МИНОБРНАУКИ РОССИИ
Федеральное государственное бюджетное образовательное учреждение высшего профессионального образования
«Юго-Западный государственный университет»
(ЮЗГУ)

Кафедра иностранных языков

УТВЕРЖДАЮ
Проректор по учебной работе
О.Г. Локтионова
_____ 2014 г.

АНГЛИЙСКИЙ ЯЗЫК

Методические указания для самостоятельной работы бакалавров и магистров специальностей 221700.62 Стандартизация и метрология (СМб), 221400.68 Интегрированные системы управления качеством (Итм); 222000.68 Инноватика (УИм).

Курск 2014

УДК 387.147

Составители: Л.В. Левина, Г.В. Стрельникова

Рецензент
Кандидат филологических наук, доцент кафедры иностранных языков *Попадинец Р.В.*

Английский язык: методические указания по английскому языку / Юго-Зап. гос. ун-т; сост.: Л.В.Левина, Г.В. Стрельникова. Курск 2014. 26 с. Библиогр.: с.26.

Цель методических указаний научить студентов читать и переводить научную литературу по специальности, уметь извлекать и обобщать необходимую информацию. Методические указания основаны на аутентичных текстах, задания ориентированы на активное обучение английскому языку и формирование понятийного аппарата по специальности.

Методические указания соответствуют требованиям примерной программы дисциплины «Иностранный язык» федерального компонента цикла общегуманитарных и социально-экономических дисциплин в ГОС ВПО.

Методические указания предназначены для бакалавров и магистров специальностей 221700.62 Стандартизация и метрология (СМб), 221.400 Интегрированные системы управления качеством (Итм) 222000.68 Инноватика (УИм);

Тест печатается в авторской редакции

Подписано в печать . Формат 60x84 1/16.
Усл.печ.л____Уч.-изд.л. ___ Тираж___ экз. Заказ. Бесплатно.
Юго-западный государственный университет
305040 Курск, ул. 50 лет Октября, 94.

Self-control.

Criterion (criteria) – критерий, критерия
Measurement - измерение
Frequency - частота
Conformance - соответствие
Universal - универсальный
Beyond – вне, по ту сторону
Prerequisite – предпосылки

Self-control

Ideally, responsibility for control should be assigned to individuals. Such assignment is inherently clear. It also confers status – a form of ”ownership” that responds to some basic human instincts.

Ideally, responsibility should also be coextensive with authority. Applied to quality control this requires meeting the criteria for self-control – that is, providing the operating forces with the following:

1. *A means of knowing what the goals are.* This criterion is met by publishing the goals and standards.
2. *A means of knowing what the actual performance is.* This criterion is met by establishing the system of measurement, the frequency of measurement, and the means for interpreting the measurements.
3. *A means for changing the performance in the event that performance does not conform to goals standards.* To meet this criterion requires an operating process that is inherently capable of meeting the goals and is provided with features that enable the operating forces to change the performance as needed to bring it into conformance with the goals.

The concept of self-control is also universal. It applies to everyone in the company, from the CEO to the worker level, inclusive.

The importance of the self-control concept goes beyond its value in establishing clear responsibility and ownership: self-control is a necessary prerequisite to motivation.

To hold someone “responsible” in the absence of controllability (see the following section) creates the risk of unwarranted blame and of divisiveness. In this way one of the tests of completeness of planning for control is whether the criteria for self-control have been met.

I. Questions:
   1) Who should responsibility for control be assigned to?
   2) What should responsibility be coextensive with?
   3) What are the criteria for self-control?
   4) Why is the concept of self-control universal?

II. Speak about self-control.

Control by the Work Force.

a feature - черта
to design - проектировать
to depict - описать
facilities - средства
essential - существенный
work force – рабочая сила
clerk - служащий
factory worker – рабочий
salesperson - продавец
middle manager – менеджер среднего звена
upper manager – менеджер высшего звена

The control pyramid.

Any company has a huge number of things to control: the myriad features of the various processes. There is no possibility for the managers and professional specialists to do all that control work. Instead the company designs a plan of delegation somewhat as depicted in Figure 1.

