

INDUSTRIAL ENGG.AND QUALITY CONTROL

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INESPECTION and QUALITY CONTROL-

An **inspection** involves checking something, i.e., examining and assessing something. ... In the world of business, **inspection** is the critical appraisal of materials, items, or systems involving examination, testing, and gauging. Inspectors take measurements and make comparisons

Quality control (QC) is a procedure or set of procedures intended to ensure that a manufactured product or performed service adheres to a defined set of **quality** criteria or meets the requirements of the client or customer.

PLANNING OF INESPECTION-

Inspection plans provide details about what characteristics must be tested in order to ensure the quality of the product, as well as specific metrics and measurements that must be achieved in order for the product to be judged in compliance with standards.

TYPES OF INESPECTION-

There are three primary **types** of quality **inspections**: pre-production, **in-line**, and final. **There** are a variety of details that must be **inspected** and approved during each phase **in** order to detect and correct quality problems.

- **FACTOR – Money:** Most important **factor affecting the quality** of a product is the money involved in the **production** itself. ...
- **Materials:** To turn out a high **quality** product, the raw materials involved in **production** process must be of high **quality**.
- **Management:** ...
- **People:** ...
- **Market:** ...
- **Machines and Methods:**

TQM-

Total quality management (TQM) consists of organization-wide efforts to "install and make permanent climate where employees continuously improve their ability to provide on demand products and services that customers will find of particular value."^[1] "Total" emphasizes that departments in addition to production (for example sales and marketing, accounting and finance, engineering and design) are obligated to improve their operations; "management" emphasizes that executives are obligated to actively manage quality through funding, training, staffing, and goal setting

- Total quality management (TQM) is an ongoing process of detecting and reducing or eliminating errors.
- It is used to manufacture to streamline supply chain management, improve customer service, and ensure that employees are trained.
- The focus is to improve the quality of an organization's outputs, including goods and services, through continual improvement of internal practices.
- Total quality management aims to hold all parties involved in the production process accountable for the overall quality of the final product

ISO9000/1400-

The International Organization of Standardization (ISO) is a worldwide federation consisting of member bodies from 91 countries, which promotes the development of international manufacturing, trade and communication standards.

ISO 9000 refers to a generic series of standards published by the ISO that provide quality assurance requirements and quality management guidance. ISO 9000 is a quality system standard, not a technical product standard. The ISO 9000 series currently contains four standards - ISO 9001, ISO 9002, ISO 9003 and ISO 9004. Firms select the standard that is most relevant to their business activities. However, these four standards will be revised in late 2000. More information is provided later in this paper under ISO 9000:2000.

ISO 14000 refers to a series of standards on environmental management tools and systems. ISO 14000 deals with a company's system for managing its day-to-day operations and how they impact the environment. The Environmental Management System and Environmental Auditing address a wide range of issues to include the following:

1. Top management commitment to continuous improvement, compliance, and pollution prevention.
2. Creating and implementing environmental policies, including setting and meeting appropriate targets.
3. Integrating environmental considerations in operating procedures.
4. Training employees in regard to their environmental obligations.
5. Conducting audits of the environmental management system.

ISO 9000 and ISO 14000 are tools to assist business and government to insure the quality of their products and services, and to manage the impact of their activities on the environment. Like all ISO standards, their use is voluntary unless a business sector makes them a market requirement or a government issues regulations making their use obligatory. Organizations that implement ISO 9000 and ISO 14000 voluntarily do so to improve operations and provide real benefits

JIT-

What Is Just-in-Time (JIT)?

The [just-in-time \(JIT\) inventory system](#) is a management strategy that aligns raw-material orders from suppliers directly with production schedules. Companies employ this inventory strategy to increase efficiency and decrease waste by receiving goods only as they need them for the production process, which reduces inventory costs. This method requires producers to forecast demand accurately.

The JIT inventory system contrasts with just-in-case strategies, wherein producers hold sufficient inventories to have enough product to absorb maximum market demand.

