



**P.M.S CO., LTD**  
**'Pioneer Manufacturing & Supply'**

711 Byucksan digital valley, #303, Daedong-ro,  
Sasang-ku, Busan, Korea  
TEL : 82-51-713-8300 FAX : 82-51-713-8397

**CERTIFICATE LIST**

**Client** : FARNIKAN  
**Project** : HX-127  
**Shipper** : P.M.S

**Date** : 2024. 12. 04  
**Ref. No.** :  
**P/O. No.** : PMS-24-050

**- DESCRIPTION :** U-TUBE

**APPLICATION NO. :** T-407

**\* ENCLOSED CERTIFICATE**

		PAGE	Ref. No.
Inspection Item List (T-407)	-----	( 1 )	( )
<b>1. U-TUBE</b>			
1) Inspection Certificate	-----	( 2 )	( )
2) Heat Treatment Report	-----	( 3~4 )	( )
3) Dimension Check Sheet	-----	( 5~7 )	( )
4) Calibration Cert	-----	( 8~11 )	( )

**\* REMARKS**

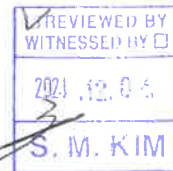
결 계	담당	팀장	이사	전무	사장
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## Inspection Item List

FPA/ HX-127

T- 407

No.	Equip.	Item	Material	Size				Q'ty	Heat No. (Lot No.)	Remark
				OD	Avg.T	STL	R			
1	HX-127	U-BENDING TUBE	SA334 Gr.6	19.05	1.65	2,305	35.7~ 273.7	379	B1-2313351 (YC241010-01)	
TOTAL								379		



CERTIFICATE NO: 20241016-03		PAGE: 1		DATE: 2024-10-16	
CUSTOMER:		PMS			
P/O NO. (W/O NO.):		PMS-24-050-01			
COMMODITY:		SEAMLESS COLD-DRAWN CARBON STEEL TUBE FOR LOW-TEMPERATURE SERVICE			
SPECIFICATION:		ASME SA334 GR.6/SA1016(2023ED.)			

NO	LOT NO	I . D	O . D	W . T	LENGTH(M)	Q 'TY(PCS)	T.LENGTH(mm)	WEIGHT(kg)	REMARK	NOTE
1	YC241010-01	--	19.05	1.650 (AVG)	5.569	388	2,160,772	1,529.8	FINAL TEMP.  900℃	G: GOOD  ※1: CHEMICAL COMPOSITION 2: * 100 3: * 1000

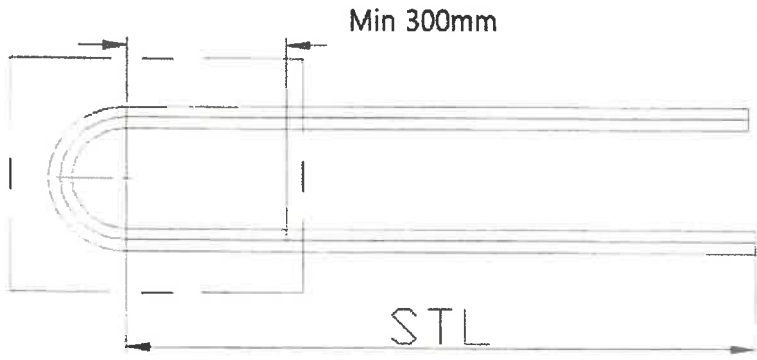
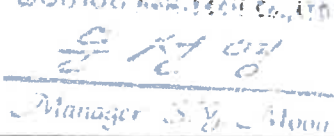
REVIEWED BY  
WITNESSED BY  
2024. 12. 03  
S. M. KIM