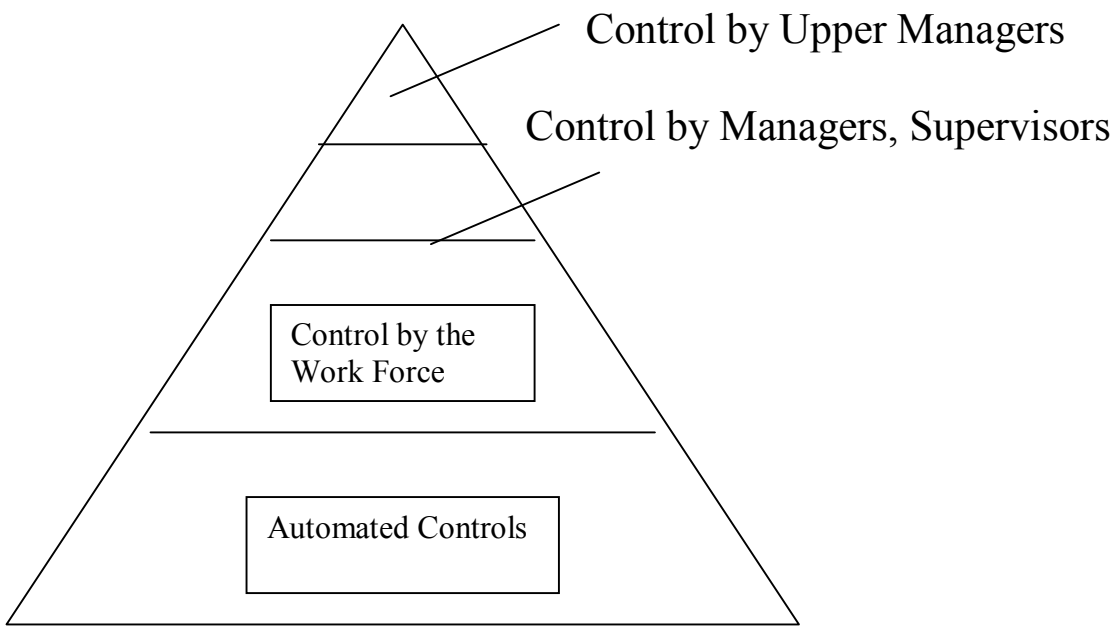

FIGURE 1. The pyramid of control

At the base of the pyramid are the *error-proof (foolproof) and automated processes* designed to keep on producing products that conform to goals. These processes control most of those myriad features. Yet they do so through feedback loops that operate with little or no human intervention other than maintenance of the facilities (which is, however, an essential control).

The remaining controls in the pyramid do require human intervention, at several levels.

Control by the Work Force: Controllability

Most human control is exercised by *the work force* – the clerks, factory workers, salesperson, etc. Many of these have been put into a state of self-control, so that they are able to defect and correct nonconformances.

There also exist a great many operations for which the criteria for worker self-control have not been fully met. In such case it is risky for managers to hold the workers "responsible" for quality. What is required in such cases is recognition of the concept of *controllability.*

If all the criteria for self-control have been met at the worker level, any resulting product nonconformances are said to be worker controllable. If any of the criteria for self-control have not been met, then management's planning has been incomplete. The nonconforming

products resulting from such planning deficiencies are then said to be management controllable.

In the minds of workers and managers alike, responsibility for results should be keyed to controllability. However, in the past many upper managers have not understood the state of controllability as it prevailed at the worker level. Numerous studies conducted in the 1950s and 1960s showed that for operations at the worker level the proportion of management-controllable to worker-controllable nonconformances was of the order of 80 to 20. That ratio helps to explain the failure of so many programs that tried to solve the company's quality problems solely by motivating the work force.

Tasks:
1) Describe the Control pyramid
2) Make up a summary of the texts Control by the Work Force
3) Control by the Work Force

Control at All Levels

Level - уровень
An employee - служащий
The chief executive officer (CEO)
To make use - использовать
The subject matter – основной вопрос
Numerous - многочисленный
A specification, a manual – инструкция, руководство
To tend – иметь тенденцию
Emphasis - ударение
Competitive - конкурентоспособность
Sensor – сенсор, датчик
To relate to – относиться к чему-то
Property - свойство
Decision - решение

Control at all levels

All company employees, from the chief executive officer (CEO) down to the workers, are active in quality control, and all make use of the feedback loop. However there are differences. One such difference is in the *subject matter* of control. At the worker level the goals consist mainly of numerous product and process features that are set out in specifications and procedures manuals. At managerial levels the goals are broader. They tend to become business oriented, and emphasis is often on being competitive in the marketplace. In turn, the differences in subject matter require additional differences:

Sensors. At the worker level, these tend to be "technological" – that is, related to the process itself. Technological sensors may be instruments that measure physical, chemical, or electrical properties. Or they may be information generated in the course of providing a service, like counts of units, or chronological time. At managerial levels, the sensors tend to be summary data systems.

