MECOMARE, 14 (1) (2025) pp. 32-41

Published by: TRIGIN Publisher

International Journal of Mechanical Computational and Manufacturing Research

Journal homepage: www.trigin.pelnus.ac.id

Dimensional measurement calibration of dial calipers based on JIS B 7507: 2016 standard in the measurement laboratory

Agnes Br Manurung[1], Adi Syahputra Purba[2], Ari Angga Manalu[3], Erna Juwita[4], Adhe Aryswan[5]

[1]Energy Conversion Engineering, Mechanical Engineering, Politeknik Negeri Medan, Indonesia
[2,3,5]Mechanical Engineering, Politeknik Negeri Batam, Indonesia
[4]Mechanical Engineering, Mechanical Engineering, Politeknik Negeri Medan, Indonesia

ARTICLE INFO

Article history:

Received May 5, 2025
Revised May 13, 2025
Accepted May 20, 2025

Keywords:

Accuracy;
Calibration;
Dial Calliper;
Measurement;
Standard.

ABSTRACT

Dial calipers are very frequently used by both measurement laboratories and production. Dial calipers need to be calibrated every 12 months. The purpose of this study is to provide an understanding of how to calibrate a dial caliper, using a method based on JIS B 7507:2016 Standard. The JIS standard itself provides guidance and reference for dial caliper calibration. Based on the calibration results obtained, it is known that the dial caliper has deviation or error values in each measurement (outside, inside, depth, and step) with values of 0.0200 mm and -0.01000, referring to an accuracy of +/-0.03mm. After evaluation based on the standard, these error values still meet the requirements of JIS B 7507-2016. The benefit of this calibration is dial calipers are important to calibrate both before and after use to ensure optimal accuracy and consistent measurement results and also this calibration performed is sufficiently valid and reliable.

Corresponding Author:

Adi Syahputra Purba,
Mechanical Engineering,
Politeknik Negeri Batam,
Jl. Ahmad Yani, Batam Centre, Batam, 29461, Indonesia
Email: adipurba@polibatam.ac.id

1. INTRODUCTION

Calibration is a regular process arranged systematically to adjust and ensure the accuracy of measuring instruments and devices according to established standards. This calibration involves a series of activities that serve to establish a connection between the value displayed by the measuring instrument, or represented by a measuring object, and the known value of the measured quantity under certain conditions (Ismaini, Naomi Tosani, 2021). The aim is to ensure that the device provides consistent results and meets recognized standards, so that the measurement results produced by the device can be trusted (Suleman, et al., 2011). Test or measurement results are merely approximations. These approximations still have a level uncertainty. An uncertainty value is a way to express the uncertainty that results from the measurement procedure. The calibration procedure allows for the measurement of this value (Ni Luh Tirtasari, 2017).

A vernier caliper is a gadget used to quantity the distance between two inverse sides of an item (Yoneda, 2022). Accurate and fast access to Vernier Caliper readings is a critical issue in automated verification of Vernier Calipers (Chen et al., 2022). High resolution automated systems continue to gain prominence, manual metrological instruments like the digital vernier caliper remain prevalent due to their affordability and ease of use (Alsoufi et al., 2025). A reliable procedure for the metrological assessment of manufacturing processess and manufactured parts would be highly adavantageous for micro/nano manufacturing as well as for large-scale manufacturing (Kankar et al., 2022). These devicese have become even more important in the diagnosis and treatment process (Hilal Yayan et al., 2020). The center distance caliper is a measuring rotation system or elecetronic measurement to read the distance of relative movement (Xiong et al., 2025). The calibration of measuring systems, as well as individual measuring instruments is required in many fields of technology (Klebba et al., 2023).

Every measuring instrument must be calibrated against national or international standards at specified intervals, typically every 12 months. Both before and after use, the measuring instrument must be calibrated to ensure optimal accuracy and consistent results in measurements. Measurement is the process of obtaining information about the true value of a certain physical quantity. This activity has been a part of communal life for generations and keeps improving to become more efficient (Rahmah & Salsabila, 2022).

Measuring instruments have a significant impact on the quality of the products produced because they are directly related to the process and therefore require maintenance to ensure a long lifespan (Rochim & Taufiq, 2006). One type of measuring instrument is the caliper. The caliper is a tool used to measure length, with an accuracy of up to 0.1 mm and capable of measuring the length of an object up to 20 cm (Mila Rosa Angraini et al., 2024; Nurlina & Riska, 2019). This caliper is more precise than tape measures and rulers, which makes it ideal for measuring small objects. The diameter of rings, the inner diameter of pipes, the depth and thickness of an object, and even the area of an object may all be measured with this tool in addition to its ability to measure length (Chusni, 2019; Fatiatun et al., 2022). One kind of caliper is the dial caliper, a measuring device used in instrumentation to determine an object's inner and exterior diameters as well as the depth of any holes or gaps in it (Zulfebri & Arief, 2015).

