relationship with JIS Q 9000 Family This Standard was drafted for use as supporting technique for an organization to administer management system effectively and efficiently based on **JIS Q 9001** and **JIS Q 9004**.

0.4 Compatibility with other management systems Although this Standard has not been developed as supporting technique specific to any management system, such as environmental management, occupational health and safety management, financial management, risk management, etc., it may be used by organizations as technique to support performance improvement of relevant management systems. Also, this Standard may be used in applications such as design for environmental suitability.

1 Scope This Standard defines guidelines for quality function deployment as supporting technique for organizations to achieve effective and efficient performance improvement of management system and provides methods for deployment and realization of the voice of the consumer from product quality characteristics and product elements to process elements. Furthermore, it provides methods for identifying operation or job function that is important in assuring product quality. This standard has been designed for use by organization requiring the following.

Items from the perspective of new product development are the following:

- Identification of voices of the consumer toward new product to be developed and compilation of such voices in the form that can be viewed easily
- Identification of the design elements necessary to realize markets needs
- Quantitative assessment of required quality and quality characteristics to be prioritized in product to be developed
- Determination of design quality of the product in the planning and development stage
- Early identification of technology to become bottleneck in development and review into solution of the problem
- Prehension of management of new product development process from total perspective including quality, cost, productivity and reliability

Items from the perspective of quality assurance are the following:

- Items that must be assured for customers and compilation of such items in the form that can be viewed easily
- Quantitative assessment of product quality characteristics, product functions, subsystems, and parts that are important in realizing assurance requirements
- Development of quality assurance (QA) table and quality control (QC) table in the planning and development stage to identify key points in manufacturing and prevent quality problems in the mass production stage

By making above points clear, quality problems in manufacturing process can be avoided.

This Standard can be applied to any organization trying to improve performance of its management system and to execute quality function deployment in areas such as quality design and environment-compliant design, regardless of industry, business, scale, or products offered by the organization.

2 Normative reference The following standard contains provisions which, through reference in this text, constitute provisions of this Standard. This normative reference applies only the edition indicated below, and subsequent revision and amendments do not apply.

JIS Q 9000:2000 *Quality management system — Fundamentals & vocabulary*

3 Terms and definitions For the purposes of this Standard, the terms and definitions given in **JIS Q 9000:2000** and the following terms and definitions apply.

Terms that are used in the definitions or in INFORMATIONs and are defined in clause 3 herein are indicated in boldface, followed by item number for the term in parentheses. Terms defined in **JIS Q 9000** are indicated in boldface, followed by **JIS Q 9000** in parentheses. The terms indicated in boldface are replaceable with the full definition of the respective terms.

Throughout the text of this Standard, wherever the term “product” occurs, it can also mean “service”.

3.1 Terms related to quality function deployment

3.1.1 transformation Operation in which an element is correlated with an element of another dimension and replaced by that element.

3.1.2 deployment Operation in which necessary characteristic is defined for an element through repeated **transformation**.

3.1.3 deployment table Table that shows systematically the results of hierarchical analysis of elements.

3.1.4 matrix Table that shows the correlation between items found in separate **deployment tables** by combining the two **deployment tables**.

3.1.5 correlation strength Strength of correlation found in the **matrix**.

INFORMATION : For example, correlation is shown with symbols ◎, ○ and △, and correlation strength ratios shown with symbols ◎, ○ and △ are represented numerically as 3:2:1, 5:3:1, 4:2:1, etc.

3.1.6 quality function deployment (QFD) Methodology employed various types of **transformation** and **deployment** in order to realize **quality objective** (**JIS Q 9000**) for a **product** (**JIS Q 9000**), which may be abbreviated as QFD.

INFORMATION : Term referring collectively to **quality deployment**, **engineering deployment**, **cost deployment**, **reliability deployment** and **job function deployment**.

3.1.7 quality deployment Method in which **required quality** is **transformed** into **quality characteristic** (**JIS Q 9000**), **design quality** of a **product** (**JIS Q 9000**) is defined, and the required quality is **deployed** on quality of functional parts and their respective components and on process elements.

3.1.8 engineering deployment Method in which **bottleneck engineering** is identified by examining whether function that realizes **design quality** is achieved in the currently planned scheme.

3.1.9 cost deployment Method in which cost reduction or cost-related problem is identified by allocating target cost corresponding to **required quality** or function.

3.1.10 reliability deployment Method in which assurance items related to reliability are identified vis-à-vis **required quality**.

INFORMATION : In contrast to **quality deployment** which focuses on positive **deployment of required quality**, reliability methods to prevent negative results, such as failure, is employed to prevent such failure at the design stage.

3.1.11 job function deployment Method in which job functions that constitute **quality (JIS Q 9000)** are hierarchically analyzed and identified.

3.1.12 voice of the customer Requirements (JIS Q 9000) of the customer (JIS Q 9000) in a product (JIS Q 9000).