The scope of the decision making. At the worker level this tends to be limited to decision and actions that are relevant to conformance to specifications and procedures. At managerial levels the responsibility widens considerably.

These differences can be summarized as follows:

Table 1.

	At work-force levels	At managerial levels
Control goals	Product and process features in specifications and procedures	Business oriented: product salability; competitiveness
Sensors	Technological	Data systems
Decisions to be made	Conformance or not?	Meet customer needs Or not?

1. Answer the questions:

1) Who is active in quality control?
2) What do the goals of control the worker level consist of?
3) What are the goals of control at managerial level?
4) What can technological sensors measure?

2. Analyze table 1.

3. Speak about control goals, sensors, decisions to be made of Work-Force Levels and at managerial levels.

Strategic Quality Management.

An approach - подход
To be similar to – быть подобным
A hierarchy - иерархия
Infrastructure - инфраструктура
Reward - награда
Participation - участие
Investment - инвестиция
Key words – ключевые слова

What is Strategic Quality Management.

SQM is a systematic approach for setting and meeting quality goals throughout the company.

SQM is the apex of the broader system of managing quality throughout the company. This broader system is variously called companywide quality management, total quality management, and so forth.

In this book the apex (SQM) is discussed in the present chapter. The middle sector of the pyramid is discussed in the next chapter, “Operational Quality Management”. The base of the pyramid is discussed in chapter 8, “The Work Force and Quality”.

In this connection it is instructive to look at the list of features of Japanese companywide quality management as identified by a committee of Japanese experts (Ykezawa and others 1987).

The Finance Parallel.

The methodology of SQM is quite similar to that long used establish and meet other broad company goals, notably financial goals. The similarity is so striking that is worthwhile to review briefly the well-known approach to companywide financial management, before getting deeply into the corresponding means for SQM.

Many companies manage for finance by use of a structured, coherent approach that can be described as companywide financial management. This approach consists of establishing financial aims.

1. President-led QC Activities in which. All Personnel participate
2. Top Priority consistently assigned to Quality by Management
3. Policy Dissemination and Control by Delegation
4. QC Audits and Their Implementation
5. Quality Assurance Activities ranging from Planning and Development to Sales and Servicing
6. QC Circle Activities
7. QC Education and Training
8. Development and Implementation of QC Techniques
8. Extension of Applications from Manufacturing to Other Industries
9. Nationwide QC Promotion Activities

Certain features of this approach are generic: they can be applied to other functions, including the quality function. These generic features consist of largely of the following:

A Hierarchy of Goals. The major financial goals – the corporate budget – is supported by a hierarchy of financial goals at lower levels, such as divisional and departmental budgets, sales quotas, cost standards, and project cost estimates.

A Formalized Methodology for establishing the goals and for providing the needed resources.

An infrastructure that (usually) includes a finance committee, a full-time controller, and supporting personnel.

A Control Process that includes system for data collection and analysis, financial reports, and reviews of financial performance against goals.

Provision of Rewards. Performance against financial goals is given substantial weight in the system of merit rating and recognition.

Universal Participation. The financial goals, reports, and reviews are designed in hierarchical form to parallel the company's organizational hierarchy. These hierarchical designs make it possible for managers at all levels to support upper managers in managing for finance.

A Common Language. This is centered on a major, common unit of measure: money. There are also other common units of measure, for example, ration such as return on investment. In addition, key words (such as *budget, expense,* and *profit*) acquire standardized meanings, so that communication becomes more and more precise.

Training. It is common for managers at al levels to undergo training in various financial concepts, processes, methods, and tools. Companies that have so trained their managers, in all functions and at all levels, are well poised to outperform companies in which such training has been confined to the finance department.