Dial calipers are often used in measurement laboratories and manufacturing. Given the importance of this issue, it is necessary to calibrate the calipers to determine the correction/distortion value and the measurement component values. Deviation can be defined as a correction or an error (Irawan, 2019). Deviations in dial calipers can occur for several reasons, including wear and tear, temperature changes, or mechanical damage to the device itself. With continuous use, dial calipers can experience wear on components such as gears or the pointer needle, which can lead to inaccuracies in measurements (SNSU, 2020). An error or correction can be used to describe a deviation. Additionally, the temperature stability in the workplace can also affect the performance of dial calipers, as temperature changes can cause dimensional changes in the materials used to make the device (Muflikhun, et al., 2022). Research by experts has shown that continuous use of measuring tools or instruments leads to deviations in measurements. A study conducted by Professor and Head of the Department at Oxford University, N.V. Raghavendra, published in the journal "Engineering Metrology and Measurement," reported on the examination of deviations in several types of instruments used in the manufacturing process. He took measurements with several types of dimensional measuring instruments, performed repetitions or repeatability tests, and drew a conclusion. Every measuring instrument used is important to calibrate within a specified timeframe in order to determine the error value of an instrument so that all sources of instrument error can be evaluated and controlled (Raghavendra & Krishnamurthy, 2013).

The significance of metrology grew during the era of industrialization. Improvements in technology are increasingly demanding enhancements in this sector (Lamichhane, 2024). The conformity assessment of a product often includes a measured value, which is located close to the uncertainty zone (Arief et al., 2021). The industry has now entered an era of full automation, with marketing and technological advancements leading to products with extremely high performance and sophisticated quality engineering. There are also cutting-edge technologies such as measuring instruments for industrial data measurement (Husnah et al., 2023). The vernier caliper is widely used in both measurement laboratories and production (Amani & Arief, 2013). The partial surface contact error applies to any measurements made using the outside measuring faces, and the scale shift error applies to measurements using any other measuring faces available on the caliper, such as inside, step, and depth measurement (Mitutoyo, 2018). Every dial caliper used, whether before or after a certain period, must be calibrated according to national or international standards. The conformity assessment of a product often includes a measured value, which is located close to the uncertainty zone (S. Arief, et al., 2021).

Ideally, the accuracy of a caliper is determined by its ability to provide measurements that correspond to the actual value of the object's dimensions being measured. The accuracy of a caliper is usually provided by the manufacturer. Mitutoyo dial calipers have an accuracy of ±0.03 mm or ±0.04 mm for measurements up to 200 mm. Based on this background, this study aims to provide an understanding of how to calibrate a dial caliper based on JIS B 7507:2016 Standard in the measurement laboratory to determine the correction/distortion value and the value of measurement components.

2. RESEARCH METHOD

Before the calibration process is carried out, the things we need to pay attention to are preparing the digital dial caliper calibration tools, such as: considering the room conditions, considering the type of caliper to be calibrated, and preparing the standard calibration tools (Gauge Block). The method used in this study is shown in the flowchart in Figure 1.

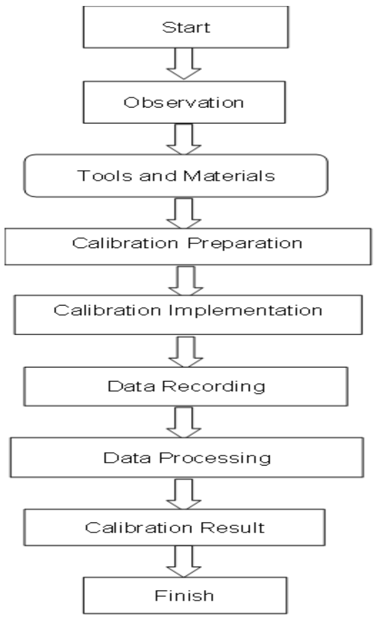


Figure 1. Calibration Flowchart

Here are the steps in the research process to obtain the following research:

1. Observation
   The first step in the research is to observe the title that will be researched. In this process, the obligation of the calibration process for each measuring instrument used in every company is identified. Using one dial calliper in this step.
2. Tools and Materials
   After observation, the next step is to prepare the main tools and materials for the calibration process.
3. Calibration Preparation
   This process involves a visual check of the measuring instruments and standards used, as well as the humidity and temperature in the calibration room.
4. Calibration Execution.

The next step is to perform the calibration process, which includes all measurements on the dial caliper, in accordance with JIS B 7507:2016 standards. This calibration method is generally can be used for any dial caliper.