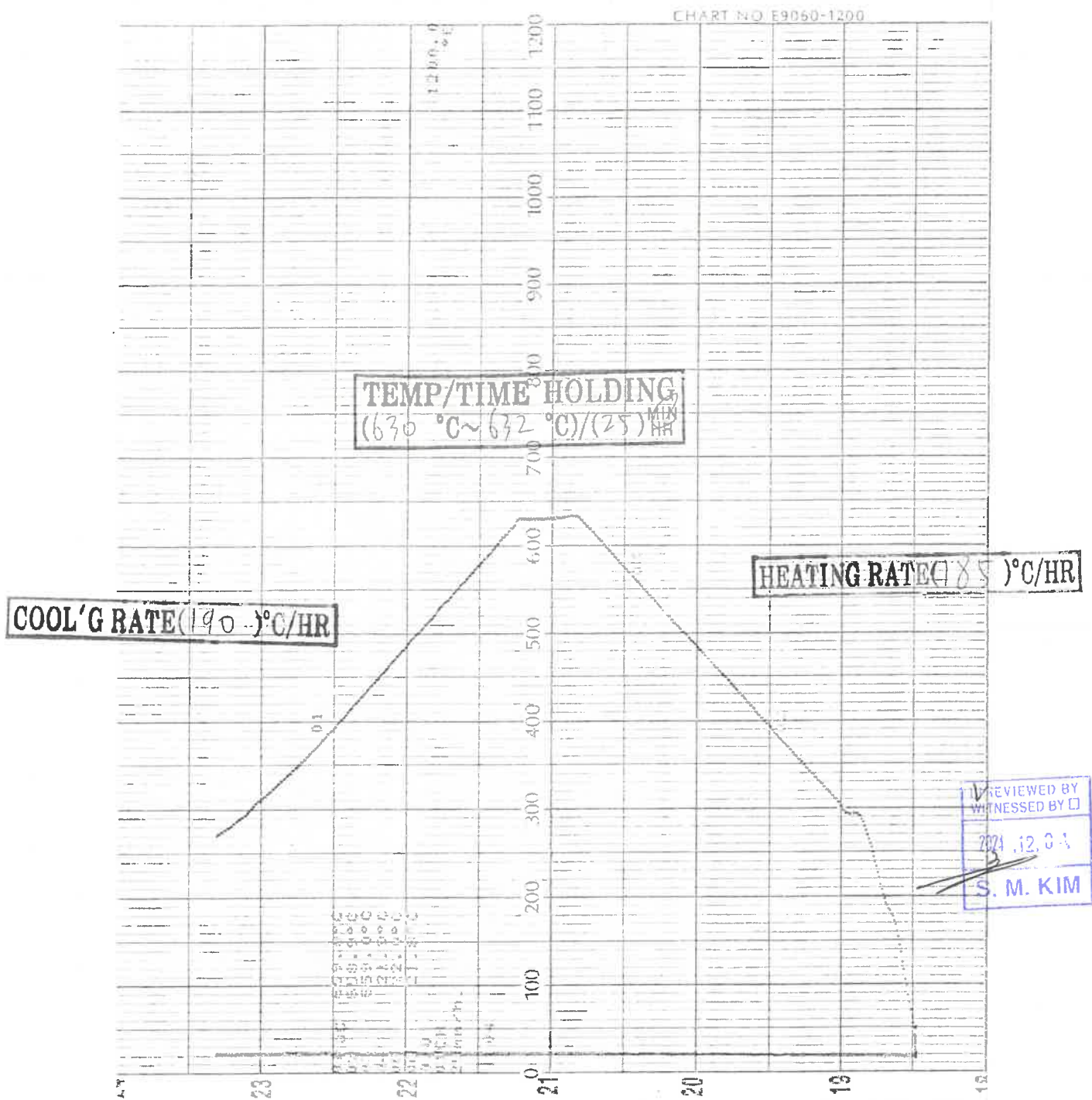
NO	LOT NO	CHEMICAL COMPOSITION					TENSILE TEST				HEAT NO	DIMENSION V I S U A L & F L A T T E N I N G	S T R A I G H T S T R A I G H T	F L A R I N G T E S T	I M P A C T T E M P	C U R R E N T E D D Y	H A R D S S T A T I C H Y D R O C H R O M I T	※ 2: T.S: TENSILE STRENGTH (Mpa) Y.P: YIELD POINT STRENGTH (Mpa) ※ 3: E.L.: ELONGATION (%)
		C	Si	Mn	P	S	T.S (※2)	Y.P (※2)	EL (※3)									
		MAX	30	--	106	25	25	415	240	30								
		MIN	--	10	29	--	--	--	--	--								
1	YC241010-01	H	16	29	123	15	8	512.3	349.8	37.0	B1-2313351	G	G	G	-	-	68.3	69.0
		P	16	30	122	14	9	508.9	348.7	38.0								

※NOTE:SA334-1 and SA334-6:For each reduction of 0.01% below the specified carbon maximum,  
an increase of 0.05% manganese above the specified maximum will be permitted up to a maximum of 1.35%.