Tasks:

Answer the questions:

1) What is SQM?
2) What is the methodology of SQM similar to?
3) How can the approach, used by many companies be described?
4) What does this approach consist of?
5) What are the generic features of this approach?

Speak about the generic features of the approach.(A hierarchy of Goals ,a Formalized Methodology, An Infrastructure and so on).

Discuss the problem of SQM in pairs.

Summarise the texts.

Metals.

Metals are used in industry be cause of their properties. The separation between the atoms in metals is small. That is why metals are malleabte. Metals vary greatly in their properties. The properties of metals depend on the size, shape, orientation and composition of these grains.

Heat treatment controls the nature of the grains and their size in the metal.

All metals can be formed by different, but some require hot - working. Metals can be worked using different machine – tools.

Plastics

Plastics are non-metallic, synthetic, carbon-based materials. Plastics are synthetic polymers. Polymers consist of identical small molecules. Molecules are called monomers. The molecules can be either natural or synthetic. The natural polymers are cellulose, wax, and natural rubber.

Most plastics are synthesized from organic chemicals or from natural gas or coal. Plastics are good electrical insulators.

Plastics can be classified into several broad types.

1. Thermoplastics
2. Thermosetting plastics
3. Elastomers

Thermoplastics soften or heating and harden when cooled.

Typical examples are polystyrene polythene, PVC (polyvinyl chloride). Thermosetting plastics are less flexible, and less subject to creep. Examples are urea-formaldehyde, polyesters.

Elastomers have sufficient cross-linking between molecules to prevent stretching.

Termoplastics - термопластмасса
Thermosetting plastics – термореактивные пластмассы.

Texts for Reading

Inspection and the Role of Quality Control

We have seen that by controlling the process we can consistently produce a product of the same quality at the same price. It would then be logical to suggest that inspection is unnecessary and that the term "Quality Control" is meaningless. This is basically true, yet this function and the people performing it are generally found in our operations no matter how well the manufacturing process is controlled. We must understand their purpose and the way that their objectives, authorities, and responsibilities have changed from those used in an uncontrolled process.

The Role of Inspection

How often have we heard the phrase "You can t inspect quality into the product"? But how many people really believe it to be true? Not too many if we look at the way most products are made. In many plants the products are made. In many plants the product is inspected at several points in the production phase and almost all have a "final inspection" station. If you ask what all of this inspection is for, the answer is almost always that it assures that the product is sound and that nothing leaves the plant that is not manufactured completely according to the standards set by management. In other words, the in-line inspection is there to be sure that the correct materials are used, and that the operators do their job correctly. The final inspection is to check everything once again to be sure that both the operators and the prior inspectors carried out their tasks erectly and did not miss any errors.

Inspection Accuracy

The answer given above cannot be accepted as anything more than wishful thinking, however, if all of the factors involved in inspection are considered carefully. The first question to be asked is whether the inspectors can consistently determine if every part of the product is correctly made and assembled. If the operators are incapable of doing their jobs properly all the time, it is illogical to suggest that the inspectors can carry out their inspection accurately all the time. As far as final inspection is concerned, once the assembly operation is complete it is usually impossible to do more than inspect the external appearance of the product. The inspector may be able to derive some idea of quality from this, but it is a far cry from checking the overall product reliability (Figure 16).

As suggested above, we have to consider whether a human inspector can consistently work to a constant standard. Again the answer is in the negative. Many studies have been carried out on this subject and all indicate the same inefficiency and inaccuracy, especially when subjective decisions have to be made. One military contractor presented the same product to the same inspector on two separate occasions; the inspector` s finding only agreed in about 45% of the defects originally indicated. When four inspectors were used in the test agreement fell to around 15%. Yet these very inspectors were the people who were deciding whether the products met the specification or whether they should be reworked or rejected. If a final inspection is necessary to check the prior work and inspection, it is logical to suggest that there should be a post-final, final inspection in case the final inspector missed a defect. Of course, this procedure can continue ad nauseam until we have more inspectors than operators. Although this is ridiculuous, it has actually occurred and is not far from what exists in some manufacturing operations.