5. Data Recording
Next is the data recording process on a worksheet to record the calibration measurement results for the dial caliper. For quality control, taking data recording more than one data is required for accuracy.
6. Data Processing
After the data is collected, the next step is to process the data to obtain the error value of a dial caliper. Quality control conducted during the calibration process to ensure the accuracy of the results
7. Calibration Results
The final step is to issue a calibration certificate containing data about the calibration results and the deviation value of a dial caliper.

Tools and Materials

- Gauge Block Set Grade 0 (0.5 – 100 mm) brand Mitutoyo and certificate are used as a measuring tool to calibrate dial calipers, as shown in Figure 2.

Figure 2. Mitutoyo Gauge Block (0-200 mm) with certificate

- A thermohygrometer is used to measure the temperature and humidity conditions of a calibration room.
- The flat table is used as an aid for taking measurements with the dial caliper.
- Alcohol as a cleaning fluid
- Latex hand gloves are used to protect hands during calibration work.
- Cloth/tissue is used to clean instruments of dust.

Dial Caliper Calibration Preparation

Visual inspection and function checks are performed on the dial caliper to be calibrated.

- Before calibration, condition the caliper and standard for at least 6 hours in the calibration room to ensure uniformity of the instrument.
- All identification details of the dial caliper to be calibrated have been recorded on the data analysis sheet.
- Room temperature and humidity during calibration are recorded on the calibration data analysis sheet.

Calibration Procedure

The dial caliper and gauge blocks were prepared according to the maximum capacity of the dial caliper.

- Outside measurements were taken by measuring values at 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100% of the dial caliper's full capacity, repeated 3 times.

- Inside measurements were taken by measuring values at 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100% of the dial caliper's full capacity, repeated 3 times.
- Depth measurements were taken by measuring values at 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100% of the dial caliper's full capacity, repeated 3 times.
- Step measurements were taken by measuring values at 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100% of the dial caliper's full capacity, repeated 3 times as seen in Figure 3.

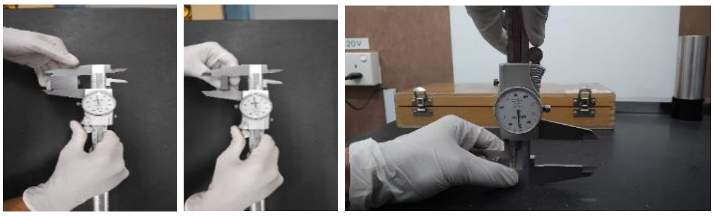


Figure 3. Dial caliper calibration process

- The goal of accuracy is to reflect the extent to which measurement results approach the true value or expected standard. This is important to ensure that the measurements taken provide accurate and reliable information. Here are some values across the dial caliper measurement range, as well as the accuracy and permissible instrument error values for dial calipers, which must comply with Table 1, referring to JIS B 7507, 2016 (JIS B 7507, 2016).

Table 1. Caliper error based on JIS B 7507:2016

Measuring Length (mm)	Scale intervals, minimum indicating quantities or minimun reading values (mm)	
	0.1 or 0.05	0.02 or 0.01
50 or under	±0.05	±0.02
Over 50 to 100 or under	±0.06	
Over 100 to 200 or under	±0.07	±0.03
Over 200 to 300 or under	±0.08	
Over 300 to 400 or under	±0.09	±0.04
Over 400 to 500 or under	±0.10	
Over 500 to 600 or under	±0.11	±0.05
Over 600 to 700 or under	±0.12	
Over 700 to 800 or under	±0.13	±0.06
Over 800 to 900 or under	±0.14	
Over 900 to 1000 or under	±0.15	±0.07

3. RESULTS AND DISCUSSIONS

After calibrating the dial caliper, the next step will be to process the calibration data. Data processing was done using Microsoft Excel, utilizing mathematical calculations. Obtaining the data meets the more accuracy measurement.

Data Recording

- Record the calibration results on the analysis sheet from the measurements. Below are some deviations found in the dial caliper measuring tool.

Lembar Kerja Kalibrasi Caliper

Data Order		Spesifikasi Alat	
		Nama Alat	Dial Caliper
		Merek	Mitutoyo
		Model	-
Spesifikasi Standar		No. Seri // Tag No.	08016192 // AABB22
		Rentang Ukur	0-100 mm
Nama Standar	Gauge Block Set Grade 0	Resolusi	0.01 mm
		Tanggal Kalibrasi	14/04/2021
		Kondisi Ruang	
Merek	Mitutoyo	Reff. Suhu	**20 ± 1 ºC**
		Suhu Awal	20.9 ºc
		Suhu Akhir	20.8 ºc
No. Seri	10205	Reff. Kelembaban	**50 ± 10 %**
		Kelembaban Awal	47%
		Kelembaban Akhir	48%