MANAGER OF Q.A DEPT  
**H. S. KIM**

WE HEREBY CERTIFY THAT THE MATERIALS HEREIN HAS BEEN MADE AND TESTED  
IN ACCORDANCE WITH ABOVE SPECIFICATIONS AND THE RESULT OF ALL TEST ARE ACCEPTABLE




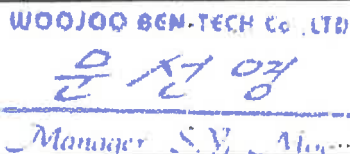
WOOJOO		HEAT TREATMENT REPORT	
CUSTOMER	P M S	DATE	2024. 10. 28
JOB NO	24-050-04	REPORT NO.	HT - PMS
PROJECT NAME		MATERIAL	SA334 - Gr.6
ITEM NAME	U-TUBE	DESCRIPTION	19.05x1.65Tx2305 STL
RECORD NO	YOKOGAWA437006 / T7006UA306	QUANTITY	379 Q'TY
TYPE OF HEAT	<input checked="" type="checkbox"/> POST FORMING/BENDING <input type="checkbox"/> POST WELD <input type="checkbox"/> BEFORE WELD		
TREATMENT	<input checked="" type="checkbox"/> S/R <input type="checkbox"/> QUENCHING <input type="checkbox"/> TEMPERING <input type="checkbox"/> P.W.H.T		
TYPE OF THERMOCOUPLE		<input checked="" type="checkbox"/> ALUMEL - CHROMEL <input type="checkbox"/> OTHERS	
HEAT TREATMENT CONDITION			
CONDITION		SPECIFICATION	ACTUAL
1. LOADING TEMPERATURE(부하온도)		300°C	290°C
2. HEATING RATE(가열율) Max		Max.220°C / Hr	185°C / Hr
3. HOLDING TEMPERATURE(유지온도)		600°C~650°C	630°C ~ 632°C
3. HOLDING TEME(유지시간) Min		15 min	25 min
4. COOLING RATE(냉각율) Max		278°C / Hr	190°C / Hr
5. UNLOADING TEMPERATURE(추출온도)		UNDER 300°C	270°C
6. HEAT SOURCE(가열원)		ELECTRIC LOCAL	
7. CHART NO.	E9060-1200	8. CHART SPEED	25mm / H
9. Heat Treatment in accodance with DWG NO		WOOJOO STANDARD ITP	
LOCATION OF THERMOCOUPLE 			
RESULT : REVIEWED BY 2024. 12. 04. S. M. KIM		INSPECTED BY WOOJOO BEN-TECH Co.,LTD  Manager S.Y. Moon	
CUSTOMER OR AUTHORIZED INSPECTOR		WOOJOO QUALITY CONTROL DEPARTMENT	



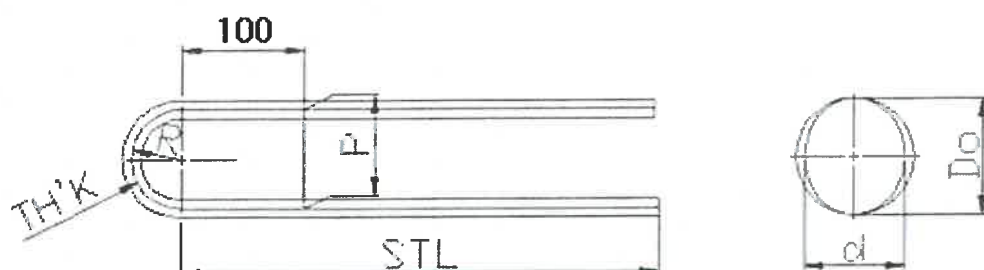

RECORD OF HEAT TREATMENT	
CUSTOMER	PMS
SIZE	1405 x 1.65 TX 2305 STL
TEMP & HOLDING	630 °C~632 °C/25 MIN
DATE	2024.10.20
LOT NO	HT-PMS

