DESIGN AND MANUFACTURING OF RECEIVING GAUGE

Shubham Koparde[1], Maruti Nandgadkar[2], Prasad Mahind[3], Shekhar Sawant[4], Prashant Mulik[5]

[1] BE Scholar, Mechanical, DACOE, Karad, Maharashtra, India.

[2] BE Scholar, Mechanical, DACOE, Karad, Maharashtra, India.

[3] BE Scholar, Mechanical, DACOE, Karad, Maharashtra, India.

[4] BE Scholar, Mechanical, DACOE, Karad, Maharashtra, India.

[5] Mechanical, TKIET, Warnanagar, Maharashtra, India.

---***---

Abstract - ***Various types of inspection methods are being used in various industry, from that quality of any product is to be checked. The different types of inspection methods involves CMM (coordinate measuring machine) and various type of gauges are used. Gauges are the tools which are used for checking the size, shape and relative positions of various parts but not provided with graduated adjustable members. Gauges are, therefore, understood to be single-size fixed-type measuring tools. This project leads to focus on inspection of items. . Receiving gauge is a gauge that has an inside measuring surface for testing the size and counter of the male part. The gauge is designed as per standards that checked the dimensions is concerned***

Key Words: *Receiving gauge, Inspection, Design, Manufacturing.*

1. INTRODUCTION

A gauge or gage, in science and engineering, is a device used to make measurements or in order to display certain information, like time. A wide variety of tools exist which serve such functions, ranging from simple pieces of material against which sizes can be measured to complex pieces of machinery. Depending on its usage, a gauge can be described as a device for measuring a physical quantity, for example to determine thickness, gap in space, diameter of materials.

Basic principles of gauging

a) Measurement- Measuring can be defined as the determination of a dimension.

b) Gauging- Gauging is defined as the acceptability of a given dimension whether it lies in its specified or allowable limits or not.

c) Gauge tolerance - 10% work tolerance

A clear distinction between measuring instruments and gauges is not always observed. Some tools that are called gauges are used largely for measuring or layout work. Even some are used principally for gauging give definite measurement.

1.1 Types of Gauges

(a) Based on the standard and limit

- Standard gauges
- Limit gauges or "go" and "not go" gauges

(b) Based on the consistency in manufacturing and inspection

- Working gauges
- Inspection gauges
- Reference or master gauges

(c) According to the shape or purpose for which each is used

- Plug
- Ring
- Snap
- Taper
- Thread
- Form
- Thickness

1.2 Receiving Gauge

The receiving gauge is specially designed and manufactured for inspection purpose. It measures the job very accurately and precisely as per the job standards and specification. It can be used in metrology area as well as production floor. They give the operator the possibility to perform dimensional inspection of the part without having to rely on a coordinate measuring system.

Receiving gauge used for checking dimensions precisely as per the standards.

1.3 Purpose Of Receiving Gauge

The basic purpose of using receiving gauge in mass production industries are

1. For accuracy, reliability and repeatability with strong focus on ergonomics.
2. To reduce measuring time and its cost.
3. For accurate and precise inspection.
4. Increase production rate.
5. Initial cost low.
6. Requires less cycle time.
7. Coordinate measurement.

2. LITERATURE REVIEW

2.1 Paper 1:

"A Review of Current Geometric Tolerancing Theories And Inspection Data Analysis Algorithms"
Shaw C. Feng
Theodore H. Hopp
Factory Automation Systems Division
National Institute of Standards and Technology
Gaithersburg, MD 20899-0001
February 1991,

This report provides an overview of the state of the art in mechanical dimensioning and tolerancing theories and CMM inspection data analysis technology. We expect that the information included in this review will benefit CMM software developers, CMM users, and researchers of new CMM technology. This document is the results of a survey of published geometric dimensioning and tolerancing theories and post-inspection data analysis algorithms. Both traditional and modern theories have been reviewed. Principles on which current national and international standards are based have been stated. These geometric dimensioning and tolerancing principles are commonly used in mechanical design and part inspection. Post-inspection data analysis algorithms, used for extracting features and evaluating tolerances, have also been reviewed. The effects of using different fitting criteria are discussed. From this theory and algorithm review, we recommend directions for future development in these areas. The bibliography covers activities and accomplishments of the research in advancing inspection technology.
This paper provides an overview of current geometric dimensioning and tolerancing theories and post-inspection data analysis algorithms. These theories and algorithms will be the basis of improved CMM technology in the future. As a review paper, we summarize current technology rather than propose solutions to problems in CMM software and engineering metrology.