For example, a senior member of one of the armed services pointed out that almost half the cost of some military electronics is solely to pay for the inspection that is carried out by the inspectors, top assure that the contractor complies with the myriad specifications and standards that are imposed in the contract. We note that in these cases the words reliability and quality are rarely used; “meeting the specification” is everything. But the specification is only man’s attempt to describe in words some of the product changes that may be caused by variations to the process. They can be difficult to define and describe and the specification can never be anything but imperfect.

These comments are not intended to decry the abilities of inspectors but rather to show that we expect them to do work that a normal human begin is incapable of performing consistently. All too often we ask them to inspect by rote, to compare results to pictures or diagrams, or to use some other indirect measurement. If only we trained our inspectors correctly they would be able to inspect with intelligence.

Although it is true that we cannot inspect quality into the product, we attempt to do so day after day. Yet a moment's thought tells us that if the process is correct – if everything is always done in exactly the same materials – the product quality will always be the same. Somehow we fine great difficulty in accepting these simple truths.

Inspection and the Operation

There is a far more subtle factor to be considered when inspection is used in the way described above, and that is the effect on the thinking of the operators. Whether we like it or not, it says, "There is no need to strive to do the job properly—we have arranged for someone to pick up all the mistakes that you make. This was brought home strongly to me as a. Young newly appointed manufacturing manager. There were quality problems in my plant which were causing a high rate of field failures, and I did not know how to tackle the situation. Inspection had been beefed up by my predecessor to the point where there was an inspector to every five operators, but the field-failure rate of the product did not drop. Walking down the production lines one day I saw a component lying on the floor. I picked it up and gave it to the operator from whose bench it had fallen with the comment. "You will need this." "Oh, no"said the operator, "It has nothing to do with me— it's his responsibility," pointing to the inspector sitting immediately behind him. As a result of this experience I reorganized the shop floor and removed all inspection from the production lines. I also changed the role of quality control from inspection to that of process monitoring. The responsibility for quality was placed squarely back on the operators. With some other minor actions, field failures fell in a few weeks to one tenth the original figure. We did not have a quality problem we had a management and organizational problem.

What then is the task of inspection in the well-controlled process?

Certainly not to decide whether the product is good enough to ship or not, for that will be taken care of through excellent process control. Instant, inspection is needed to develop data. These data are used first to assure that the process is indeed within the control limits, and second to initiate any preventive actions that may be necessary to maintain or improve the process control.

For example, suppose that the product has a highly polished finish. In an uncontrolled process the inspector would check every item for defects in (ho polish, returning those that did not pass his inspection criteria for re-finishing There may well be some limit set on the number of items that can he returned without some investigation as to why these defects are being generated, but there is usually no attempt to eliminate the problem There is "an acceptable defect level." In this case the accuracy of the inspection becomes very important. If the limit is set at 1% but the inspector is only 70% efficient, there may well be a number of products shipped that have scratches or paint dribbles The inspector is the final arbiter, he is solely responsible for the quality of the finish and will be blamed for any defects. Yet it is impossible for him to ho 100% efficient, and from the very start we know that he will miss some errors.

Rework

What can be done to make the product quality right when it is found to be faulty? The product can certainly be reworked, but this is expensive and in many cases will result in nothing more than a cosmetic fix. For example, the cracked casing on a lawn mower that was dropped while it was being as-assembled may be found at inspection and replaced, but its bent shaft or out-of-line bearings are unlikely to be discovered and may ultimately result in a short life for the machine. In other words, rework will hide from the customer the fact that a problem existed in the product quality, because the cosmetic defects will be fixed. It will also hide the fact that problems exist in the manufacturing operation—in this particular case, the way the lawn mowers are handled and stored—which have to be reviewed and improved. Rework removes the pressure on production to fix the problems promptly because the products are eventually being shipped, but in many cases this means that the problems are never fixed.

After all, if we believe that inspection can find every defect in every product and there is a group of people whose job is solely to fix products that fail inspection, why bother to prevent the problems from occurring? In many cases the rework department is nothing more than a catch-all that hides from management the fact that quality problems exist and removes any pressure to eliminate those problems.

Rework and Reliability

It would be naive to say that no rework should ever be carried out, although some companies are in fact making this part of their overall objective. However, rework should never be carried out without a thorough understanding of what is to be done. The rework methods should be clearly defined, the operators well trained. Above all other considerations, it must be determined that the rework will not impair the life, or performance of the product. Finally rework must never be carried out lightly; me must recognize that it indicates a bacillus somewhere in the process and the basic cause of that failure must be found and eliminated.

