Establishment of Quality Control System for production factories based on the Juran Trilogy & ISO 9001:2008 requirements.

A study submitted to Engineers Union in Sulaymaniyah by:

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1 Introduction

Markets always especially nowadays are undergoes an intense competition to achieve customer satisfaction, who are looking for products that meet their needs, suitable for its intended use, in a suitable prices for them and available to them when needed, for all this in addition to the necessities of safe use of the product and for purposes of sustainability and maintain of environment, it is become inevitable for all of these reasons, to apply a quality control systems to ensure of the product conformity with the specifications and features which it has been designed for.

So that it is important to prepare and apply an efficient quality control systems in manufacturing industries & that what this study will care of it in the next Items.

2 Study objectives

This study aimed to provide a guidelines for prepare and apply Quality Control Systems, to whom in concern of this issue, to allow them to prepare their own Quality Control System by themselves by following these guidelines.

3 Study Methodology

Adoption of Juran Trilogy & the Quality Management System requirements (ISO 9001:2008) in preparation of guidelines to establishment a quality control system to be applicable in production factories.

4 Section one: *Juran Trilogy*

4-1 About Juran ”The Father of Quality”

JOSEPH M. JURAN, Co-Editor-in-Chief, has published the leading reference and training materials on managing for quality, a field in which he has been the international leader for over 70 years. A holder of degrees in engineering and law, Dr. Juran has pursued a varied career in management as an engineer, industrial executive, government administrator, university professor, corporate director, and management consultant. As a member of the Board of Overseers, he helped to create the U.S. Malcolm Baldrige National Quality Award and has received over 50 medals and awards from 14 countries, including The Order of the Sacred Treasure from the Emperor of Japan for “the development of Quality Control in Japan and the facilitation of U.S. and Japanese friendship”; and the National Medal of Technology from the President of the United States for “his lifetime work of providing the key principles and methods by which enterprises manage the quality of their products and processes, enhancing their ability to compete in the global marketplace. "He is also founder of the consulting firm of Juran Institute, Inc., and founder of Juran Foundation, Inc.

The latter is now a part of the Juran Center for Leadership in Quality at the Carlson School of Management in the University of Minnesota. Among his 20 books, the Handbook is the international reference standard.

- In 1925 Juran started work with the inspection department of Western Electric where he was faced with many quality management challenges
- In 1928 Juran applied statistical methods to manufacturing problems.
- In 1937 Juran becomes Chief of Industrial Engineering at Western Electric's home office.
- 1951 The Quality Control Handbook (A reference book for all who are involved in quality management).
- 1950's revolutionized the Japanese philosophy for TQM and helped shape their economy into an industrial superpower.
- 1964 The Managerial Breakthrough.
- 1979 Juran Institute founded.
- 1986 The Juran Trilogy.

4-2 Quality Definitions

Many of Quality Definitions could be found from several perspectives, I'd like to mention some of them in few words.

1. Quality Definitions from customer perspectives could be:

   Product Quality: it is its fitness for intended use.

   Or *a greater number of features with fewer defects.*

2. Quality Definitions from perspectives of quality control Inspector is:

   Quality: *achievement of design specification in the product.*

3. While the simple definition of Quality in Quality Management System (ISO 9001:2008) is that:

   Quality is customer satisfaction.

   Where customer be satisfied if he got the product in expected quality when needed in suitable price.

4-3 What is Juran Trilogy?

According to Juran the attain quality must begin by establishing the vision, policies and goals of the organization. Converting these goals into results is done through three managerial processes called the JURAN TRILOGY. (Aka the three universal processes for managing for quality)

1. Quality Planning.
2. Quality Control.
3. Quality Improvement.

4-4 Quality Planning "Quality *does not happen by accident, it must be planned*"

Quality Planning: the structured process for designing products and services that meet new breakthrough goals and ensure that customer needs are met. The steps in quality planning process are:

1. Establish the project.
2. Identify the customers.
3. Discover the customer needs.
4. Develop the product.
5. Develop the process.
6. Develop the controls and transfer to operations.

