International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-2, December 2019

System Quality Management of the Industry Enterprise (on the Example of Separate Production)

Garina E.P., Garin A.P., Romanovskaya E.V., Andryashina N.S., Kuznetsova S.N., Batsyna Ya.V.

Abstract: ***Increase of production efficiency through generalization of design practices of integrated product quality management of the industry is a necessary condition for sustainable development of domestic production.***
The purpose of the study is to assess the existing system of quality management of the enterprise on the example of a separate business unit and identify directions to increase its effectiveness. Object of study — Production Association of Software (Polished Glass) JSC AGC "Borsky Glass Factory". The subject of study is an integrated quality management system. Research methods — method of economic analysis, and method of expert assessments. A practical significance of the work lies in the possibility of using the results to control non-conforming products in the process of industrial production. These studies allow to draw conclusions about the effectiveness of the technology used for product quality management and production processes of the industry enterprise on the example of a separate production.

Keywords : production, quality management, non-conforming product management, causes of defects

I. INTRODUCTION

In the conditions of implementation of the competitiveness policy of domestic products at the world level, the economic importance of adaptive quality management systems of production increases. The initial step towards formation of integrated quality systems was the transition of domestic production to compliance with international standards ISO 9000 series in the 1990s. This opened up the possibility of increasing the efficiency of economic activity by entering new sales markets, strengthening logistics systems and resource support for production, forming a federation of systems, and conditions for entering the CALS system.

Revised Manuscript Received on December 30, 2019.
***** Correspondence Author
Garina E.P.*, Minin Nizhny Novgorod State Pedagogical University e.p.garina@mail.ru
Garin A.P., Minin Nizhny Novgorod State Pedagogical University rp_nn@mail.ru
Romanovskaya E.V., Minin Nizhny Novgorod State Pedagogical University alenarom@list.ru
Andryashina N.S., Minin Nizhny Novgorod State Pedagogical University natali_andr@bk.ru
Kuznetsova S.N., Minin Nizhny Novgorod State Pedagogical University dens@52.ru
Batsyna Ya.V., Institute of Food Technologies and Design — the branch of Nizhny Novgorod State University of Engineering and Economics alx_jn@sinn.ru

In the 2000s, the expertise (certification) of product quality was distributed on a systematic basis — according to the results of the research of the international organization for standardization ISO. In the Russian Federation for the period from 2012 to 2018, the number of quality management systems has reached more than seven hundred. In the 2010s in the context of improving tools and mechanisms for integration of system participants based on appropriate regulatory and institutional support for production processes. The focus is on ensuring the adaptability of quality management systems not for experimental products sites, but the production as a whole. Problems of system management of quality and safety of products, management of non-conforming products in the production process are solved.

II. THEORETICAL AND METHODOLOGICAL APPROACHES

In the research process, the method of observation, systematization, process approaches to the technology of production and organization of production were used. The objectives of the research were: 1) evaluation of the quality management system separate production processes; 2) the formation of decisions to improve production efficiency based on the principle of end-to-end integrated quality management and requirements of international ISO standards.

III. RESULTS OF THE STUDY

In order to formulate the content of a product quality and safety management system, the generally accepted definition of a quality management system and product quality were used in the following interpretation: product quality is a set of essential properties quantified by the system of technical and economic indicators, distinguishing products from other similar purposes, determining demand on products in market conditions at socially needed costs and market - generated prices for these products.
Under the system of product quality management in the research, we mean an integrated system for managing the processes of ensuring product quality by identifying appropriate (meeting the requirements of standards) and non-conforming products in the production process: detection and identification of non-conforming products at different stages of the manufacturing process; preventing the unintended delivery of non-conforming products to consumers; Identify ways to manage inappropriate products.

In fact, the quality and safety management system of industrial integrated structures is a complex multifactor system of interrelated elements and procedures: 1. Automatic detection of non-conforming products (first control point); 2. Identification of non-conforming products by personnel on the assembly line (second control point); 3. Control of product elements “on the way” in the assembly (third control point).Considering the issue on the example of a separate production (production of sheet glass), we determine:

- In the glass industry, in accordance with the existing GOST, quality control in the production of sheet glass is carried out by various methods and tests.
- Management of non-conforming products in the process of production of polished glass includes several stages: 1) detection and identification; 2) maintenance of records of non-conformities; 3) recycling, repair of blocks, reclassification of non-conforming products. Sources of non-conforming products are the results of automated continuous control.