Data Pengamatan

No	Poin Pengukuran	Reading of UUT (mm/inch)											
	Gauge Block	Outside Measurement			Inside Measurement			Step			Depth		
		1	2	3	1	2	3	1	2	3	1	2	3
1	10	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00	10,00
2	20	20,01	20,01	20,01	20,00	20,00	20,00	20,00	20,00	20,00	20,00	20,00	20,00
3	30	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00	30,00
4	40	40,00	40,00	40,00	40.02	40.02	40.02	40.00	40.00	40.00	40,00	40,00	40,00
5	50	50,00	50,00	50,00	50,00	50,00	50,00	50,00	50,00	50,00	50,02	50,02	50,02
6	60	60,00	60,00	60,00	60,00	60,00	60,00	60,00	60,00	60,00	60,00	60,00	60,00
7	70	70,00	70,00	70,00	70,00	70,00	70,00	70,00	70,00	70,00	70,00	70,00	70,00
8	80	79.98	79.98	79.98	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00
9	90	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00	90,00
10	100	100,00	100,00	100,00	100,00	100,00	100,00	99,99	99,99	99,99	100,00	100,00	100,00
11													
12													
13													
Repeatability		79.98	79.98	79.99	40.02	40.02	40.02	99,99	99,99	99,99	50,01	50,01	50,00
		79.99	79.99	79.98	40.01	40.01	40.01	100,00	99.99	100,00	50.02	50.02	50,01
		79.98		79.99	40.02		40.02	99.99		99,99	50,01		50.02
		79.99		79.98	40.01		40.01	100,00		100,00	50.02		50,00

Figure 4. Measurement Sheet

Data Processing

Calibration data processing contains measurement point values, dial caliper measurement results, repetitions, average values of the measuring instrument, standard reference values, and deviations or discrepancies in the calibration measurement results.

1. Measurement point values are the values obtained from the dial caliper calibration measurement points. These values are taken from 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% up to 100% of the measuring instrument's range.
2. Measurement Result values are obtained from the readings on the dial caliper compared to the standard reference, which is taken 3 times according to the standard reference.
3. Repetition or repeatability values are the process of obtaining measurement deviation values considered furthest from the standard reference, taken 10 times.
4. The average value of the measuring instrument is obtained by summing the measurement results and dividing by the number of data points taken.
5. Standard reference values are the values on the standard reference used as calibration material for comparison.
6. Deviation values are obtained by subtracting the dial caliper reading values from the standard reference values.
   Deviation Value (Error)
   E = UUT – STD
   UUT (Unit Under Test)
   Obtained from the results of reading the measuring instrument by (N1+N2+N3)/3 STD (Standard)
   Obtained from the reference standard value based on the standard calibration certificate.
   E = UUT – STD
   = (79,98 – 80,00000)
   = - 0,02000
   Here is the data processing table for the calibration data that has been obtained. Based on Table 2, the deviation value from the measurement results of the outer side at a setpoint of 20.0 mm was found to be 0.01 mm.

Table 2. Results of outside data recording measurement

Nominal Length *(mm)*	Measurement Data Outside Diameter *(mm)*					Average L	L Standards *(S)* *(mm)*	Deviation (mm)
0.0	*0.00*	*0.00*	*0.00*	Repeatibility (*mm*)		0.000	0.00000	0.00000
10.0	10.00	10.00	10.00	79.98	79.99	10.000	10.00000	0.00000
20.0	20.01	20.01	20.01	79.99	79.98	20.000	20.00000	0.01000
30.0	30.00	30.00	30.00	79.98	79.99	30.000	30.00000	0.00000
40.0	40.00	40.00	40.00	79.99	79.98	40.000	40.00000	0.00000
50.0	50.00	50.00	50.00	79.98	79.99	50.000	50.00000	0.00000
60.0	60.00	60.00	60.00			60.000	60.00000	0.00000
70.0	70.00	70.00	70.00			70.000	70.00000	0.00000
80.0	79.98	79.98	79.98			79.980	80.00000	-0.02000
90.0	90.00	90.00	90.00			90.000	90.00000	0.00000
100.0	100.00	100.00	100.00			100.000	100.00000	0.00000