The benefits of a JIT system

The following are some of the many benefits that you could gain through the implementation of just in time

1. **Reduction in the order to payment timeline;** cash, as they say is king in business. Many businesses will suffer with cash flow problems as they will often have to purchase large amounts of raw materials prior to manufacturing and subsequent payment by the customer. Often this gap is many months. Through implementing JIT you are able to considerably reduce that time period.
2. **Reduction in Inventory costs;** one of the main aims with any JIT implementation is to improve stock turns and the amount of stock being held. Personal experience has seen reductions of more than 90% stock in some industries. Along with the reduction in the stock come many other associated benefits.
3. **Reduction in space required;** by removing large amounts of stock from the system and moving processes closer together we will often see a significant reduction in the amount of floor space being used. Results from 100's of projects run within companies in the UK through the Manufacturing Advisory Service saw average reductions of 33% for simple 5 day implementation projects.
4. **Reduction in handling equipment and other costs;** if you don't have to move large batches there is less need for complex machinery to move them and all of the associated labor and training.
5. **Lead time reductions;** one of the most significantly impacted areas is that of the time it takes for products to flow through the process. Instead of weeks or months most JIT implementations result in lead times of hours or a few days.
6. **Reduced planning complexity;** the use of simple pull systems such as Kanban, even with your suppliers, can significantly reduce the need for any form of complex planning. With many implementations the only planning is the final shipping process.
7. **Improved Quality;** the removal of large batch manufacturing and reduction in handling often results in significant quality improvements; often in the region of 25% or more.
8. **Productivity increases;** to achieve JIT there are many hurdles that must be overcome with regards to how the process will flow. These will often result in productivity improvements of 25% upwards.
9. **Problems are highlighted quicker;** often this is cited as being a negative aspect of JIT in that any problems will often have an immediate impact on your whole production process. However this is the perfect way to ensure that problems are highlighted and solved immediately when they occur.
10. **Employee empowerment;** one requirement of JIT as with most other aspects of Lean manufacturing is that employees are heavily involved in the design and application of your system.

SIX SIGMA-

Six Sigma is a method that provides organizations tools to improve the capability of their business processes. This increase in performance and decrease in process variation helps lead to defect reduction and improvement in profits, employee morale, and quality of products or services. Six Sigma is a highly effective approach which creates improvement in business processes by advancing each sector of an enterprise. It uses both statistical and analytical methods to reduce variation in the end products. Six Sigma examples are great ways of helping one understand the characteristics and benefits of techniques used during its implementation. There are several Six Sigma project modules which use these examples to help the learner understand the manner the system operates.

Six Sigma is:

- **A Business Strategy:** Using Six Sigma Methodology, a business can strategize its plan of action and drive revenue increase, cost reduction and process improvements in all parts of the organization.
- **A Vision:** Six Sigma Methodology helps the Senior Management create a vision to provide defect free, positive environment to the organization.
- **A Benchmark:** Six Sigma Methodology helps in improving process metrics. Once the improved process metrics achieve stability; we can use Six Sigma methodology again to improve the newly stabilized process metrics. For example: The Cycle Time of Pizza Delivery is improved from 60 minutes to 45 minutes in a Pizza Delivery process by using Six Sigma methodology. Once the Pizza Delivery process stabilizes at 45 minutes, we could carry out another Six Sigma project to improve its cycle time from 45 minutes to 30 minutes. Thus, it is a benchmark.
- **A Goal:** Using Six Sigma methodology, organizations can keep a stringent goal for themselves and work towards achieving them during the course of the year. Right use of the methodology often leads these organizations to achieve these goals.
- **A Statistical Measure:** Six Sigma is a data driven methodology. Statistical Analysis is used to identify root-causes of the problem. Additionally, Six Sigma methodology calculates the process performance using its own unit known as Sigma unit.
- **A Robust Methodology:** Six Sigma is the only methodology available in the market today which is a documented methodology for problem solving. If used in the right manner, Six Sigma improvements are bullet-proof and they give high yielding returns.

