

Chapter :-1

INSPECTION

Contents:- Introduction

Units of Measurement

International,National and Company standrad

Types of inspection

1.1 INTRODUCTION

The term 'Inspection' has been defined by different authors in different ways:

According to Kimball, "Inspection is the art of comparing materials, products or performance with the established standards."

According to Spriegel and Landsberg, "Inspection is the process of measuring the qualities of a product or service in terms of established standards."

"Inspection is the art of applying test preferably by the aid of measuring instruments to observe whether a given item or product is within the specified limits of variability."

1.2 PHYSICAL QUANTITY

Any quantity which can be measured is called physical quantity. There are two types of physical quantities:

1. Fundamental or basic quantities,
2. Derived quantities.

1. Fundamental or Basic Quantities : The mutually independent quantities are called fundamental or basic quantities.

2. Derived Quantities : The quantities which can be expressed in terms of fundamental or basic quantities are called derived quantities. e. g.

- i. Velocity = Displacement/Time = Length/Time
- ii. Linear momentum = Mass*Velocity

$$= \text{Mass*Length/Time etc.}$$

1.3 UNITS OF MEASUREMENT

To measure a physical quantity, a standard is required which is called unit. Thus unit may be defined as the standard which is used for measurement.

1. It should be well defined
2. It should have proper size
3. It should not change with time, place or physical conditions.

Accordingly, units are classified as under :

1. Fundamental or basic units,
2. Derived units.

1.3.1 Fundamental or Basic Units

The units selected for the measurement of fundamental or basic quantities are known as fundamental or basic units.

1.3.2 Drived units

The units which are derived from fundamental units are called derived units.

1.4 SYSTEM OF UNITS

There are four systems of units recognized unversally:

1. C.G.S. System: In this system, the units of length, mass and time are cen timeter gram and second resectively.
2. F.P. S. System: In this system, the units of length, mass and time are foot, pound and second respectively.
3. M.K.S. System: In this system, the units of length, mass and time are meter, kilogram and second respectively.
4. S.I System: Eleventh General Conference of Weights and Measures recommended a unfied and systematic system of fundamental and derived units for international use.

1.5 MEASUREMENT

Measurement is the process of comparing an unknown quality with a known fixed unit quantity of the similar nature.

1. A unit
2. A number or numerical factor.

1.6 INTERCHANGEABILTY

In large quantity production of the components of and assembly, when one component assembles properly with any mating component, both being chosen at random, then this provision is known as interchangeability of components of an assembly.

1.6.1 Types of Interchangeability

Three types of interchangeability systems are used which are as follow:

1. Full or Universal Interchangeability
2. Selective Assembly
3. Matched Fit.

1.7 TYPES OF INSPECTION

A. Based upon the method of inspection:

1. Remedial inspection,
2. First-off inspection,
3. In process inspection,
4. Operation inspection,
5. Final inspection,
6. Endurance inspection

B. Based upon Location:

1. Centralized or crib inspection,
2. Decentralized or floor inspection.

1.8 STUDY OF FACTORS INFLUENCING THE QUALITY OF MANUFACTURE

There are many factors which influence the quality of manufacture. Some of these are as follow:

1. Raw Material
2. Skilled Manpower
3. Machinery and Equipment
4. Process
5. Design
6. Purpose.

Chapter :-2

MEASUREMENT AND GAUGING

Contents:-

- Basic Principle used in measurement
- Study of various measuring instrument
- Geometrical parameters and error
- Testing and maintenance of measuring instruments

2.1 Measuring instruction

Measuring instructions are used to measure, check and set the dimensions specified.

Measuring instruments are dimensions control instruments used to measure the exact size of the object

2.2 TYPES OF MEASURING INSTRUMENTS

1. Instruments for linear measurements:

- i. Steel rule,
- ii. Divider,
- iii. Caliper,
- iv. Vernier calliper,
- v. Depth gauge,

2. Instruments for angular measurement:

- i. Sine bar
- ii. Combination set
- iii. Dividing head
- iv. Auto-collimator

3. Instruments for plane surface measurements;

- i. Spirit level
- ii. Straight edge
- iii. Surface gauge
- iv. Optical flat

2.3 STEEL RULE

It is also known as scale. It is simplest and the most common measuring instrument for linear measurements. *It measures on the basic techniques of comparing an unknown length to the one previously calibrated*

2.4 CALIPER

Caliper is the measuring instrument which is used for comparing linear measurement against known dimension.