4-5 Quality Control

A universal managerial process for conducting operations so as to provide stability--to prevent adverse change and to "maintain the status quo"

Quality control can also be described as "a process for meeting the established goals by evaluating and comparing actual performance and planned performance, and taking action on the difference"

The Quality Control Process:

1. Choose control subject.
2. Establish Measurement.
3. Establish standards of Performance.
4. Measure Actual Performance.
5. Compare to Standards (interpret the difference).
6. Take action on the difference.

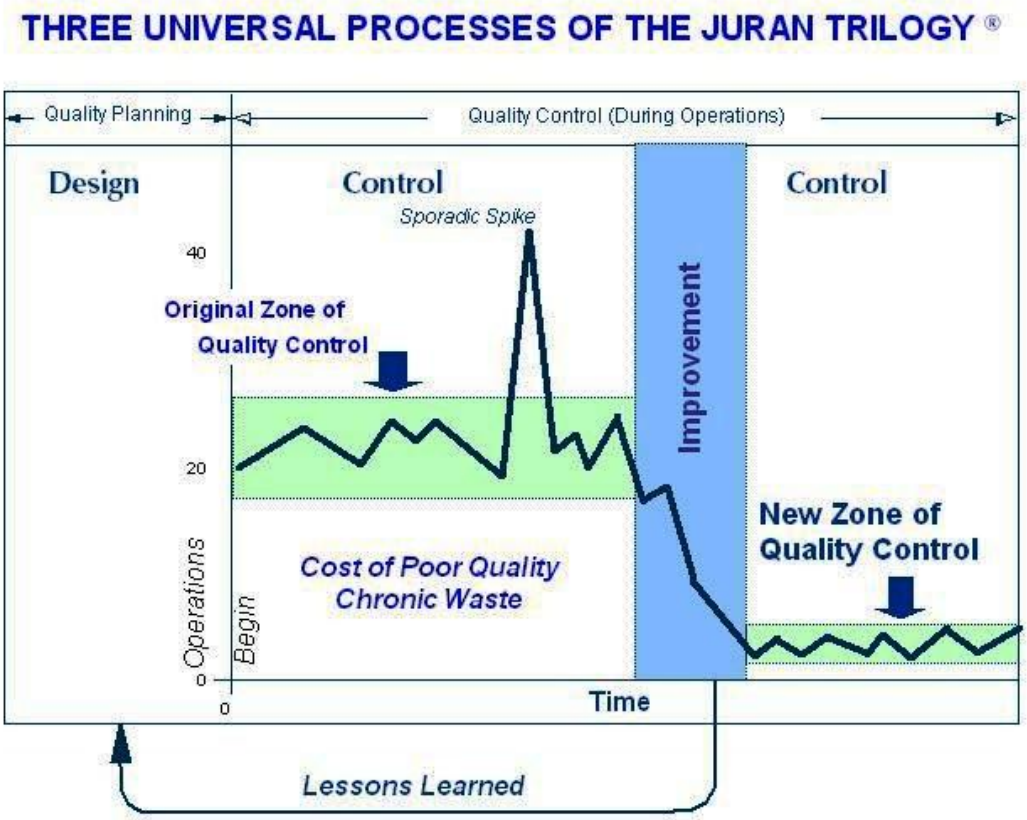
4-6 Quality Improvement

The process for creating breakthrough levels of performance by eliminating wastes and defects to reduce the cost of poor quality through:

1. Prove the need for improvement.
2. Identify the improvement projects.
3. Establish project improvement teams.
   Provide the project teams with resources, training, and motivation to:
   - 3-1 Diagnose the causes.
   - 3-2 Stimulate the remedies.
   - 3-3 Establish controls to hold the gains.

