

Tools Design Conepaper Speaker Measurement Using the JIG ID for Changing the Caliper

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Abstract

For mass production of speakers we have to prepare the component part to part and install the part accordance with their own functions, Quality Control (QC) makes sure the product is good or broken, Quality Control (QC) mechanism action based on the measurement tools and human resources (operator), to ensure the measuring instrument functions properly then each new measurement tools need to be checked periodically to ensure the measuring instrument in good condition. During the measurement process, Quality Control (QC) is inhibited by measuring parts that mushy or have shape changing big because of pressure is on cone paper part, if it occurred, it will cause charge and a loss of time. To compensate for the costs and loss of time, Quality Control (QC) create tools JIG ID (Inside Diameter) made of stainless steel 304 round bar with size $\text{Ø}60 \times 182 \text{mm}$ this stainless steel for fairly fit because the stainless steel material resistant to heat, abrasion resistant and rustproof being choosed because JIG ID (Inside Diameter) will receive repetitive friction and resistant to low and high temperatures during the measurement process and saving. The idea of making JIG ID (Inside Diameter) is being affected by the human factor because measurements made by operator with other is not the same because of experience factor and pressure, then the idea that was created to deal with stress factors that showed using gravity (workpiece dropped down), so that the same measurement results obtained on each operator. And the results obtained on the two measurements can be seen that the most perfectly using JIG ID (Inside Diameter) with valuen 60.50mm.

Keywords: speaker, stainless steel, JIG, calibration, accuracy, accuracy, quality control

1. Introduction

The speakers are transducers for changing electric signal into sound by vibrating frequency components in the form cone paper, it vibrates the air so it make sound waves reach our eardrums and we can hear it as a sound. In creating speakers must know how the condition of the components or parts that already existed, so the problem will be detected early and did not cause trouble during the assembly process. Part component consists of two parts: the soft parts and hard parts. Soft parts, means that the material component parts easily deformed because the material used paper, rubber and others. Part component consisting of soft spider, cone paper, gaskets, voice coil and others. while the hard material component is not easily deformed, because the materials used plastic, steel, die cast aluminum and others. Hard part is composed of frame, top plate, magnet, yoke and others. Which often appears a problem with the speaker components is because the soft parts flexible product form, the problem is amplified by the process of dimensional measurement that does not comply with the standards sometimes can be over maximum and minimum limit will cause problem and loss impact for speakers producers. To overcome the problems with the existing dimension we make a JIG ID (Inside Diameter), to help measurement process and get the precision, accuracy and speed read in the measurement process takes place. To determine a good measuring tool it needs calibration.

2. Theory

2.1 Mean CNC

Today CNC machines using in most fields, from education and technologies that use modern tools to produce research and useful products, which already widely used in everyday life of society.

In medium and large industries, we will find CNC Machine using to support production process the CNC machine is divided into two types : CNC Lathe and CNC Frais Machine

2.2 Speaker

Is a transducer that converts electrical signals into sound frequencies (audio) by vibrating components that form the membrane to vibrate the air so it can make sound waves reach our ear drums and may we hear as sound



Figure 1 Assembly Speaker and Part

2.2.1 Speaker Component

In the manufacture of component speakers is very important, when this part is broken, the speakers that already made also damaged. Therefore, it was broken or not we have to make sure, then made by components that already qualified by Quality Control. (QC)

1. Frame uses as the framework for the components attachment (the soft part and the hard part)
2. Yoke uses to deliver one permanent magnetic field, the magnet affixed below, on the middle there like a pillar even this sphere made of iron to pass the magnet
3. Top plate uses to delivers one field pole permanent magnet, affixed above magnet, called a round board, combined with the frame to be impassable terrain magnet
4. Magnet uses to generate a magnetic field permanent magnet is iron, a certainly regular speaker use a magnet, speakers by using this magnetic force moving voice coil and conepaper so it will cause a sound
5. Conepaper uses to transform mechanical energy into sound energy or part of speakers that emit sound, conepaper with power generated by the magnetic circuit and the voice coil to vibrate, a part which is soft part because it is very important to establish a sound wave
6. Spider balance or balance uses to balancing that restricts the movement of the voice coil, spider is around soft part like wave to keep the voice coil on true location
7. Voice coil uses to generate un electricity permanent like a signal on the terminal, voice coil sheets from thin paper and aluminum twisted by copper wire reinforce with glue. Because this parts that vibrate or move within the magnetic gap circuit
8. Dust cap uses as a protective in order to voice coil areas are not dirty, it also acts as a conduit sounds together with conepaper in accordance with the provisions of the material
9. Gasket uses to press conepaper side, and to make a better appearance when installing speakers into the box

2.3 Measuring Instrument

Measure is a process of associating numbers empirically and objectively on the properties of an object or a real incident so that the numbers can give a clear picture of the object

2.3.1 Caliper

Used to measure the length, width, thickness, or depth of objects or substances. Accuracy term calipers: There are at least two types of calipers, namely vernier caliper with accuracy and with accuracy 0,01 mm - 0,05mm



Figure 2 Caliper

2.3.2 Micrometer

Uses for measuring diameter millimeter-sized objects or a few centimeters only. Accuracy micrometer screw there is only one kind, namely that carefulness 0.01mm



Figure 3 Micrometer

2.4 Accuracy

The ability of a measuring instrument to provide an approach to the true value of the measured object or the nearest pricing a instrument reading and variables measured against the actual value so that the level of measurement error becomes smaller, the precision with regard to measuring instruments used at the time of measurement

2.5 Exactness

The closeness values of the individual measurements and distributed around the average value or individual deployment of the average value. Good precision measuring tools have nice does not guarantee that the gauge has great accuracy.