LEAN MANUFACTURING-

Lean manufacturing is a methodology that focuses on minimizing waste within **manufacturing** systems while simultaneously maximizing productivity. Waste is seen as anything that customers do not believe adds value and are not willing to pay for.

PLANT MAINTENANCE

Plant-

A plant is a place, where men, materials, money, equipment, machinery, etc are brought together for manufacturing products.

Maintenance-

Maintenance of facilities and equipment in good working condition is essential to achieve specified level of quality and reliability and efficient working. It helps in maintaining and increasing the operational efficiency of plant facilities and contributes to revenue by reducing operating of production.

Objectives of plant maintenance-

- To achieve minimum breakdown and to keep the plant in good working condition at the lowest possible cost.
- To keep the m/c in such a condition that permit to use without any interrupter
- To increase functional reliability of production facilities
- To maximize the useful life of the equipment
- To minimize the frequency of interruption to production by reducing breakdown
- To enhance the safety of manpower

IMP of maintenance-

- Equipment breakdown leads to an inevitable loss of production
- An improperly maintained or neglected plant will sooner or later require expensive and frequent repairs, because with the passage of time all machines or other facilities, building, etc wear out and need to be maintained to function properly.
- Plant maintenance plays a prominent in production management because plant breakdown creates problem such as- loss of production time
 - ✓ Rescheduling of production
 - ✓ Spoilt materials (because sudden stoppage of process damages in-process materials)
 - ✓ Failure to recover overheads (because loss in production hours)
 - ✓ Need for overtime
 - ✓ Need for subcontracting work
 - ✓ Temporary work shortage- workers require alteration work

Duties, functions and responsibilities of plant maintenance department-

- Inspection is concerned with the routine schedule checks of the plant facilities to examine their condition and to check for needed repairs
 - Inspection ensures the safe and efficient operation of equipment and machinery
 - Frequency of inspections depends upon the intensity of the use of the equipment
 - Items removed during maintenance and overhaul operation are inspected to determine flexibility of repairs
 - Maintenance items received from vendors are inspected for their fitness
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- Engineering involves alterations and improvements in existing equipments and building to minimize breakdowns
 - Maintenance department also undertakes engineering and supervision of constructional projects that will eventually become part of the plant.
 - Engineering and consulting services to production supervision are also the responsibility of maintenance department.
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- Maintenance of existing plant equipment.
 - Maintenance of existing plant buildings and other service facilities such as yards, central stress, roadways.
 - Minor installation of equipments, building and replacements
 - Prevent breakdown by well-conceived plans of inspection, lubrication, adjustments, repair and overhaul.
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- Maintenance department carries corrective repairs to avoid unsatisfactory conditions found during preventive maintenance inspection.
 - Such a repair work is of an emergency nature and is necessary to correct breakdowns.

- Overhaul is a planned, schedule reconditioning of plant facilities such as machinery etc.
- It involves replacement, reconditioning, reassembly etc.

- In some organizations, maintenance department is provided with equipment and personnel and it takes up construction job also.
- It handles construction of wood, brick and steel structures, electrical installation etc.

- It may also handle disposition of scrap or surplus materials.
- This involves segregation and disposition of production scrap.

- Maintenance department keeps records of cost, of time progress on jobs, electrical installations, water, steams, air and oil lines, transport facilities.
 - a) Generation and distribution of power.
 - b) Providing plant protection
 - c) Establishing and maintaining a suitable store of maintenance materials
 - d) House keeping
 - e) Pollution and noise control

Types of maintenance:

Maintenance may be classified as

- a) Corrective or breakdown maintenance
- b) Scheduled maintenance
- c) Preventive maintenance
- d) Predictive maintenance

a) Corrective or breakdown maintenance:

- Corrective or breakdown maintenance implies that repairs are made after the equipment is out of order and it cannot perform its normal function any longer. Ex – electric motor will not start, a belt is broken.
- Under such conditions, production department calls on the maintenance department to rectify the defect. The maintenance department checks into the difficulty and makes the necessary repairs.
- After removing the fault, maintenance engineers do not attend the equipment again until another failure or breakdown occurs.
- Breakdown maintenance is economical for those equipment whose down time and repair costs are less.
- Breakdown type maintenance involves little administrative work, few records and comparative small staff.