All improvement activities should be customer focused based on "fitness for use":

1. Quality of design.
2. Quality of conformance.
3. Availability.
4. Safety.
5. Field use.



Ten Steps to Quality Improvement

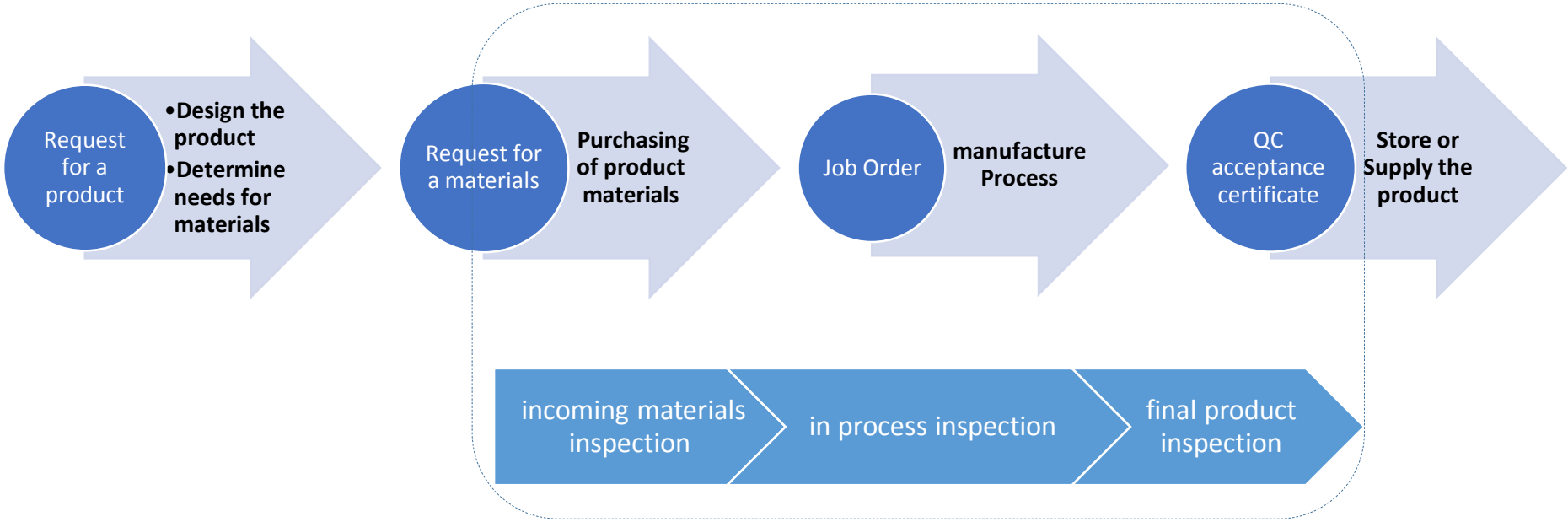
1. Build Awareness of need and opportunity for improvement.
2. Set goals for improvement.
3. Organize to reach goals.
4. Provide training.
5. Carry out projects to solve problems.
6. Report Progress.
7. Give Recognition.
8. Communicate Results.
9. Keep Score.
10. Maintain Momentum by making annual improvement part of the regular systems and processes of the company.

5 Section two: *Establishment of Quality Control System*

5-1 Production circle.

Intended by production cycle, is the stages of producing a product, starting from identifying its properties, and ending with the realization of a physical product identical to the requirements which it has been made for.

Figure 1 below represent the stages of production cycle that related with Quality Control System.



Three types of Quality Control Activities indicated in the finger above:

1. Incoming materials inspections, to ensure that supplied materials matching with required raw materials specification to produce the product.
2. In Process inspection, to ensure accurate manufacturing activities during producing the product.
3. Final product inspection, to insure that the product meet all of its required specifications.

5-2 Steps of Establishing a QC system based on & ISO 9001 requirements.

