

# Measurement of Concentricity and Runout

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**Abstract**— This work proposes an importance of a Geometrical Dimensions and Tolerance process that is interlaced in the product development process becomes a deeply rooted philosophy. GD&T is a system for defining and communicating engineering tolerances. It uses a symbolic language on engineering drawings and computer-generated three-dimensional solid models that explicitly describes nominal geometry and its allowable variation.

In our GD&T we wanted to reduce the Human error while Measuring Dimensions which can ultimately reduce the repetition of work to achieve desired shape and sizes with accuracy up to micron level.

The instrumentation system that we have made is isolated from human error and external vibration while measuring or determining tolerances of a work job so that we can achieve a high precision work job for industries.

The findings of this work show that Dimensional Engineering is a profitable activity since many companies have integrated this process in their work and the Dimensional Engineering field is expanding rapidly. It is an activity that has shown to decrease time to market, enhance product functionality and decrease product development costs. In addition, it stimulates the mind-set of employees to think proactively and it boosts organizational awareness.

**Index Terms**— Concentricity, Geometric dimensioning and tolerance (GD&T), Circular Runout, Total Runout.

## I. INTRODUCTION

GD&T is a large part of quality assurance field that the companies want to remain in the competitive field. By establishing processes for dimensional engineering the lead time for the new products has shown to be shortened. In order to decrease the development, cost the goal of every company is to produce a product that is perfect every time without the need for post processing or rework. This means that every product made perfect every time it is manufactured. Since every time when the component is manufactured there are possibilities of variation from normal design.

Currently V-Block is widely used to determine concentricity and round out which needs to rotate the device by human effort or by rotating by the coupling generated by human

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hands. Since human hands are not stable may be due to Hand-Arm vibration syndrome (HAVS) and other Reasons. When we try to rotate job while taking reading on dial gauge due to human induced vibration we are not able to determine exact tolerance sometimes.

Our project and paper is dealing with measurement of eccentricity to get highly precision job in micron level. With our project we can achieve high precision result without induce of any human induced vibration or Errors while measuring. Which ultimately gives the accurate reading and thus it can lead improve the quality of required job and to meet the industries precision need.

In many industries, v-block method is used to get eccentricity reading. But in v-block method one have to press his hand on the job so that the v-block can hold the job. While measuring, human error may change the actual reading. To overcome this problem, we are introducing new mechanism which will give the eccentricity reading without causing any human error

## II. FABRICATION PROCESS

It consists of carburized and demagnetized base plate of mild steel of 280X150mm area. Two plates of 80X100mm area and 10mm thick are undergo drilling operation to get three holes.

Both the plates are drilled simultaneously to maintain paralytic. Now these plates are placed vertically 45mm apart and are packed by other plates so that it forms enclosed box. Two mild steel rods having diameter 35mm and length 170mm. They are faced 10mm on either sides on Lathe machine. Then turning operation is done on both rod on the portion of length of 50mm to get 31mm diameter. Now centerless grinding is done for finishing. Remaining portion of the rods are turned to 11mm. Grinding operation is performed on both the rods to get good surface finish. These rods are passed through holes on the box structure formed by mild steel plates. Bushes are provided to reduce friction.

Another rod of length 120mm is turned and ground to 10mm. This rod is inserted diagonally to previous two rods so that it forms triangular structure and intermeshed with 28 teeth Plastic Spur Gears. All three rods are connected to each other by using gears so that upper two rods will get rotate in same direction.

A motor is connected to drive the mechanism. A vertical stand is attached to magnetized horizontal plate to hold roller bearing as shown in figure. The roller bearing is provided to constrained upward motion of the work piece.



Fig. Actual Image of Assembled Instrument

III. METHODOLOGY

An Electric Eliminator of Input 220V~240V AC supply having output of 12V DC, 3 Amp to a 3.5 RPM electric motor which is connected to Driver shaft of gear ( $G_1$ ) by using flat belt or the rotation motion can be fed by rotating the knob provided on driver gear's Shaft.

The Driver Gear ( $G_1$ ) is then meshed with two Driven Gear ( $G_2$  &  $G_3$ ) in such a way that it can form a Triangle if Centre of all gears joined together as shown in below Figure 1. Then these Driven Gears are attached with Rollers which are parallel and 3mm apart, which act as the support as well as rotates the job. A bearing at the end of the hinged lever is provided to constrain the upward motion inspection job while rotating as shown in fig2.

Then After placing the job on Roller Bar and after constraining the upward motion, A Magnetic Base is attached on the MS steel slab which act as a support for Magnetic Base. Then this Magnetic Base is attached with Lever Dial Gauge of least count 0.01mm and gently a point contact is made on the job. Depending on what we wanted to measure. If concentricity, make a point contact to the surface of inner circle of job or If runout, make a point contact to the outer surface of the job. The supply of eliminator is switched on which rotates the job and reading is taken accordingly to verify tolerance of the job.