INFORMATION 1 The **voice of the customer** may be called primitive information.
2 Methods of collecting **voices of customers** include conventional interview surveys, questionnaire surveys, customer behavior surveys, use of opinion cards, use of the internal information, and use of industry news.

3.1.13 required quality Matters related to **quality (JIS Q 9000)** vis-à-vis **requirements (JIS Q 9000)** in a **product (JIS Q 9000)**.

3.1.14 bottleneck engineering (BNE) Problems in key technology that must be resolved to develop and/or improve a **product (JIS Q 9000)**, which may be abbreviated as BNE.

3.1.15 quality assurance (QA) table Table used to communicate the key points of quality assurance intended by design to the manufacturing division.

3.2 terms related to quality table

3.2.1 required quality deployment table **Deployment table** that shows **required quality** in hierarchical structure.

INFORMATION : **Required quality** is grouped with affinity diagram, etc., and arranged and established in the form of **deployment table**.

3.2.2 quality characteristic deployment table **Deployment table** that shows **quality characteristics (JIS Q 9000)** in hierarchical structure.

INFORMATION : **Required quality** is transformed into **quality characteristics (JIS Q 9000)** and arranged and established in the form of the **deployment table**.

3.2.3 quality table **Matrix** based on **required quality deployment table** and **quality characteristic deployment table**.

INFORMATION 1 The **voices of customers** are systematized by expressions in language form, and the correlation with **quality characteristics (JIS Q 9000)** is indicated. This is employed in quality design to realize **required quality**.

- 2 The scope of a quality table may either show only **matrix** between **required quality deployment table** and **quality characteristic deployment table** or along with quality planning table, design quality table, and quality characteristic correlation analysis.

3.2.4 quality of planning **Quality objective (JIS Q 9000) vis-à-vis required quality.**

INFORMATION : **quality table** is employed to establish the objective, alongside research into importance level of required quality and competitiveness against **required quality** of competitors.

3.2.5 quality of design **Quality objective (JIS Q 9000) vis-à-vis quality characteristics (JIS Q 9000).**

3.2.6 ratio of level improvement Ratio of the current level of satisfaction in **quality of planning** to **required quality**.

INFORMATION : Benchmark obtained by dividing the **level of quality of planning** by **level of satisfaction of an organization (JIS Q 9000)**, to show the level of improvement made against **required quality**.

3.2.7 selling point Items in **required quality** identified in defining **quality of planning** for focus in marketing.

3.2.8 unadjusted weight Product of the level of importance of the required quality, the **ratio of level improvement** and **selling point**.

3.2.9 adjusted weight of required quality The ratio of **unadjusted weight** of each **required quality** to total of **unadjusted weight**.

INFORMATION : This shows the level of importance of each **required quality** when total is 100, with policy taken into consideration in the level of importance of required quality.

3.2.10 quality characteristic weight The value by **transforming** adjusted weight of **required quality** employing correlation in **quality table**.

4 Basic concepts

4.1 General In order to improve customer satisfaction, an organization shall assess customer needs and expectations towards products that the organization offers and reflect the results on product design. At the same time, it is important in new product development to study into solutions for foreseeable quality problems. The approach based on quality function deployment provides guidelines in product design that satisfy customer needs and expectations, while maintaining consistency in the process from product planning to manufacturing. Also, the constituent elements of the product that realize this and the desired results in the manufacturing process can be identified clearly. This is on design-driven approach stemming from the origin, unlike conventional analytic approach.

4.2 Quality function deployment in quality management Quality function deployment in the new product development process is based on the following.

- a) **Customer focus** In order to achieve the objective of the organization on a continuing basis, offered products should secure customer satisfaction.
- b) **Participation of people** Review into the desired image of the new product is available with participation of all relevant organizations.
- c) **Early detection of technological issues** Technological issues in realizing customer needs and expectations should be identified early in development. Improvement or alternative proposals to address such issues may be reviewed.
- d) **Development management** In order to reduce lead time in development, realization of concurrent development process is feasible.
- e) **Secure quality assurance** In order to assure realization of customer needs and expectations, a consistent process can be developed and managed.
- f) **Multilateral evaluation** Based on the assurance of quality, product development process can be reviewed and evaluated in terms of cost, technology and reliability. Also, adaptation for environmental considerations is available.

4.3 Principles of quality function deployment Quality function deployment combines various deployment tables as matrices and reviews quality by employing this chain of matrices. These matrices are developed based on the following principles.

- a) **Principle of deployment** This principle has the aspect of assessing the hierarchy of elements based on systematic representation of items identified and the aspect of deploying information for realizing user demands comprehensively from planning to manufacturing process.
- b) **Principle of segmentation and integration** This principle has the aspect of stimulating new discovery by, for example, separation and review of customer needs and expectations in the product and design elements for realizing such needs and expectations and the aspect of integrating them in the form of matrix to identify the cause-and-effect relationship between the two.
- c) **Principle of multi-dimensional development and visualization** This principle has the aspect of reviewing information obtained on two levels and the aspect of information-sharing based on the matrix developed.
- d) **Principle of consolidation and breakdown** Matrix created has the aspect of identifying key elements and the aspect of capturing key elements as parts and directing attention to total balance.
- e) **Principle of transformation** By combining various types of matrices, a scheme for communicating information on customer needs and expectations to quality characteristics of the product and its components is realized.