Any rework, no matter how small or simple, is an unnecessary expense that demands immediate corrective action.

What is the Objective?

Our aim must be to make the highest quality product that we posibly can. It must perform perfectly, be completely reliable, have a superb appearance, and last forever. It is unlikely that we will ever achieve this aim, but if our objective is lower than this it is unlikely that we will ever achieve more than mediocrity Perfection must always be the ultimate quality requirement and our overall objective.

Living in a practical world we have to consider the many factors that will determine the lowest level of product quality that can be shipped, that is, the quality level that is acceptable to the customer and produces a saleable product. This is a much more difficult level to define and requires that many facets of our business be examined closely.

• At [he least, the product must perform properly according to its advertised claims.
• The sales price must be competitive.
• The reliability must be at least as good as the competing products.
• Its appearance must attract the customer.
• It must be convenient and safe to use.

The Specification Level

The specification level defines the absolute minimum level of acceptable quality and nothing less than this quality must ever be allowed out of our plant. We have to set our goals much higher than this or we will never get away from constant quality problems and bickering over specification requirements.

Setting such a goal is like attempting to fly over a 20,000-fooi mountain 30,000 feet; these minor variations will be a nuisance but will not affect the outcome of the flight. There is plenty of tolerance for unplanned and unexpected variables, and there will always be variable forces acting on the aircraft just as there will always he variable items in our manufacturing process Although we must minimize these variables, they will always exist to some degree and there must be sufficient tolerance in the process to accept them without causing the product quality to deteriorate below the specified level.

There are many product specifications already in existence, ranging from those applicable to military and aerospace hardware to those developed by the various standards organizations and industry organizations. It is rarely necessary to start from scratch and write a new one. Yet most suffer from the same problems.

• They attempt to specify the barest minimum that can he accepted on the incorrect assumption that good quality will make manufacturing more expensive.

• They do not define what should be done when the product fails to comply with the specification.

. The author frequently sits on committees that write product specifications, and invariably a majority of its members have one idea in mind and that is to dilute the specification to the absolute minimum quality level in an attempt to reduce the cost of manufacture. Typical is the case of the criteria for acceptable solder joints in electronics. We would all like to see that every joint is perfectly made with a complete soldered connection around 360 degrees of the lead, which would guarantee a sound reliable joint. Yet, at every meeting on the subject, the argument is put forward that 180 degrees of joining is "all right " The argument then goes on to say that if a specification calls for 360 degrees of solder around the lead, then all of the joints having a lesser amount of connecting solder will have to be reworked to make them comply with the requirement and this will push up the labor costs. Here is a case where the objective is to do the least that is necessary to gel the product out, not to provide the ultimate quality and reliability. The simple fact is that it costs no more to make a good joint with a 360 degree fillet than it does to make one with a 180 degree fillet.

Quality and the Future

Because it is unlikely that we can ever know what our competitors are planning to do, our struggle for quality can never end. There will never be a clear objective: what will be adequate today will not be competitive tomorrow. Not too many years ago we were quite happy if the tires on our car lasted for 20,000 miles. We would never buy tires from a manufacturer today who could not guarantee a much greater life. Thus, we must recognize that quality is an open-ended objective; as soon as we close in on our target it moves farther away. We must also accept that our striving for quality can never end. Indeed, this constant struggle to improve, to compete successfully, is at the very heart of our society.

We can then add the following reference to the future, to our definition of quality.

Quality is a measure of the performance, reliability, and cost of our product. Our quality is adequate when our customers continue to buy our products.

Quality and the Organization

Many companies in the United States are genuinely striving to manufacture products of the highest quality. Some are among the best performers in the world. Unfortunately, the majority fall into two classes.

1. Those who profess to strive for quality but do not translate their words into actions.
2. Those who really do not believe that quality programs work, or if they do, assume that the cost will be prohibitive.