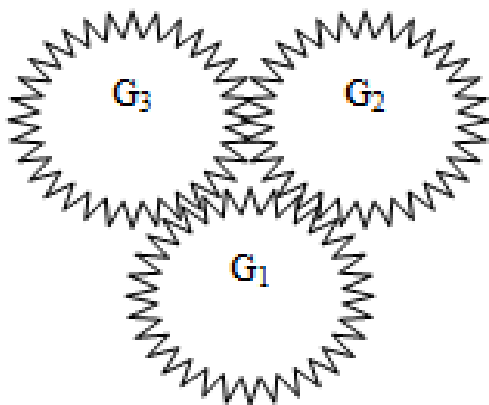


Fig 1. Meshing of Gears

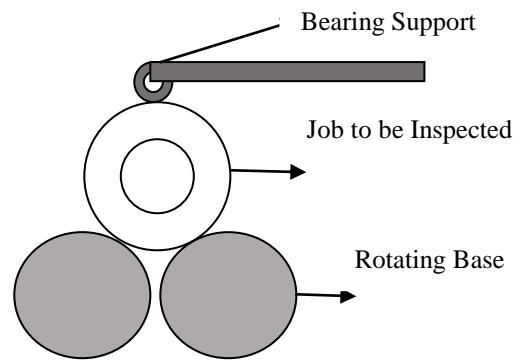


Fig 2. Layout of Job Support

IV. RESULT AND DISCUSSION

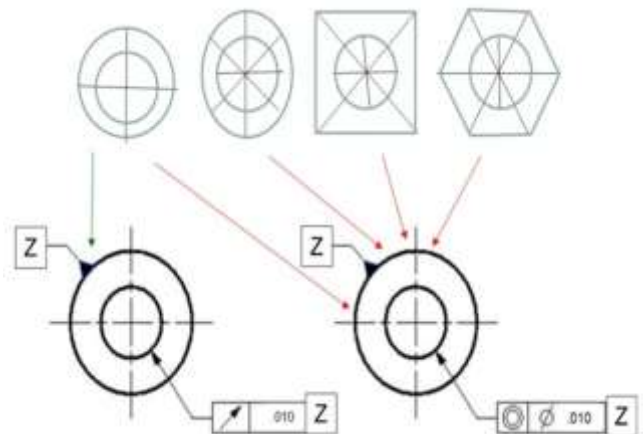
The result can be obtained by placing the job and taking reading by above given methodology.

Concentricity:

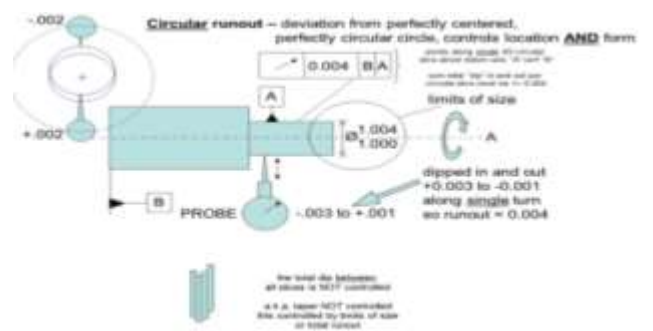
A cylindrical tolerance zone whose axis coincides with the datum axis Z and within which all cross-sectional axes of the feature being controlled must lie. Concentricity is very expensive and time consuming to measure. Concentricity is a geometric control of the median points of all diametrically opposed elements of revolution.

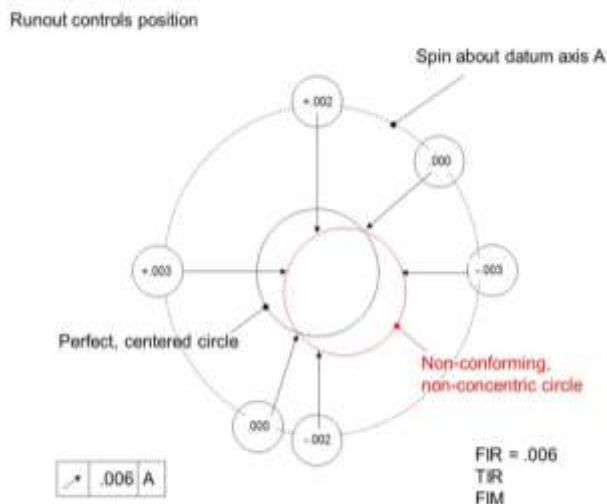
Circular Runout:

A composite tolerance used to control the relationship of one or more features of a part to datum axis during a full 360 degree rotation about the datum axis Z.



1. Circular Runout 2. Concentricity





## V. CONCLUSION

Our instrument can accurately measure the concentricity, circularity, circular runout and total runout of job. Precise measurement can be achieved quickly for outer circle and inner circle of shaft of work piece. Standard accuracy of 0.01 mm can be achieved by using lever dial gauge, even higher precision can be achieved by using more precise lever dial gauge. Human error can be eliminated and precise accuracy of upto 0.001mm can be achieved. Since the instrument is highly portable it can be taken anywhere, the instrument is also simple to maintain, operating environment should be free of vibration.

Overall we can achieve a high precise tolerance in the work piece and achieve the desired tolerance limit of modern industries.

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