2.6 Density and Specific Gravity

2.6.1 Density

The density is the magnitude of a substance. A substance similar though has different size and mass of the object, the density remains the same. The density of 1 gram of iron same with a density of 1 kg of iron. Instead, the two substances that have different types have a different kind.

a density in the SI is kg/m^3 or kg m^{-3} . Unit mass of the type often used is g/cm^3 , which is:

$$1\text{g/cm}^3 = 1000\text{kg} / \text{m}^3$$

Here is the density of the iron = 7.86, = 7.12 zinc, aluminum = 2.7, gold = 13.55, tin = 11.34, nickel = 8.85, stainless steel = 7.9

2.6.2 Specific Gravity

Density of a substance is the weight ratio of the volume of these substances, the international system of units density is N/m^3

2.7 Calibration

Calibration is an activity to determine conventional truth value designation of measuring instruments and measuring ingredients by comparing against a standard measure that is capable of searching (traceable) to a national standard that have the following benefits: to make sure measuring instrument and measuring materials are same with their specification

2.8 Substance

Stainless steel called to as stainless steels because it is resistant to oxygen influence and has stable oxide layer on the surface of the steel, stainless steel can survive oxidation impact because it contains chromium more than 10.5%, chromium which is the main protector of stainless steel from any condition caused environmental.

2.9 CAD (Computer Aided Design)

Is a design which is helped by computer technology to assist in the design and analysis (technical drawing and engineering drawing) or part of the product, including the entire building

3. Research Method

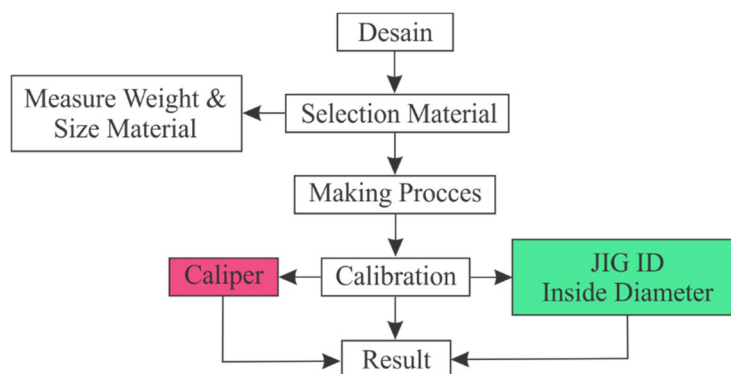


Figure 4 Flow Chart of Research

Creation concept of tool JIG ID (Inside Diameter) in advance of our designs with existing software, then select the appropriate materials with have characteristics that is resistant to corrosion and friction, and calculate the material to check the dimension and weight so that in can be the starting dimension and the purchase price, then the material is processed using a CNC lathe, after the finished product JIG ID (Inside Diameter) followed by dimension checked and appearance to ensure actual conditions, then proceed with the measuring process and the final result “OK” conepaper or “Reject”.

3.1 Calibration Purpose

To determine the accuracy of the results of the JIG ID (Inside Diameter) that will be used with the measuring process conepaper then be given instructions that are marked with circles