Table 3. Results of inner data recording measurement

Nominal Length *(mm)*	Measurement Data Inside Diameter *(mm)*					Average L	L Standards *(S)* *(mm)*	Deviation (mm)
0.0	*0.00*	*0.00*	*0.00*	Repeatibility		0.000	0.00000	0.00000
10.0	10.00	10.00	10.00	40.02	40.01	10.000	10.00000	0.00000
20.0	20.00	20.00	20.00	40.01	40.02	20.000	20.00000	0.00000
30.0	30.00	30.00	30.00	40.02	40.01	30.000	30.00000	0.00000
40.0	40.02	40.02	40.02	40.00	40.02	40.020	40.00000	0.02000
50.0	50.00	50.00	50.00	40.02	40.01	50.000	50.00000	0.00000
60.0	60.00	60.00	60.00			60.000	60.00000	0.00000
70.0	70.00	70.00	70.00			70.000	70.00000	0.00000
80.0	80.00	80.00	80.00			80.000	80.00000	0.00000
90.0	90.00	90.00	90.00			90.000	90.00000	0.00000
100.0	100.00	100.00	100.00			100.000	100.00000	0.00000

Based on Table 3, the deviation value for the measurement results of the inner side at a setpoint of 40.0 mm was found to be 0.02 mm.

Table 4. Results of inner data recording measurement

Nominal Length *(mm)*	Measurement Data *Step Diameter* *(mm)*					Average L	L Standards *(S)* *(mm)*	Deviation (mm)
0.0	*0.00*	*0.00*	*0.00*	Repeatibility		0.000	0.00000	0.00000
10.0	10.00	10.00	10.00	99.99	100.00	10.000	10.00000	0.00000
20.0	20.00	20.00	20.00	100.00	99.99	20.000	20.00000	0.00000
30.0	30.00	30.00	30.00	99.99	99.99	30.000	30.00000	0.00000
40.0	40.00	40.00	40.00	100.00	99.99	40.000	40.00000	0.00000
50.0	50.00	50.00	50.00	99.99	99.99	50.000	50.00000	0.00000
60.0	60.00	60.00	60.00			60.000	60.00000	0.00000
70.0	70.00	70.00	70.00			70.000	70.00000	0.00000
80.0	79.99	79.99	79.99			79.990	80.00000	0.00000
90.0	90.00	90.00	90.00			90.000	90.00000	0.00000
100.0	99.99	99.99	99.99			100.000	100.00000	0.01000

Based on Table 4, a deviation was found in the measurement results of the step level at a setpoint of 80.0mm, which was 79.99mm or 0.01mm.

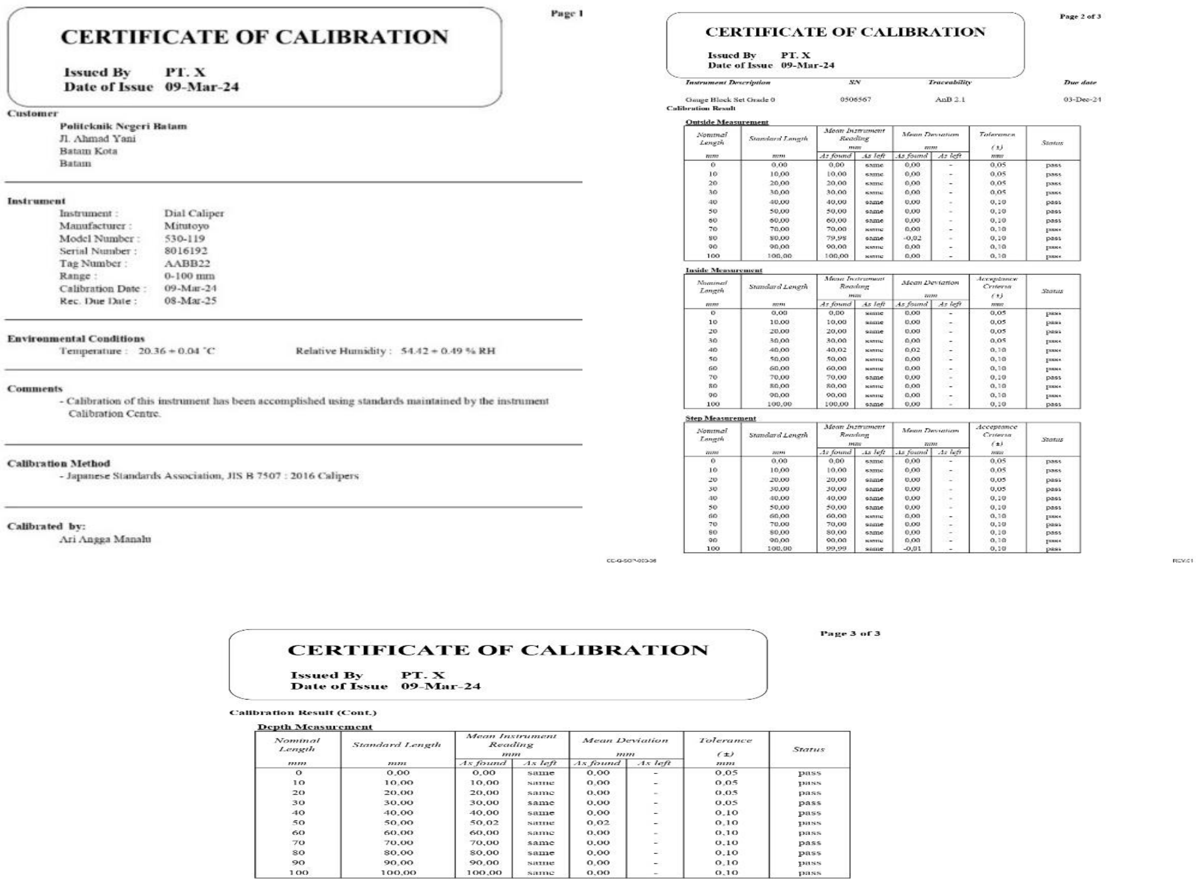
Table 5. Results of depth data measurement