The sequence of actions to control non-conforming products at control points is shown in Figures 1-2.

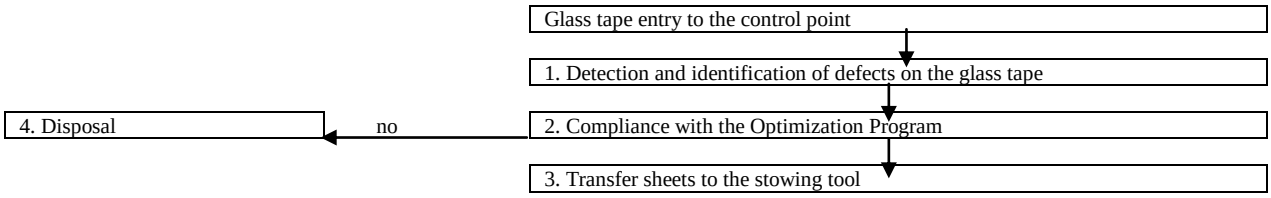

Figure 1 — The first control point. Automated control of glass tape

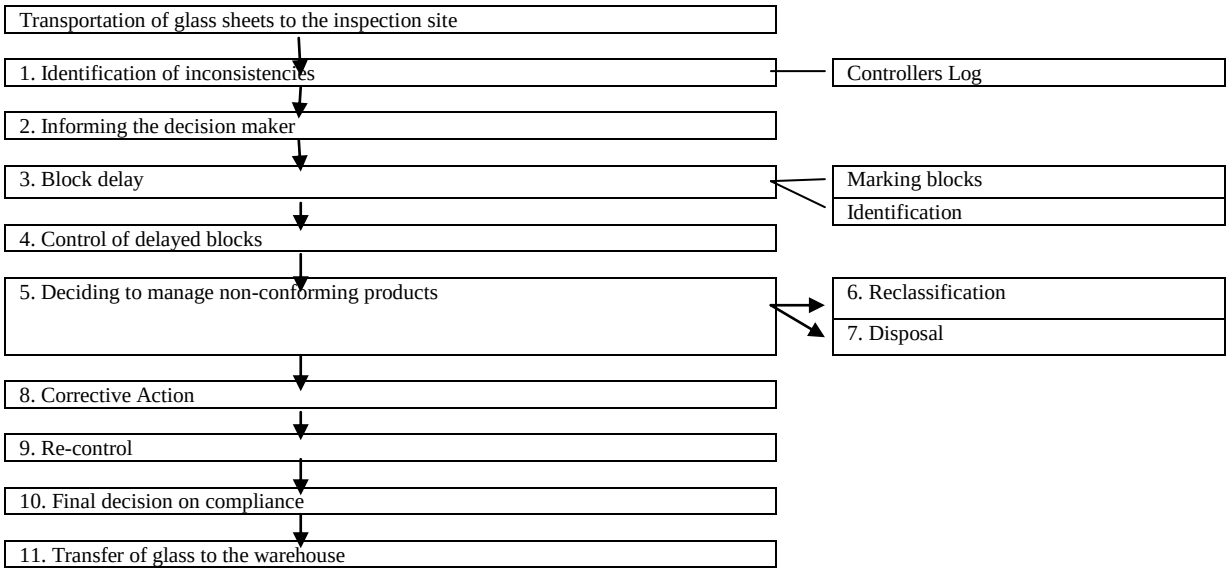

Figure 2 — The second control point. Glass inspection by personnel on the line*

* Third control point — The control of glass blocks by the personnel on the stowing is similar

Description of work in the management of non-conforming products is given in Tables 1-3.