5 Quality Table

5.1 General The quality table is a matrix diagram based on the required quality deployment table and the quality characteristic deployment table aimed at defining quality of planning and required quality to be prioritized, clarifying quality characteristics to achieve its quality, and establishing quality of design for the project. To this, quality planning table, quality of design table and quality characteristic correlation analysis are added.

INFORMAITON : See 5.3

5.2 Deployment table and matrix

5.2.1 Deployment table The required quality deployment table assesses required quality as a whole, based on market surveys, etc., and arranges it in hierarchical structure. Commonly, it is arranged into a systematic presentation, with high-level items of the system at the top, followed by primary required quality, secondary required quality, tertiary required quality, etc. Required quality arranged in this way is shown that as required quality deployment table.

The deployment table is not restricted to required quality alone. It is a systematic representation of results grouped with the affinity diagram method. Therefore, systematic presentation of quality characteristics is called quality characteristic deployment table; and systematic presentation of functions is called function deployment table.

In quality function deployment, study should be conducted on whether items should be presented in deployment table form or list form. Deployment table should be created if the number of items gathered are huge and its structure should be assessed. If hierarchical structure is not necessary, on the other hand, the deployment table may be omitted. What is strictly important are the content to be identified and the objective of the table.

5.2.2 Matrix In quality function deployment, the matrix is strongly correlated with the principle of transformation (see 4.3 e)). For instance, matrix for required quality deployment table and quality characteristic deployment table serves as bridge between required quality that represents the sphere of the customer and quality characteristics representing technology. It not only shows simple correspondence but correlates information of different levels.

In quality function deployment, various matrices are created for each application separately. Especially important is structuring matrix with attention to chain of information. Without adequate attention to the method of matrix structure and link with other matrices, quality function deployment adapted to the objective of the organization becomes difficult.

5.2.3 Transformation in level of importance For instance, in creation of a matrix for required quality deployment table and quality characteristic deployment table, it is necessary to define the required quality and quality characteristics that should be emphasized in product to be developed. For this purpose, items defined in required quality should be evaluated quantitatively in order of importance. Next, quantified values should be transformed into order of importance of the items in the quality characteristic deployment table correlated with the matrix. Here, the following methods may be applied to transformation of values.

- a) **Independent rating method** Numerical value obtained on each element in one deployment table is multiplied with numerical value representing correlation for transformation of elements in the other deployment table into numerical values.
- b) **Proportional distribution method** Numerical value obtained on each element in one deployment table is distributed proportionally to the numerical value representing correlation for transformation of elements in the other deployment table into numerical values.

For example, take a matrix for required quality deployment table and quality characteristic deployment table. In independent rating method, adjusted weight of required quality is applied directly on the correlation in the matrix, clarify the quality characteristic that is especially important. On the other hand, the total calculated quality characteristic weight does not correspond to the total adjusted weight of required quality, thus making it necessary to transform the quality characteristic weight into percentage once again.

In proportional distribution, the adjusted weight of required quality is distributed based on correlations in the matrix. Therefore, transformed quality characteristic weight can be used as percentage. On the other hand, quality characteristic may be underevaluated in one extreme or overevaluated in the other, depending on the balance in correlations.

Since both methods have their respective advantages and disadvantages, it is necessary to look into which transformation method should be chosen. Also, study into the differences in results of transformation based on the two methods is important.

5.3 Composition of the quality table

Quality table consists of the following three tables.

- a) **Required quality deployment table** Created to assess customer needs and expectations in general. The type of deployment table is chosen depending on the objective. If there are a large number of items to be listed, it should be arranged as deployment table, and expression level adjusted as well.
- b) **Quality characteristic deployment table** Created to identify design elements needed to realize required quality and to recognize elements that are important. Again, adoption or not of deployment table should be studied depending on objective and number of items to be listed.
- c) **Matrix** Created to clarify correlation between required quality and quality characteristics, as well as to ensure that there is no omissions in quality characteristics.

The following tables may be added, as shown in Figure 1.

- d) **Quality planning table** Created to clarify required quality to be identified based on priorities. Its composition may vary, depending on use of the quality table. Items to be included are priorities based on demand, level of technical difficulty and level of the competitors.
- e) **Design quality table** Created to define target value in design vis-à-vis important quality characteristic. If necessary, comparative analysis is conducted by including items such as standards for competing products.
- f) **Quality characteristic correlation table** Created to analyze correlations between quality characteristics. Correlation between quality characteristics may have synergistic effect or may have contradicting effect. In establishing design quality, such information shall be taken into consideration.