2.2 Paper 2:

"Gauge Repeatability and Reproducibility Studies and Measurement System Analysis: A Multimethod Exploration of the State of Practice"
By Mr. Rathel R. (Dick) Smith, Dr. Steven W. McCrary & Dr. R. Neal Callahan
The effectiveness of a measurement system depends upon accurate gauges and proper gauge use. Common measuring devices such as calipers and micrometers are of particular concern when used incorrectly (Hewson, O'Sullivan, & Stenning, 1996). Measuring equipment and processes must be well controlled and suitable to their application in order to assure accurate data collection (Little, 2001).
According to the MSA Reference Manual, MSA defines data quality and error in terms of "bias," "reproducibility," "reliability," and "stability" (AIAG, 2002). Further, MSA provides procedures to measure each term, however the phrase Gauge Repeatability and Reproducibility Studies (GRRS) has come to incorporate the procedures recommended for measurement of "bias," "reproducibility," and "reliability" (Foster, 2006).
Following the definitions of MSA, bias is the "systematic error" in a measurement, sometimes called the "accuracy" of a measurement. Repeatability is "within operator" (one appraiser, one instrument) error, usually traced to the gauge itself, and is best considered to be "random error." Reproducibility is "between operator" (many appraisers, one instrument) error, and is usually traced to differences among the operators who obtain different measurements while using the same gauge (Kappele & Raffaldi, 2005; Montgomery, 2005).
Several authors address the use of GRRS to specifically address the management of these errors, especially the human aspects of these errors (Besterfield, 2004). Dasgupta and Murthy (2001), for example, addressed the use of GRRS as both an audit tool and as a source of feedback to improve the measurement procedure. Wang (2004) recommended the use of GRRS as feedback for measurement system improvement. Lupan and Bacivarof (2005) recommended the analysis of measurements to detect "the most important causes for process variation" (p. 723). And Smith, Callahan, and Strong (2005) demonstrated the practical use of GRRS for improving measurements.
In addition to reliance on physical measurements there is an additional and unavoidable reliance on human visual inspection processes, which rely very heavily on subjective judgment of specific product or process attributes.
As noted, the researchers determined the need for using GRRS as feedback to improve measurement systems. These findings piqued the researcher's interest in a possible theory-practice gap, leading to the following study on the state-of-practice of GRRS, using an exploratory, regional survey.

2.3 Paper 3:

"Geometric tolerancing: I. Virtual Boundary Requirements,"
Jayaraman, R. and Srinivasan, V.
IBM J. of Research and Development, Vol. 33, No. 2, March 1989, 90-104.
"Issues in Conditional Tolerances for CAD Systems"
IEEE Int'l Conf. on Robotics and Automation, 1985, 373-375.
"Geometric tolerancing: II. Conditional Tolerances of Research and Development, Vol. 33, No. 2", March 1989,

105-124.
Jayaraman and Srinivasan present a geometric tolerancing theory based on functional gaging concepts. They develop the *virtual boundary* concept. This is a boundary of perfect form, established at a theoretically exact position that models the fit between two part surfaces in assembly. For a non-interference fit, one surface must lie entirely inside the virtual boundary, while the other surface must lie entirely outside. The virtual boundary also serves as the maximum material envelope for both surfaces. Relating the measurement made of actual features on both parts against the virtual boundary, the type of fit (clearance, transition, or interference) can be calculated using this virtual boundary condition approach.

3. DESIGN DATA

3.1 Diagram

The fig. given below shows the details of receiving gauge

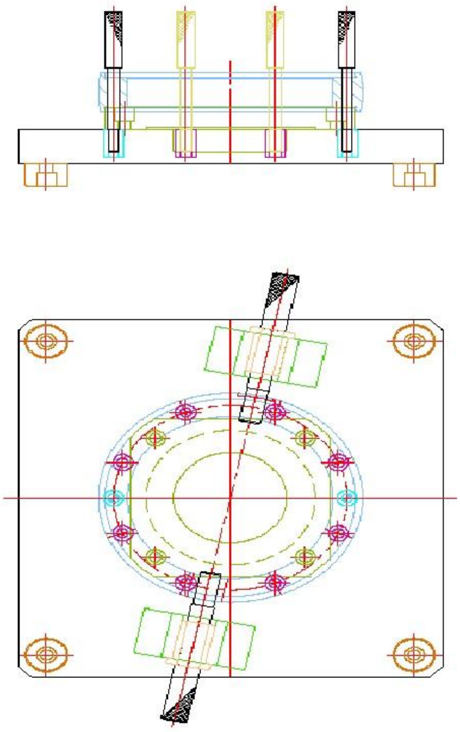

Fig.1- 2D drawing of receiving gauge with job

3.2 Procedure

1. Set the receiving gauge properly.
2. Locate the job on receiving gauge by locating pins.
3. Insert the plug gauges in the holes which to be checked.
4. Check the co-ordinates of the job.
5 Check the ovality of drills and depth.

3.3 Advantages

[1] This project aims to developing a highly cost effective inspection purpose.
[2] Very rapid inspection and requires less time for inspection as compared to coordinate measuring machine (CMM).
[3] Mainly designed for mass production inspection purpose.
[4] It is very easy to operate and even unskilled operator also operate it easily.