According to ISO 9001 requirements, clause 7.3.3

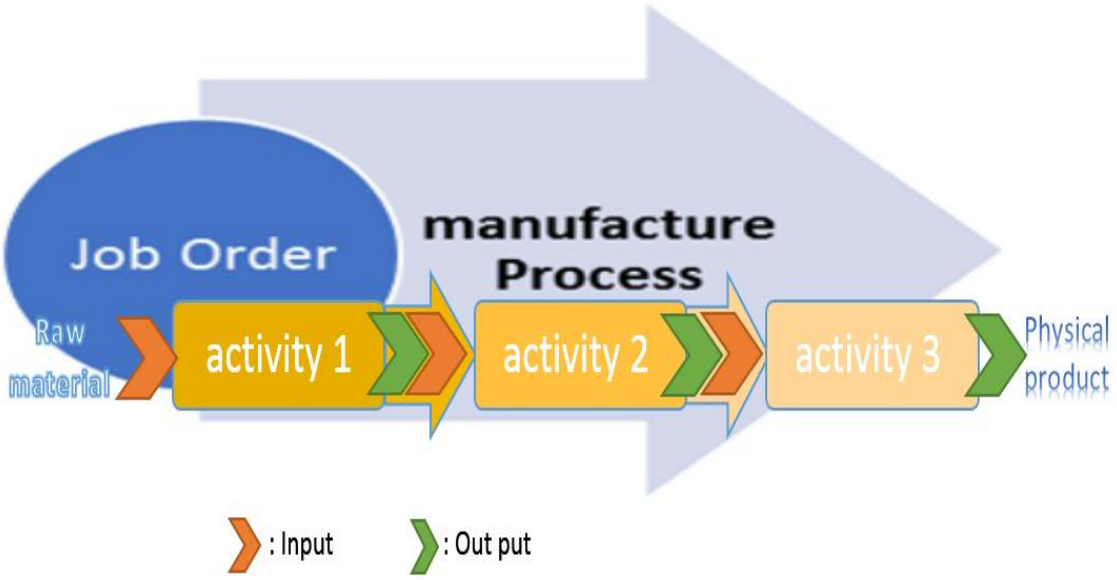
"*The outputs of design and development shall be in a form suitable for verification against the design and development input and shall be approved prior to release.*
Design and development outputs shall
a) meet the input requirements for design and development,
b) provide appropriate information for purchasing, production and for service provision,
c) contain or reference product acceptance criteria, and
d) *Specify the characteristics of the product that are essential for its safe and proper use.*"

We can see clearly that items b & c directly related with Quality Control activities. The steps of establishing a QC system will be:

5-3 Determine the technological path of manufacturing the product.

Generally the product will pass through many activities during manufacturing process. Each one of these activities has input & output, the output of the first activity will an input to the second activity, & so on until final manufacturing activity, where the product must have gained all its specifications. That is the technological path of manufacturing the product. This path vary depending on the nature of the product, the degree of its complexity & the available technology of manufacturing.