Nominal Length *(mm)*	Measurement Data *Depth Diamter (mm)*					Average L	L Standards *(S)* *(mm)*	Deviation (mm)
0.0	*0.00*	*0.00*	*0.00*	Repeatibility		0.000	0.00000	0.00000
10.0	10.00	10.00	10.00	50.02	50.01	10.000	10.00000	0.00000
20.0	20.00	20.00	20.00	50.01	50.02	20.000	20.00000	0.00000
30.0	30.00	30.00	30.00	50.02	50.01	30.000	30.00000	0.00000
40.0	40.00	40.00	40.00	50.02	50.01	40.000	40.00000	0.00000
50.0	50.02	50.02	50.02	50.01	50.02	50.000	50.00000	0.02000
60.0	60.00	60.00	60.00			60.000	60.00000	0.00000
70.0	70.00	70.00	70.00			70.000	70.00000	0.00000
80.0	80.00	80.00	80.00			80.000	80.00000	0.00000
90.0	90.00	90.00	90.00			90.000	90.00000	0.00000
100.0	100.00	100.00	100.00			100.000	100.00000	0.00000

Based on Table 5, a deviation was found in the depth measurement results at a setpoint of 50.0mm, which was 50.02mm or 0.02mm.

Calibration Results

The calibration result is a calibration certificate for the dial caliper, containing information about the dial caliper's deviation values and other metrological properties.



Page 1

CERTIFICATE OF CALIBRATION

Issued By PT. X
Date of Issue 09-Mar-24

Customer
Politeknik Negeri Batam
Jl. Ahmad Yani
Batam Kota
Batam

Instrument
Instrument : Dial Caliper
Manufacturer : Mitutoyo
Model Number : 530-119
Serial Number : 8016192
Tag Number : AABB22
Range : 0-100 mm
Calibration Date : 09-Mar-24
Rec. Due Date : 08-Mar-25

Environmental Conditions
Temperature : 20.36 ± 0.04 °C Relative Humidity : 54.42 ± 0.49 % RH

Comments
- Calibration of this instrument has been accomplished using standards maintained by the instrument Calibration Centre.

Calibration Method
- Japanese Standards Association, JIS B 7507 : 2016 Calipers

Calibrated by:
Ari Angga Manalu

Page 2 of 3

CERTIFICATE OF CALIBRATION

Issued By PT. X
Date of Issue 09-Mar-24

Instrument Description	SN	Traceability	Due date
Gauge Block Set Grade 0	0506567	AnB 2.1	03-Dec-24

Calibration Result

Outside Measurement

Nominal Length mm	Standard Length mm	Mean Instrument Reading mm		Mean Deviation mm		Tolerance (±) mm	Status
		As found	As left	As found	As left		
0	0,00	0,00	same	0,00	-	0,05	pass
10	10,00	10,00	same	0,00	-	0,05	pass
20	20,00	20,00	same	0,00	-	0,05	pass
30	30,00	30,00	same	0,00	-	0,05	pass
40	40,00	40,00	same	0,00	-	0,10	pass
50	50,00	50,00	same	0,00	-	0,10	pass
60	60,00	60,00	same	0,00	-	0,10	pass
70	70,00	70,00	same	0,00	-	0,10	pass
80	80,00	79,98	same	-0,02	-	0,10	pass
90	90,00	90,00	same	0,00	-	0,10	pass
100	100,00	100,00	same	0,00	-	0,10	pass