Table 1 - Automatic detection of non-conforming products (first reference point)

Process Operations	Name equipment/responsible person	Deadline	Log in to the operation	Exit the operation
1 Detection and identification of defects on the glass tape	Laser detector/controller SP -PPS	Constantly	Glass Tape	Detected and identified defects, information on electronic carrier
2 Optimization Program Compliance Decision	Automatically (optimization program)/Supervisor of the SP-PPS	After identification	Glass Tape Optimization Program, Replacement Cutting Job, Internal Specifications	Information on electronic carrier Yes: related products; No: non-conforming products
Yes: 3 Transfer of sliced sheets to the stowing	Automatically (cutting line)/cutting control operator	After decision	Information on electronic carrier	Information on electronic carrier, suitable products
No: 4 Disposal: trimming a sheet with unacceptable defects from the tape	Automatically /Adjusters of glass machines	After decision	Information on electronic carrier	Information on electronic carrier, cullet

Table 2 - Identification of non-conforming products by the glass controller (second control point on line) (fragment)

Process Operations	Responsible performer	Deadline	Log in to the operation	Exit the operation

1 Detection of nonconformities and their identification	Comptroller of SP-PPS	At least once every 2 hours	GOST R 54170, STP 02, RI, sheet of glass (2 linear meters)	Detected and identified defects, certain inconsistencies, information in AS "KIS-Float"
2 Informing decision maker	Comptroller of SP-PPS	After identification	Information on discrepancies identified	Awareness of the responsible persons (PPS quality engineer, shift supervisor, quality service controller)
3 Block delay: Identification of delayed blocks; - Marking blocks; - entry of the delay code in AS "KIS-FLOAT"	Comptroller of SP-PPS Comptroller SP Quality Service	Immediately after receiving information about non-compliance	Information on discrepancies identified	Delayed blocks. Records in checklists. Information in AS "KIS-Float": entering a delay code and notes to blocks. Identification of delayed blocks
4 Control of delayed blocks	Quality Engineer of Quality Service Comptroller SP Quality Service	In the day shift	GOST R 54170, MDI, identified delayed blocks, information in AS "KIS-Float", checklist	Control results: records in the checklist, information in AS "KIS-Float"
5 Deciding on non-conforming products	Quality Engineer	After the control of the delayed blocks	GOST R 54170, information on revealed inconsistencies	Decision: *Reclassification* *Repair*
Reclassification:	Head of PPS			*Disposal*
….				

Table 3 — Identification of non-conforming products by the GP quality controller (third control point — on the stowing tool) (*fragment*)

Process Operations	Responsible performer	Deadline	Log in to the operation	Exit the operation
1 Detection and identification of defects on glass sheets in the block	Comptroller SP Quality Service, Adjusters of glass machines	Constantly	GOST R 54170, STP 02, RI, cut blocks on the pyramid	Information in the KIS technological journal, information in AS "KIS-Float"
2 Informing decision maker	Comptroller SP Quality Service	After a block delay	Information on discrepancies identified	Awareness of responsible persons (quality service engineer, shift master)
3 Block delay: Identification of delayed blocks; - Marking blocks; - entry of the delay code in AS "KIS-FLOAT"	Comptroller SP Quality Service	Immediately after receiving information about non-compliance	Information on discrepancies identified	Delayed blocks. Records in checklists. Information in AS "KIS-Float": entering a delay code and notes to blocks. Identification of delayed blocks
4 Control of delayed blocks	Quality Engineer QS, Comptroller SP Quality Service	In the day shift	GOST R 54170, MDI, identified delayed blocks, information in AS "KIS-Float", checklist	Control results: records in the checklist, information in AS "KIS-Float"
…				

If large, unacceptable defects or a high level of defect are detected, then the optimization program automatically triggers and the glass is sent to the disposal machine for further use of a return glass.

If discrepancies are detected, the volume produced between the last two tests if the discrepancy was detected by the controller. Also from the moment, the discrepancy appears if this can be accurately determined by the control devices, for example, interruption of the glass tape, equipment shutdown, etc.

For an appropriate decision (disposal, reclassification, or the possibility of shipment) for delayed blocks, a production commission is assembled consisting of interested managers and specialists (Figure 3).

.