Causes of equipment breakdown:

- Lack of lubrication
- Neglected cooling system
- Failure to replace worn out parts
- External factors (too high or too voltage)

Disadvantages of breakdown maintenance:

- Breakdowns occur at inopportune times, which lead to poor, hurried maintenance and excessive delays in production.
- Reduction of output
- More spoiled material
- Increased chances of accidents and less safety to both workers and machines
- Direct loss of profit.
- Breakdown maintenance cannot be employed to cranes, lifts, hoists and pressure vessels.

b) Scheduled maintenance:

- Scheduled maintenance is a stick-in-time procedure aimed at averting breakdowns
- Scheduled maintenance do inspection, lubrication, repair and overhaul of certain equipments are done in predetermined schedule.
- Schedule maintenance practice is generally followed for overhauling of machines, cleaning of water and other tanks, white washing of building etc.

c) Preventive maintenance:

- A system of scheduled, planned or preventive maintenance tries to minimize the problems of breakdown maintenance.
- It is a stitch-in-time procedure.
- It locates weak spots (such as bearing surfaces, parts under excessive vibrations etc) in all equipments, proceeds them regular inspection and minor repairs reducing the danger of unanticipated breakdown.
- Preventive maintenance involves.
- Periodic inspection of equipment and machinery to prevent production breakdown and harmful depreciation.
- Upkeep of plant equipment to correct

Objective of FM:

- To minimize the possibility of unanticipated production interruption and major breakdown by locating the fault.
- To make plant equipment and machinery ready to use
- To maintain the optimum productive efficiency
- To maintain the operational accuracy
- To achieve maximum production and minimum repair cost
- To ensure safety of life and limbs of the workers

Advantages:

- Reduces breakdown and down-time
- Lesser odd-time repairs
- Greater safety for workers
- Low maintenance and repair cost
- Increased equipment life.
- Better product quality.

d) Predictive maintenance:

- It is a newer maintenance technique.
- It uses human senses or other sensitive instruments such as audio gauges, vibration analysers, amplitude meters, pressure, temperature and resistance strain gauges to predict troubles before the equipment fails.
- Unusual sound coming out of a rotating equipment predict a trouble, an electric cable excessively hot at one point predicts a trouble.
- In predictive maintenance, equipment conditions are measured periodically or on a continuous basis enables maintenance men to take timely action such as equipment adjustments, repair and overhaul.

- It extends the service life of an equipment without fear of failure.

Recent developments in plant maintenance:

The management techniques used for plant maintenance to increase maintenance efficiency, reduce maintenance cost and to improve services.

A. Use of work study:

Work study can improve maintenance scheduling and eliminate a great deal of frustration and anxiety on the part of production supervision.

B. Use of network planning techniques:

- CPM has enables some firms to cut their down time by 20 to 30 %
- Maintenance costs have been cut down.
- CPM is useful for large maintenance projects
- 70 % of reduction in time for overhaul by central electricity board in Great Britain using network planning technique.
- PERT reduced shut down time 18 to 16 days 102 and added 90000 barrels to production volume of a refinery.

c. Use of operation research:

Operation research handles maintenance problems such as the economiv level of spare parts or when to replace an item etc.

D. Use of computers;

- More efficient and control over maintenance problems.
- Computer can prepare maintenance work orders giving accurate work order descriptions and job timing.
- Eliminate human error in preparing work order.
- Reduced cost of keeping records of equipments