Inside Measurement

Nominal Length mm	Standard Length mm	Mean Instrument Reading mm		Mean Deviation mm		Acceptance Criteria (±) mm	Status
		As found	As left	As found	As left		
0	0,00	0,00	same	0,00	-	0,05	pass
10	10,00	10,00	same	0,00	-	0,05	pass
20	20,00	20,00	same	0,00	-	0,05	pass
30	30,00	30,00	same	0,00	-	0,05	pass
40	40,00	40,02	same	0,02	-	0,10	pass
50	50,00	50,00	same	0,00	-	0,10	pass
60	60,00	60,00	same	0,00	-	0,10	pass
70	70,00	70,00	same	0,00	-	0,10	pass
80	80,00	80,00	same	0,00	-	0,10	pass
90	90,00	90,00	same	0,00	-	0,10	pass
100	100,00	100,00	same	0,00	-	0,10	pass

Step Measurement

Nominal Length mm	Standard Length mm	Mean Instrument Reading mm		Mean Deviation mm		Acceptance Criteria (±) mm	Status
		As found	As left	As found	As left		
0	0,00	0,00	same	0,00	-	0,05	pass
10	10,00	10,00	same	0,00	-	0,05	pass
20	20,00	20,00	same	0,00	-	0,05	pass
30	30,00	30,00	same	0,00	-	0,05	pass
40	40,00	40,00	same	0,00	-	0,10	pass
50	50,00	50,00	same	0,00	-	0,10	pass
60	60,00	60,00	same	0,00	-	0,10	pass
70	70,00	70,00	same	0,00	-	0,10	pass
80	80,00	80,00	same	0,00	-	0,10	pass
90	90,00	90,00	same	0,00	-	0,10	pass
100	100,00	99,99	same	-0,01	-	0,10	pass

Page 3 of 3

CERTIFICATE OF CALIBRATION

Issued By PT. X
Date of Issue 09-Mar-24

Calibration Result (Cont.)

Depth Measurement

Nominal Length mm	Standard Length mm	Mean Instrument Reading mm		Mean Deviation mm		Tolerance (±) mm	Status
		As found	As left	As found	As left		
0	0,00	0,00	same	0,00	-	0,05	pass
10	10,00	10,00	same	0,00	-	0,05	pass
20	20,00	20,00	same	0,00	-	0,05	pass
30	30,00	30,00	same	0,00	-	0,05	pass
40	40,00	40,00	same	0,00	-	0,10	pass
50	50,00	50,02	same	0,02	-	0,10	pass
60	60,00	60,00	same	0,00	-	0,10	pass
70	70,00	70,00	same	0,00	-	0,10	pass
80	80,00	80,00	same	0,00	-	0,10	pass
90	90,00	90,00	same	0,00	-	0,10	pass
100	100,00	100,00	same	0,00	-	0,10	pass

Figure 5. The Calibration Certificate contains instrument information and calibration values.

5. CONCLUSION

From the results of the dial caliper calibration that has been carried out, it can be seen in the outside, inside, depth, and step tables. The dial caliper has a deviation value of 0.02 for outside, 0.02 for inside, -0.01 for step, and 0.02 for depth measurement, with an accuracy value of +/- 0.03mm. After being evaluated based on the standard, the dial caliper still meets the requirements according to JIS B 7507-2016. This calibration method based on JIS B 7507:2016 is effective and easy to implement in general laboratories.

REFERENCES

Alsoufi, M. S., Bawazeer, S. A., Alhazmi, M. W., Hijji, H. H., Alhazmi, H., & Alqurashi, H. F. (2025). Dimensional Accuracy and Measurement Variability in CNC-Turned Parts Using Digital Vernier Calipers and Coordinate Measuring Machines Across Five Materials. *Materials*, *18*(12). https://doi.org/10.3390/ma18122728

Amani, & Arief, D. (2013). KALIBRASI JANGKA SORONG NONIUS (VERNIER CALLIPER) BERDASARKAN STANDAR JIS B 7507 DI LABORATORIUM PENGUKURAN TEKNIK MESIN UNIVERSITAS RIAU. *Australian Orthodontic Journal*, *29*(2), 159–163. https://doi.org/10.2478/aoj-2013-0018

Arief, D., Pahlevi, A., & Permana, A. (2021). Calibration of Dial Indicator Using Calibration Tester with JIS B 7503 Standard. *The Journal of Ocean, Mechanical and Aerospace -Science and Engineering- (JOMAse)*, *65*(2), 82–87. https://doi.org/10.36842/jomase.v65i2.204

Chen, W. M., Wang, H. X., Wang, G. W., & Liang, W. H. (2022). MACHINE VISION BASED VERNIER CALIPER READING TECHNOLOGY RESEARCH. *Metrology and Measurement Systems*, *29*(4), 779–793. https://doi.org/10.24425/mms.2022.143070

Chusni, M. M. (2019). Handout Perkuliahan Pengenalan Alat Ukur. *Handout Perkuliahan*, *1*, 4–16.

Fatiatun, Naja, F., Septyana, A., & Rakhmadhani, A. (2022). Pengembangan Large Size Vernier Caliper Untuk Pengukuran Benda Dalam Kehidupan Sehari-Hari. *Jurnal Al-Qalam*, *23*(1), 47–52.