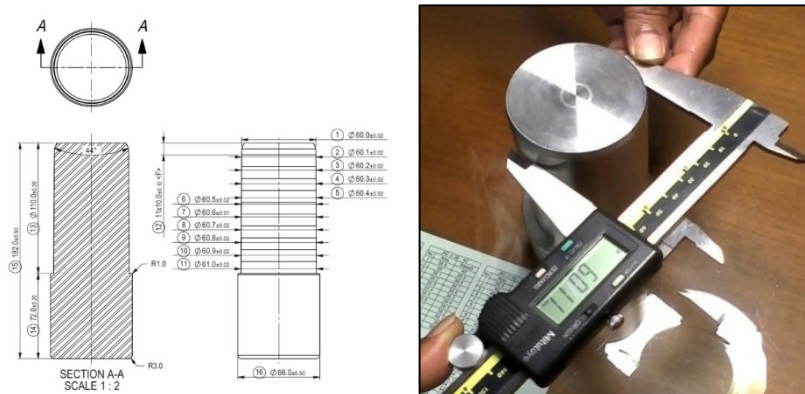


Figure 5 Calibration Guide

3.2 Process Measurements

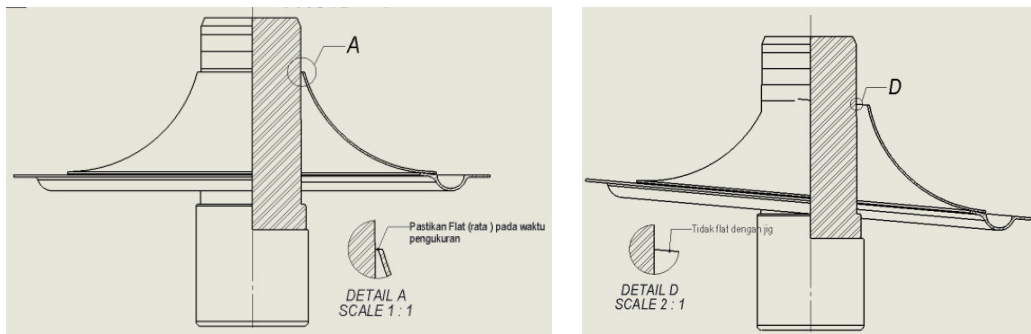


Figure 6 Process Measurements

For measurements using JIG ID (Inside Diameter) must be considered when dropped layout of conepaper with JIG ID (Inside Diameter) should be really flat (horizontally), and if affected by slope we have to measure again and drop it back. To conepaper we consider that the current perfect size is 60.50 so in the future we may conclude or analyzing the JIG ID (Inside Diameter) and tested up to three

4. Result and Analysis

4.1 Results Making CAD (Computer Aided Design) JIG ID (Inside Diameter)

Before performing the machining process and calculation of the purchase price of materials stainless steel we should create 3D images in advance so we will get the materials according to the needs (not less, and more).



Figure 7 Results Making CAD (Computer Aided Design) JIG ID (Inside Diameter)

4.2 Results JIG ID (Inside Diameter) Production



Figure 8 Result JIG ID (Inside Diameter) Production

The purpose of product JIG ID using CNC lathe is in creasing accuracy and delicecy maximally

4.3 Results for stainless steel purchase

To perform manual calculations need to know the shape (round) stainless steel price each kg and the density of the material used

Table 1 Calculation Results of Its Purchasing Material Stainless Steel

No	Dimension						Result
	(π) 3.14	Diameter		Length	Density	/1.000.000	
		r	r				
1	3.14	33.0	33.0	182	8.0	/1.000.000	4.970
Price/kg 38.500,-							191.345,-

4.4 Results Calibration JIG ID (Inside Diameter)

Table 2 Results of Calibration JIG ID

No	Dimension							
	1	2	3	4	5	6	7	8
1	60.01	60.12	60.22	60.32	60.38	60.52	60.63	60.72
	9	10	11	12	13	14	15	-
	60.82	60.92	61.02	10.05	66.70	11.60	182.30	-

The table above shows measurement results, especially in numbers 1 to 12 have a very small tolerance. Data above showed that the results given by red color is the result of measurement is problematic for point number 7. 60.63 JIG ID needs to be repaired by paper pads, polishing for number 13,14, and 15 are not seeing asproblem because it is not used in applications with Conepaper speakers

4.5 Measurement Result Between JIG ID and Conepaper, with Caliper and Conepaper

Table 3 Measurement Result Between JIG ID And Conepaper, With Caliper And Conepaper

No	Conepaper Speaker					Tlr	Result
	1	2	3	4	5		
Caliper	60.58	60.58	60.50	60.50	60.60	± 0.05	60.552
Caliper	60.50	60.58	60.50	60.60	60.50	± 0.05	60.536
Caliper	60.53	60.53	60.55	60.60	60.60	± 0.05	60.562
JIG ID	60.50	60.50	60.60	60.60	60.50	± 0.05	60.540
JIG ID	60.50	60.50	60.50	60.60	60.50	± 0.05	60.502
JIG ID	60.50	60.50	60.50	60.60	60.60	± 0.05	60.540

From data above red number means out of the dimensions and tolerances specified. standard tolerance ± 0.05 which means that the dimensions of it are 60 550 and the lower limit is 59,950. The results of the fifth dimension cone paper is very satisfy use JIG ID has the precision, accuracy and stability, when using a caliper, the results are not satisfy and many variants of red numbers that means no stability on the measurements.

4.6 Conclusion and Suggestion

4.6.1 Conclusion

- Heavy JIG ID (Inside Diameter) need weight 4.970 Kg with purchase price of Rp 191,345.00.
- After made JIG ID (Inside Diameter) weihgt reduced to 4.44346 Kg.
- The calibration results obtained figures do not suitable to the points 13, 14, and 15 is not a problem, because

it is not attached to the Conepaper. And point 7 JIG ID (Inside Diameter) will be repaired again

- The results of the measurements with between cone paper and caliper of unstable value and ended by Reject
- 4.6.2 Suggestion
- The weight of stainless steel is better replaced with lighter materials
 - Operators should be given special training to use calliper
- To JIG ID (Inside Diameter) should be calibrated by measuring instrument micrometer will be got more precise results, need to make sure how to keep it so it will not collide with other JIG (case can be used)

5. References

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