Figure 2 the technological path

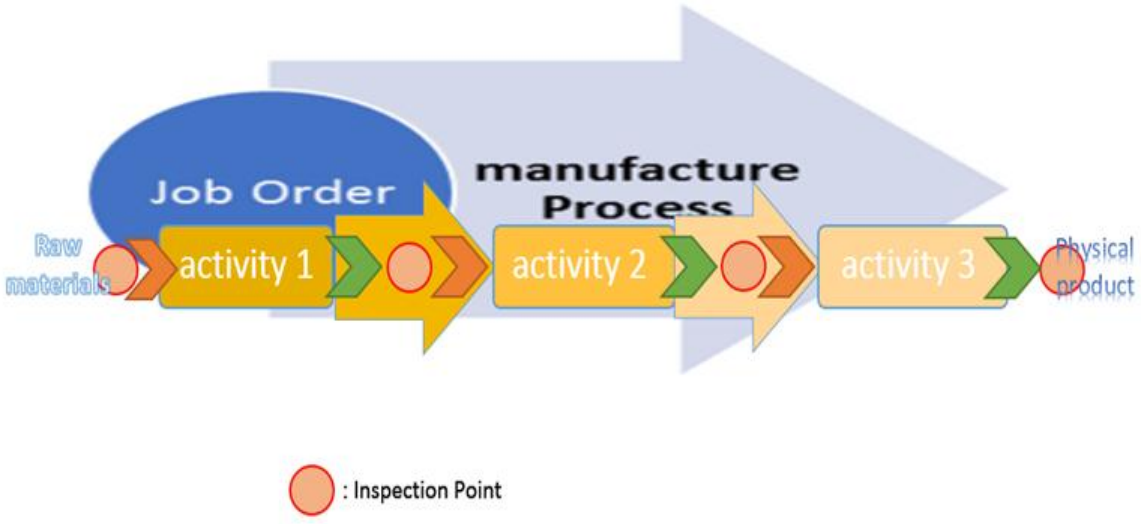


5-4 Determine inspection points on the technological path of manufacturing the product.

It's important to determine the inspection points on the technological path of manufacturing process, in all of the three stages of inspections for (incoming materials, in process & final product).

1. Start from beginning there were raw materials to be inspected according to incoming materials inspection program, to ensure of matching the raw materials with its required specification, this must be done after purchasing the raw materials before store it.
2. Then there will be many of inspection points during product processing, where many of quality control activities done during this stage (in process inspection stage), each one of these inspection points located between the output of the previous manufacturing activity & the input of the next manufacturing activity. The aim of this stage is to ensure of correct manufacturing activities, the product will not pass to next manufacturing activity without acceptance of previous inspection point.
3. At the end of manufacturing process there must be a final inspection point to insure that all required properties has been achieved in the final product.

Figure 3 locating of inspection points on the technological path of manufacturing process.



5-5 Determine inspection type for each inspection point.

Now we need to study each inspection point carefully to determine the types of inspections must be done in this point, perhaps there are more than one of these properties must be inspected and tested, (mechanical properties, shape, dimensions & tolerances, weights, surface finish & condition, materials chemical analyzing, etc.) depending on this analysis for what we have to do in each inspection points, we will go farther in establishment the QC system.

5-6 Determine inspection tools for each inspection point.

When the types of inspections & test has been clearly described for each inspection point, then determination of required testing tools & equipment must be chosen depending on product nature in

each stage of manufacturing, It's highly important to choose appropriate capacity, accuracy & rapidity of each test tool or equipment, to ensure capability of implement tests as per required specification in time.

5-7 Determine required documents for each inspection point.

There are two types of Documents needed in tests and inspections:

1. Product documents, which includes clearly required specifications to be tested (see item 5-2), these documents could be design drawings, workshop drawings, work procedures and work instructions, technical standards, etc., but the most important of them are the drawings & technical standards related to the product in each inspection point.
2. Inspection & test documents, includes both of the forms of tests reports & the test records.

5-8 Preparation of test & Inspection programs.

Since there are three major activities in quality control system, so there is need to prepare three test & inspection programs, in these programs there are many information's need to be collected, classified & recorded which, The best way to gathering all of these information is to arrange it in tables named *Incoming materials test program, In process test program & Final product test program:*

1. **Incoming materials test program:**

The main information's need to be collected, classified & recorded for this program are:

- A list of all materials used in manufacturing & packing the product includes their measurable properties.
- Testing tools / equipment for each class of materials.
- Sampling method of each material.
- Test type for each material.
- Related documents for each test.

2. **In process test program:**

In this program the information's needed are:

- A list of all manufacturing activities of producing & packing the product.
- Testing tool / equipment for each manufacturing activities.
- Sampling method of product items after each manufacturing activity.
- Test type for each manufacturing activity.
- Related documents of each manufacturing activities

3. **Final product test program:**

In this program the information's needed are:

- A list of all product.
- Testing tool / equipment or method for each final product.
- Sampling method of final product after final manufacturing activity.
- Test type for each final product.
- Related documents for each final product. (See Sample of forms in item 6 below)

5-9 Preparation of tests & Inspections forms & records.