There are many examples of the first classification. In the lobby of one typical company, a large framed document stated the corporate policy on quality. It included all the cliches, "We will always ship the highest quality products to our customers." "Quality is the most important item in our business," and so on. The author had been asked to go to this company to find the cause of certain defects in the product. It was determined that had materials were the basic problem, and it was suggested that they should he scrapped and replaced as there was no way that they could be used without jeopardizing the product quality. "But we can't do that," was the immediate response "Look at the cost, and the effect on the schedule." These two items were in fad of much more concern than the quality of the product, and it took a lengthy argument to convince the management that obtaining new materials would eventually prove to be lower in cost and of less jeopardy to the schedule. It is easy to meet the schedule by shipping defective products. It was also difficult for them to recognize that they had to reconsider all of their materials acquisition and inspection procedures, and they had to immediately rescind their instructions to always buy from the lowest bidder.

This attitude is by no means uncommon, and demonstrates clearly that any concern for true quality either is non-existent or has not reached the shop floor It is easy for senior management to agree that quality will be the watch word. to come up with slogans and posters, to issue instructions accordingly to the lower echelons of management, and then to do nothing more No budget for quality, no training programs for quality, and no personal involvement One day it comes as a surprise that sales are

falling, costs are rising, and the company reputation is reflected by the falling price of their stock. With the best will in the world, quality will never work upward from the shop floor.

Quality of the Product

A first attempt to define the quality of the product might be the following phrase.

"The product must meet the performance specification."

This is certainly a good start. Then we have to consider whether the specification can fully define all that the product is expected to do: what if a knob on a radio functions correctly but is stiff to operate; what if the handle on a rake has a rough spot that annoys the user. These are small items that may not contravene the specifications, may not even be consciously noticed by the user, but they are annoying enough to stop a customer from coming back We have all experienced the automobile which is "nice to drive"; although it may not have the acceleration of a Corvette or the comfort of a Cadillac, we enjoy using it and will probably buy another of the same make. The characteristics that make it an enjoyable car are probably impossible to write into a specification but are vitally important in retaining customers.

Quality and the Competition

What if a competitor's product not only can do all that our product is capable of. but also has additional features and sells for the same price. Can the qualiiv of our product be considered adequate'.' The marketplace will soon lell us th.'n it is not. We have to take into account not only our own product bul also how it compares with similar products at a similar price. We have to consider the life of the product. Should it be expected to last forever, even with minimum maintenance or no maintenance at all? What is the importance of the appearance of our product? We have seen examples of an item that beats its competition because of a better

appearance, even though it did not perform as well. It is not sufficient merely to manufacture our product to meet the specification; the design, the finish, even the way it is packaged become important. They are all part of this elusive factor, "quality."

Design and Quality

If the manufacturing process is truly in control, if all of the variables are eliminated, then each unit of the product will be exactly the same and the product quality and reliability will be determined solely by the design. If the designer has taken into account any possible variations in the materials and parts and in the tools and equipment, controlling the process will not be difficult and minor variations will not affect the product. However, if the design is in any way .marginal or if the material specifications are critical, it may become very difficult to set up an adequate process control operation. Ultimately, the product quality should be only a function of the design, but this in turn demands that the designer understands fully the manufacturing process and the limitations that this applies to the design of the product.

In one case, the design of some assembly machines was based on using onecomponent of the product being manufactured to hold an entire assembly during one of the major process steps. Unfortunately, the designer had not understood clearly the various tolerance buildups in the position and size of the part, nor the forces that would be applied to that part during the process. When the machine was finally tested, it consistently broke a small but unacceptable number of the parts during the process step. Several models of the machine had been built and in the end they were all scrapped, as it was quite uneconomical to modify them in any way. This particular design defect was first seen quite early in the manufacture of the machines but was ignored by the designer, who believed that some simple modifications to the completed machines could eliminate the problem. When the mechanical forces were finally investigated, it was found that the stresses on the part were so near its breaking point that nothing could be done. It is disastrous when the realization that a design problem exists comes late in production. These

things of course, should have been discovered during the preproduction phase.

Design cannot be separated from production. They are all part of the manufacturing process and' must recognize their reliance on each other. Manufacturing must understand the problems of the design team, and design must recognize the limitations of the manufacturing process.

The Place of Quality Control

The term Quality control is a totally in correct description of the function of this department. It is impossible for it to control product quality "Quality Assurance" is much better but this also does not accurately describe its responsibilities.