Measures job accurately and precisely to the job standard and specification.

3.4 Photos

Fig. 3.4.1. Top view of Receiving Gauge without job

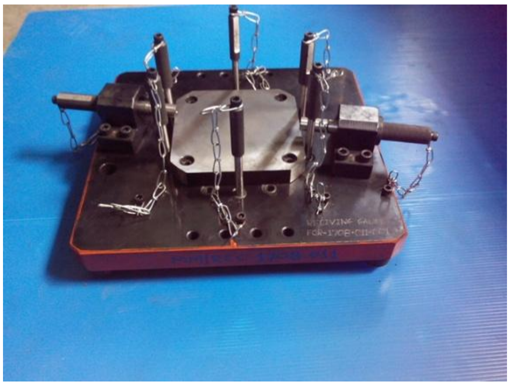

Fig. 3.4.2. Isometric view of Receiving Gauge without job

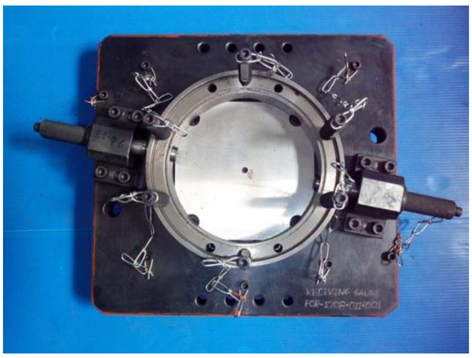

Fig 3.4.3. Top view of Receiving Gauge with job

Fig 3.4.4. Isometric view of Receiving Gauge with job

4. CONCLUSION

By checking the job on receiving gauge we conclude that this is time saving and cost effective method of inspection. Also it is one go checking i.e. ovality, dia., depth, co-ordinates.

5. REFERENCES

[1] ANSI Y14.3, Multi and Sectional View Drawings, American Society of Mechanical Engineers, New York, NY, 1975.

[2] ANSI Y14.5M-1982, Dimensioning and Tolerancing, American Society of Mechanical Engineers, New York, NY, 1982.

[3] ANSI B4.1, Preferred Limits and Fits for Cylindrical Parts, American Society of Mechanical Engineers, New York, NY, 1987.

[4] ANSI B89.3.1-1972, Measurement of Out-Of-Roundness, reaffirmed 1988,American Society of Mechanical Engineers, New York, NY, 1988.

[5] Requicha, A.A.G., "Toward a Theory of Geometric Tolerancing," Int'l J. of Robotics Research, Vol. 2, No. 4, Winter 1983, 45-60.

[6] Rossignac, J.R. and Requicha, A.A.G., "Offsetting operations in solid modelling,"Computer Aided Geometric Design, No. 3, 1986, 129-148

[7] Shepherd, D.W., "Geometric Tolerancing," Quality, Jan. 1987, 43-48.

[8] Sprow, E., "Challenges to CMM Precision," Tooling and Production, Nov. 1990, 54-61.

[9] Srinivasan, V. and Jayaraman, R., "Issues in Conditional Tolerances for CAD Systems," IEEE Int'l Conf. on Robotics and Automation, 1985, 373-375.

[10] Srinivasan, V. and Jayaraman, R., "Geometric tolerancing: II. Conditional tolerances," IBM J. of Research and Development, Vol. 33, No. 2, March 1989, 105-124.

[11] Wang, J. (2004). Assessing Measurement System Acceptability for Process Control and Analysis Using Gage R&R Study-A Masters' Thesis. University of Wisconsin-Stout.

6. BIOGRAPHIES

Mr. Shubham Dilip Koparde. Pursuing B.E. Mechanical at Dr. Daulatrao Aher College Of Engineering, Karad, from Shivaji University, Kolhapur.(2016) Completed Diploma in Mechanical Engineering at Shri Jaywantrao Bhosle Polytechnic,K.M. Gad, Sangli.(2013)

Mr. Maruti Dattaram Nandgadkar. Pursuing B.E. Mechanical at Dr. Daulatrao Aher College Of Engineering, Karad, from Shivaji University, Kolhapur.(2016)

Mr. Prasad Kashinath Mahind. Pursuing B.E. Mechanical at Dr. Daulatrao Aher College Of Engineering, Karad, from Shivaji University, Kolhapur.(2016) Completed Diploma In Mechanical Engineering at Padmashri Vasantraodada Patil Institute of Technology, Bhudhgaon, Sangli.(2013)

Mr. Shekhar Rangrao Sawant. Pursuing B.E. Mechanical at Dr. Daulatrao Aher College Of Engineering, Karad, from Shivaji University, Kolhapur.(2016) Completed Diploma In Mechanical Engineering At Government Polytechnic, Karad.(2011)