Hilal Yayan, E., Professor, A., & Zengin, M. (2020). A Key Point in Medical Measurements: Device Calibration and Knowledge Level of Healthcare Professionals. In *International Journal of Caring Sciences* (Vol. 13). www.internationaljournalofcaringsciences.org

Husnah, M., Nurlisa, S., Fazira, N. A., & Lubis, R. Y. (2023). Kalibrasi Jangka Sorong Digital (Vernier Calliper) Dengan Caliper Cheker Dan Gauge Block Berdasarkan Standar JIS B.7507:2016. *Navigation Physic : Journal of Physics Education*, *4*(5), 104–112.

Irawan, A. (2019). Kalibrasi Spektrofotometer Sebagai Penjaminan Mutu Hasil Pengukuran dalam Kegiatan Penelitian dan Pengujian. *Indonesian Journal of Laboratory*, *1*(2), 1. https://doi.org/10.22146/ijl.v1i2.44750

Ismaini, Naomi Tosani, dan N. N. H. (2021). *TATAKELOLA PERAWATAN DAN UJI KALIBRASI NERACA ANALITIK DI LABORATORIUM FAKULTAS PERTANIAN UNIVERSITAS SRIWIJAYA*. 1–6.

JIS B 7507, 2016: *Vernier, Dial and Digital Callipers*.

Kankar, P. K., Moona, G., & Desai, K. A. (2022). Measurement and Metrology in Advanced Manufacturing Processes. In *Mapan - Journal of Metrology Society of India* (Vol. 37, Issue 4, pp. 703–705). Springer. https://doi.org/10.1007/s12647-022-00606-w

Klebba, M., Adamczyk, A., Wąż, M., & Iwen, D. (2023). Application of Multi-Criteria Optimization Methods in the Calibration Process of Digital Measuring Instruments. *Sensors*, *23*(6). https://doi.org/10.3390/s23062984

Lamichhane. (2024). Investigating Cost-Effective Calibration Methods for Handheld Measurement Devices: A Study on Vernier \& Digital Calipers and Micrometers. *Degree Program in Industrial Management*, *4*(2), 91.

Mila Rosa Angraini, Suprianto, S., Nur Fadilah, Yasmin Sabrina Nur Islami, & Mubayyinah Muliyadi. (2024). Analisis Keterampilan Penggunaan Alat Ukur terhadap Pemahaman Konsep pada Materi Besaran dan Satuan. *DIAJAR: Jurnal Pendidikan Dan Pembelajaran*, *3*(2), 196–201. https://doi.org/10.54259/diajar.v3i2.2416

Mitutoyo. (2018). *Accuracy and Calibration of Calipers*. 1–2.

Muflikhun, M. Al., Alrifvian to, B., Mahard ika, M., & Salim, U. A. (2022). Metrologi Dalam Industri Manufaktur. Yogyakarta: *Gadjah Mada University Press*

Ni Luh Tirtasari. (2017). *Uji Kalibrasi (Ketidakpastian Pengukuran) Neraca Analitik di Laboratorium Biologi FMIPA UNNES*. *6*(2), 1–13.

Nurlina, & Riska, R. (2019). *Alat Ukur dan pengukuran*. *October*, 60–63.

Rahmah, F., & Salsabila, F. F. (2022). Uji Kalibrasi Alat Ukur Massa Pada Neraca Analitik Menggunakan Metode Perbandingan Langsung. *JURNAL SISFO Inspirasi Profesional Sistem Informasi*, *7*(2), 24–32.

Rochim, Taufiq. (2006). Spesifikasi, Metrologi & Kontrol Kualitas Geometrik 2. Bandung: *ITB*.

SNSU. (2020). Panduan kalibrasi Jangkal Sorong. *Badan Standardisasi Nasional*
Sulaeman, Cecep dan Kusnadi. 2011. Kalibrasi Temperatur Pada PT100 dan Termocouple. *Jurnal Ilmiah Elite Electro Volume 2 Nomor 2 September 2011*.
Xiong, J., He, W., Yuan, J., Li, M., & Ren, T. (2025). Development of calibration device for center distance caliper. *Journal of Physics: Conference Series*, *2954*(1). https://doi.org/10.1088/1742-6596/2954/1/012036
Yoneda, H. (2022). Brief study on vernier caliper and its applications in Physics. In *To Physics Journal* (Vol. 9, Issue 4). http://purkh.com/index.php/tophy
Zulfebri, & Arief, D. S. (2015). Kalibrasi Jangka Sorong Jam Ukur (Dial Calliper). *Journal of Chemical Information and Modeling*, *15*(2), 9–25.