If product quality is determined by the design, and if process control maintains that quality level, what is the need for quality control? In theory, we can eliminate this function. We could remove the quality control department entirely and the process should continue with no variations in the product quality, but, as we have already remarked, we live in a less than perfect world. and minor variations will inevitably occur in materials, machines, or operators. Quality control people are certainly an important part of process control, monitoring to identify these changes when they occur and taking the necessary steps to eliminate them. Having developed the process and trained everyone to follow it exactly, we have to be sure that it is always carried out according to the recorded instructions. We have to be sure that the materials are to specification and that the maintenance of the tools and equipments is carried out correctly.

If everyone did his job correctly, including our vendors, then there would be no need for a quality control department. But we are working with people and people invariably make mistakes. Quality control people must monitor every step in the process and immediately report any deficiencies. If this function does not exist, the process will slowly drift and eventually become totally out of control.

The quality control department should not be an inspection function. When inspection is required in any position on the shop floor, it is a manufacturing task. If quality control people are inspecting product, who is there to monitor the work that they are doing? Their prime

responsibility is to check the process steps, to know whether the training is correct and whether the tools and machines are in order, to check the calibration on measuring and control systems, and so on.

Quality control people should not be looked upon as policemen waiting to catch the unwary offender, but rather as colleagues ready to assist in maintaining control of the process. Of course, each manufacturing operation is unique, but the overall task of the quality control department remains the same-to control the quality through monitoring the developed process.

Cost Vs. Quality

Cost, of course, has to be a major concern, and this is often used as an excuse for accepting lower quality products. There is a widespread but incorrect idea that if the product is low enough in cost it will automatically beat the competition. In general this not true, especially when the customer can select from a large range of products.

If the appearance and performance are as good as or better than the competition, the product will sell initially provided that the price is not more than marginally higher; but it is the quality and reliability found in service that will determine the long-term sales. We have only to look at the automobile industry to understand this.

While the Japanese cars initially took a large slice of the sales in the United States because of their lower costs, they retained their lead by developing manufacturers came from producing quality vehicles at an acceptable price, not by making the cheapest cars on the market. Indeed, the demise of some of the automobiles imported from the old Eastern Block countries showed that customers wanted performance, looks, and overall reliability much more than simply low cost.

Of course price has an effect on the product, but it should not affect the quality as perceived by the customer. No one buying a Rolls Royce expects it to be cheap, but no one buying a Pontiac expects it to be any less reliable. Yet their respective prices are thousands of dollars apart. Cost therefore has to he balanced against the product performance in the design phase. The Pontiac may use plastic instead of leather to cover the seats, but this must not affect the comfort or life of the seating. The RR

may be quieter, but the Pontiac has to have an acceptable level of sound insulation.

When perfection is given as the ultimate aim, an attitude often exists which says that this will prove to be too expensive and that "good enough" should he our objective. Yet often, in an attempt to define and work to this mysterious "good enough," we spend more money than if we had gone for the best in the first place

As an example, on one production line the best tools for the job cost around $150 each, while less suitable tools cost under half that amount. The lower priced ones were bought with the comment that they would be "good enough." Certainly the job was carried out and the product was shipped, hut the operation times were excessive, the tools were more difficult to use and broke down more often, and operator defects increased. In the end the better tools had to be purchased to reduce the production costs.

In another case, a piece of machinery was required and capital expenditure approved. The amount of money allowed was insufficient to purchase a machine that met all of the requirements and one of lower capability was acquired. It certainly performed the operation but did not have good repeatability, and process control became extremely difficult. The cost of maintenance was excessive, and eventually the machine had to be scrapped and a new one purchased.

One company purchased fabricated materials from the Far East because they were cheaper than comparable parts made in the United Slates. In order to save money the entire transaction was carried out by mail. Fax, and through intermediaries, with no direct investigation of the vendor's capabilities It was only when a full year's supply of materials had been put into stores and began to be used that they were found to be of inadequate quality. Because of the pressure of the schedule the parts were used but only with the expenditure of excessive labor. The result was also a product with a lowered reliability.

БИБЛИОГРАФИЧЕСКИЙ СПИСОК

1. Агабекян И.Н. Английский для технических вузов. Ростов н/Д. “Феникс”, 2000 г. – 352 с.
2. Juran J.M. On Leadership for Quality. London, 1989. 625 c.
3. Woodgate R. Managing the manufacturing. 1991., Nem-York. John Wiley & Sons, Inc. 240 c.