The various types of calliper commonly used are as follow:

1. Outside calliper
2. Inside calliper
3. Odd leg or hermaphrodite calliper
4. Transfer calliper

2.5 VERNIER CALIPER

Vernier calliper is a precision instrument which is used for measuring external as well as internal diameters of shafts, thickness of parts etc. To an accuracy of 0.02 mm.

Principal of vernier : the principle of vernier is that when two scales or divisions slightly different in size are use ,the difference between them can be utilized to enhance the accuracy of measurement.

2.6 MICROMETER

Micrometers are precision measuring instruments. They are designed on the principle of 'screw and nut'. These are available in various types as follow:

1. Outside micrometer
2. Inside micrometer
3. Screw thread micrometer
4. Depth gauge micrometer
5. Differential micrometer
6. Micrometer with dial gauge

2.7 DIAL INDICATOR

Dials indicator is used to true and align machine tools, fixtures and work to test and inspect the size and trueness of a finished work to an accuracy of 0.01 mm.

2.8 SURFACE PLATE

A Surface plate is used to test the flatness of work itself. It is also used for marking out work. It is used for small pieces of work while marking out table is used for large jobs.

2.9 STRAIGHT EDGE

Straight edge is used to test the straightness or flatness of plane surface. It is generally rectangular in shape, but for accurate work, one edge is bevelled or formed into a thin knife edge.

2.10 TRY SQUARE

Try-square is used mainly to test squareness of two adjacent surfaces. In addition, it is used to measure and set out dimensions, test the finish of a plane surface, draw parallel lines at right angles to a plane surface and draw mutually perpendicular lines over a plane surface.

2.11 SINE BAR

A Sine bar is a simple device used either for accurate measurement of angles or for locating a work to a given angle.

2.12 COMPARATOR

A Comparator is employed to find how much the dimensions of given components differ from of a known datum.

2.13 TYPES OF COMPARATORS

1. Mechanical comparators
2. Electrical comparators
3. Pneumatic comparators
4. Optical comparators
5. Fluid displacement comparators

2.14 SLIP GAUGES

Slip gauges are known as precision gauge blocks. These are used for precise measurement of parts and to verify measuring tools such as comparators, micrometers etc.

2.15 GAUGES

The gauges are fixed-dimensions instruments. These are generally used to check the particular dimensions of a workpiece within its tolerance.

2.16 PLUG GAUGES

Plug gauges are used to check holes of different shapes and sizes. plug gauges are available to check straight cylindrical holes, tapered, threaded and splined holes.

2.17 RING GAUGES

Ring gauges are used to check the external diameters. These check the shafts more accurately because these embrace the whole of their surface

2.18 TAPER GAUGES

Taper gauges are used to test the taper. They are also used to gauge the diameter of taper at some point. They follow the same standard construction as plug and ring gauges and therefore, are made in both plug and ring types.

2.19 SNAP GAUGES

Snap gauges are used to check external dimensions. Shafts are generally checked by snap gauges.

2.20 FEELER GAUGES

These are used to check the gap or between two mating parts. These are made in the form of a set of steel precision machined blades 0.03 to 1mm thick and 100mm long.

2.21 PLATE GAUGE AND WIRE GAUGE

Plate gauges are used to check the thickness of sheet metal and wired gauges are used to diameter of wires.

2.22 ERRORS IN MEASUREMENT

Whenever a certain measurement is made, there remains a little difference between the measured values and true value even if we use the most accurate measuring instrument. Thus error may be defined as *the difference between the measured value and the true value.*

Error = Measured value – True value

2.23 TYPES OF ERRORS

- 2 Constant error
- 3 Random error
- 4 Gross error
- 5 Systematic error
- 6 Absolute error
- 7 Relative and percentage error.