Implementing the test programs correctly in time parallel with production time are the major responsibility of Quality Control personnel, but it's not enough, since there are huge amount of data from tests results, these data & test results must be recorded immediately, to be approved & must be known to related personnel in manufacturing process for continuity of the production cycle. So that it is important to design QC forms & records in clear & practical way.

After any test, the inspector must evaluate the result of the test to take a decision of accept, reject or repair (rework) the product. Also there is need to issuing certificates proving that the product (or its items) has been manufactured correctly.

Many forms & records may be used in any QC system, such as test reports (which may vary depending on test type), acceptance certificate, rejection reports & repair (or rework) reports.

See forms samples (item 6 below)

6 Sample of forms:

Incoming materials test program

#	materials	Specifications to be controlled	Control tool / equipment	Sampling method	Related Document	Record
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Prepared by: Approved by:

In process test program

#	manufacturing activities	Specifications to be controlled	Control tool / equipment	Sampling method	Related Document	Record
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Prepared by: Approved by:

Final product test program

#	Final products	Specifications to be controlled	Control tool / equipment	Sampling method	Related Document	Record
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Prepared by: Approved by:

Incoming material test report

Inspection Request No		Materials to Be Inspected	
Inspection Date		Reference No/Rev	
Physical Condition of Materials		Quality of Materials Received	
Factory Certificate of Conformity		Date of certificate	
#	Requested Materials Specifications	Actual Materials Specification	Accept / Not Accept (If not clarify)
1			
2			
3			
4			
5			
6			
Final Inspection Result / Comments / Remark			
Inspection Result Approved /Comments /Remarks By			
Inspector name , Signature & date		QM Manager approval	

In Process acceptance certificate

Date: / / 20

#	*Item number*	*Drawing no.*	*QTY*	*Inspected Sample*	*Belong to product*	*Remarks*
Inspector *Name & Signature*				*QC manager Name & Signature of*		

Product acceptance certification

Date: / / 20

#	Product name	Drawing No.	Qty	Customer name	Contract No.	Contract Date
QC. Supervisor Name & Signature				*Q.C. Manager Name & Signature*		
Date				*Date*		

Rejection report

Date: / /20

No.	Item Number	Drawing no.	Quantity	Parts No.	Rejection Reasons
Supervisor Name & Signature			Q.C. Manager Name & Signature		

Repair report

Date : / /		**Part or Product or Ass. Name :**			
Drawing no.		Quantity		Parts no.	

The Following Dimension / Specifications Should be repaired

Designed Specifications	Actual Specifications	Marked on Part		Rework Description
		Yes	No	
Inspector Name & Signature of			*Supervisor Name & Signature of*	

7 Conclusions and recommendations:

At first glance, it seems the establishment of quality control system is a complex issue, but if there is a guidelines for how to do it. It will be much more easier. Preparing these guidelines depending on Juran Trilogy & ISO 9001:2008 requirements has enriched this study by essence experiences of the highest global talents in this field.

My recommendation to whom concerned in establishing quality control system is to use this guidelines, whatever if they intend to apply Quality Management System or not, because the quality control system is the skeleton of Quality Management System ISO 9001, they can achieve more benefits by using the experiences of global talents.

8 Researcher profile:

- Wael Jasim Mohammed a mechanical engineer/Production & metallurgy 21 years of experience.
- B.Sc. Degree in Production & Metallurgy Engineering /University of Technology / Baghdad 1993.
- Internal Quality Auditor for ISO 9001:2008 by (BM TRADA) the accredit British Group by United Kingdom Accreditation Service (UKAS) in 2012.
- Internal Quality Auditor for ISO 9001:2000 by National Central Organization for Measurements & Quality Control in 2001.
- Quality Control manager for 12 years.
- Establish & manage the Quality Control Department & Mechanical & Chemical labs, in Azady industries (Farouk Group).
- Live in Sulaymaniyah since 2006

9 References:

1. The JURAN Quality Program / June 30th 2005.
2. INTERNATIONAL STANDARD ISO 9001 Quality management systems - Requirements Fourth edition 2008-11-15.