Form of write-off act
OPEN JOINT-STOCK COMPANY "AGC BORSKY GLASS FACTORY"
Polished Glass Department
ACT NO. ____
Approved:
Head of Department "Polished glass"

About discarding of glass sheet
Commission:
Quality manager of "Polished glass"
Head of GSP LLC "AGC Glass Russia"
Head of the shipment section
Quality Engineer of Polished Glass Quality Service
Quality Engineer KIS "Polished Glass"
Senior Engineer-Technologist of the cutting section
Specialist in accounting of glass SSP "Polished glass"
Quality Service Controller of "Polished Glass"
Senior engineer-technologist of the PPS responsible for the glass production
Date:
The Commission carried out a control check of polished glass:

Block No.	Color	Size, mm		Thickness, mm	Quality	Pcs.	Weight, t.	m^2	RS	The reason of inconsistencies.
		length	breadth							
Subtotal										

Conclusion:
Signatures of commission members:

Figure 3- Form of deduction of non-conforming (defective) products

In case of identification of non-conforming products after delivery to a consumer, further work is carried out in accordance with the procedure of ISM P 212-1 on work with claims.

Based on the above, detection of defects, their classification and obtaining quantitative characteristics are necessary to build a modern quality control system for sheet glass. The conclusion is confirmed by statistical data — the number of non-conforming products for the 1st quarter of 2018 was (Figure 4):

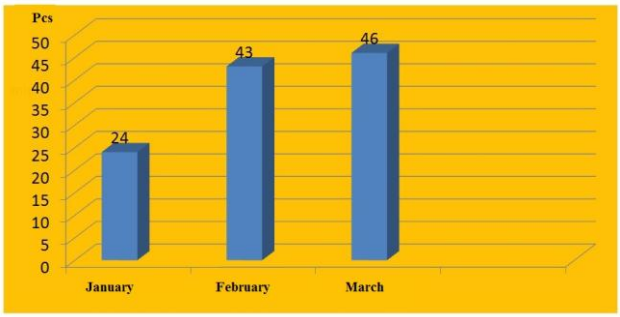

Figure 4 — Quantity of non-conforming products for Q1 2018 by individual production

The main problems leading to production of non-conforming products, as well as the actual value of defects during the period under study, are shown in Table 4

Table 4 — Main issues and number of product defect for 1st quarter of 2018 by individual production

Main problems	1st quarter of 2018	Total	August 2018	
Scratches				
Defective workpieces	113 pcs.		30 pcs.	70%
Cost of 1 defective workpiece	5584,46 rubles	631 043 thousand rubles		26,5%
Savings	167 533 thousand rubles.			

At the same time, the planned value in the forecast period is a decrease in the number of defects on glass by 70% (nominal value of 2.1 mm).

The list of root causes of these statistics is shown in Table 5:

Table 5 — List of root causes of high percentage of non-conforming products by individual production for the period

1. Staff:	- High staff turnover; - Violation of the required instructions.
2. Material:	- The presence of defects in blocks; - Low service life of the original belts; - High cost of original spare parts; - Wear of coating and “components pyramids”; - Lack of special containers.
3. Method:	- Small stock % of components; - Delivery time of spare parts from 4 weeks; - Manual manipulation; - There is no additional transfer on manual tables; - There is no 100% control
4.	- Wear of the belt surface;
Equipment:	- Lack of the crane on a carved table; - Wearout of parts; - The presence of glass fragments on tables and roller coils.
5. Environment:	- Seasonality; - Low lighting on the site; - Glass dust.
6. Management:	- Lack of staff; - Low wages

Assessment of existing problems showed: untimely replacement of belts and components; lack of spare belts. The source of the problem is the high cost of original belts and broken glass on tables for disposal. Also: manual manipulations — throwing away the defect; scratches on the sheets; poor visibility in production and lighting on tables.

To solve the identified problems, it is necessary to:

1. Install missing belts on sections;
2. Replace the carved table cover;
3. Install additional lighting of the table in the section;
4. Set the brushes for cleaning with belts.
5. Install an additional crane for blowing the carved table.
6. To eliminate the problem with personnel, it is necessary to hold a meeting on implementation of instructions on labor protection.

Implementation of these solutions will allow in the forecast period to increase production efficiency, and reduce the percentage of inappropriate products (table 6):

Table 6 — Savings and benefits after implementation of proposed measures

Month	Scratches	Savings rub.	Efficiency %
January	24	1186.08	9%
February	43	2125.06	16%
March	46	2273.32	17%
April	15	741.3	5,5%
May	10	494.2	4%
June	53	2619.26	19,5%
July	10	494.2	4%
August	22	1087.24	8%
September	21	1037.82	8%
October	12	593.04	4%
November	16	790.72	5%
December			
average value	28	1222.02	-
result	222	13442.24	100%

Thus, we can conclude that proposed measures allow us to reduce mechanical defects (scratches, abrasions on glass), and reduce the number of defective billets, and save on production costs.

IV. CONCLUSION

To sum up, we can say that ISO/TS -16949 can be implemented only if:

— with interest of the top management of the enterprise;

— participation in the work of all personnel and constant training of personnel;

— understanding the relationship between requirements of the standard and special methods.

Implementation of ISO requires a deep understanding of management decisions which based on assessment of the effectiveness of the quality management system and implementation of preventive and corrective actions for analysis and control of management processes of non-conforming products.

REFERENCES

1. Andryashina N.S. Analysis of the best practices of domestic machine-building enterprises // Bulletin of Saratov State Socio-Economic University. 2014. № 1 (50). P. 24-27
2. Garina E.P., Garin A.P. The use of modern methods of quality management to improve the production efficiency of complex product // Bulletin of NGIEI. 2017. № 11 (78). P. 111-119
3. Garina E.P., Garin A.P., Vinogradova S.A., Batsyna Ya.V. Formation of risk management system in project practice of enterprises // Financial economy. 2019. №3. P. 459-463
4. Guskova N.D., Salimova T.A., Gorin I.A. Analysis of the status of import substitution problems in the Russian Federation // Bulletin of the Samara State University of Economics. 2016. “2 (136). P. 11-17
5. Garina E.P., Kuznetsov V.P., Andryashina N.S., Romanovskaya E.V., Kuznetsova S.N. (2019) Exploring Alternative Strategies for Managing the Complexity of a Product. In: Popkova E. (eds) The Future of the Global Financial System: Downfall or Harmony. ISC 2018. Lecture Notes in Networks and Systems, vol 57. Springer, Cham
6. Parshina A.A., Levchuk V.V., Shpilevskaya E.V., Garina E.P., Garin A.P. (2019) The Study of Modern Approaches to Development of Economic Systems Through Managing Their Complexity. In: Popkova E. (eds) The Future of the Global Financial System: Downfall or Harmony. ISC 2018. Lecture Notes in Networks and Systems, vol 57. Springer, Cham
7. Romanovskaya E.V., Kuznetsov V.P., Andryashina N.S., Garina E.P., Garin A.P. (2020) Development of the System of Operational and Production Planning in the Conditions of Complex Industrial Production. In: Popkova E., Sergi B. (eds) Digital Economy: Complexity and Variety vs. Rationality. ISC 2019. Lecture Notes in Networks and Systems, vol 87. Springer, Cham
8. Romanovskaya E.V. Development of production and technologies: Teaching and Methodological Manual / Minin University. Nizhny Novgorod, 2018. 84 p.
9. Shpilevskaya E.V. Economic security of the country: Threats and ways of its provision // International Research Journal. 2016. №5-1 (47). P. 188-193
10. Shushkin M.A., Aleksandrovsky S.V., Fomenkov D.A. Research on the implementation of catch-up innovative development strategies by companies: monograph /National Research University “Higher School of Economics”. Nizhny Novgorod, 2016. 187 p.

AUTHORS PROFILE

Garina Ekaterina Petrovna, Candidate of Economic Sciences, Associate Professor, Minin Nizhny Novgorod State Pedagogical University

Garin Alexander Petrovich, Candidate of Economic Sciences, Associate Professor, Minin Nizhny Novgorod State Pedagogical University

Romanovskaya Elena Vadimovna, Candidate of Economic Sciences, Associate Professor, Minin Nizhny Novgorod State Pedagogical University

Andryashina Natalia Sergeevna, Candidate of Economic Sciences, Associate Professor, Minin Nizhny Novgorod State Pedagogical University

Kuznetsova Svetlana Nikolaevna, Candidate of Economic Sciences, Associate Professor, Minin Nizhny Novgorod State Pedagogical University

Batsyna Yana Valerevna, Candidate of Sociological Sciences, Associate Professor, Institute of Food Technologies and Design — the branch of Nizhny Novgorod State University of Engineering and Economics