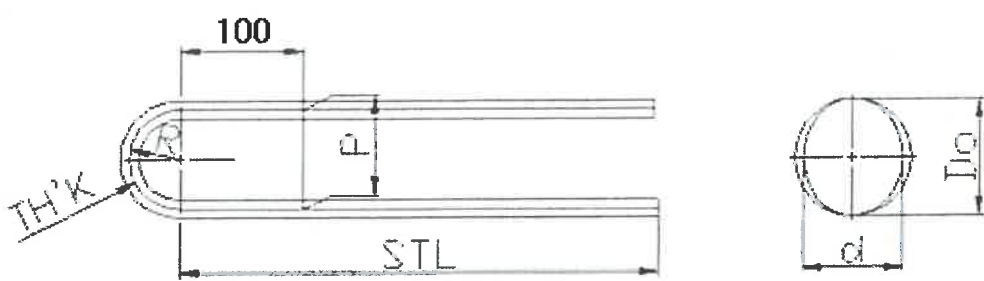
PMS	<input type="checkbox"/> WITNESSED BY
Q.A	<input checked="" type="checkbox"/> REVIEWED BY

*Smk*

		TEST REPORT (Ovality & Wall Thickness)			
CUSTOMER	P M S	DATE	2024. 10. 16		
JOB NO	24-050-04	MATERIAL	SA334 - Gr.6		
PROJECT NAME		DESCRIPTION	19.05X1.65(Avg)T R35.7		
ITEM NAME	U-TUBE	QUANTITY	1 Q'TY		
<p>* TEMA RCB-2.3</p> <ul style="list-style-type: none"> <li>- Ovality at the bend shall not exceed 10% of the nominal tube outside diameter.</li> <li>- Tube wall thinning in the bends should not exceed a nominal 17% of original tube wall thickness.</li> </ul>					
Ovality :		$\frac{\text{Max. O.D} - \text{Min. O.D}}{\text{Specified. O.D}} \times 100$			
Wall Thickness :		$\frac{\text{Max. Wall Th'k} - \text{Min. Wall Th'k}}{\text{Specified. Wall Th'k}} \times 100$			
DESCRIPTION		① 45°	② 90°	③ 135°	REMARK
Ovality (10%)	Max. O.D	19.10	19.17	19.08	
	Min. O.D	17.57	17.73	17.69	
	RESULT	8.03%	7.56%	7.30%	
	ACCEPT	ACCEPT	ACCEPT		
Wall Thickness (17%)	Max. Wall Th'k	1.65	1.65	1.65	
	Min. Wall Th'k	1.36	1.37	1.37	
	RESULT	13.74%	13.27%	13.27%	
	ACCEPT	ACCEPT	ACCEPT		
RESULT 		INSPECTED BY 			
CUSTOMER OR AUTHORIZED INSPECTOR		WOOJOO QUALITY CONTROL DEPARTMENT			



WOOJOO		DIMENSION INSPECTION REPORT (1 / 2)										
CUSTOMER	P M S			DATE		2024. 10. 29						
JOB NO	24-050-04			MATERIAL		SA334 - Gr.6						
PROJECT NAME				DESCRIPTION		19.05x1.65Tx2305 STL						
ITEM NAME	U-TUBE			QUANTITY		660 Q'TY						
 <div style="text-align: right;">(Unit:mm)</div>												
POSITION  SPEC & TOLE  Tag NO	RADIUS SPEC (Pitches 95.25 < ± 1.0 mm 95.25 > ± 1.5 mm)			STL (-0~+3.2)	U-bend OD Ovality 19.05 (1.905) (10%)			VISUAL	Q'TY			
	R	P	ACT	ACT	Do	d	%	Dent Scratch	240			
1	35.7	71.4	72.0	2308	19.17	17.73	7.56	GOOD	20			
2	47.6	95.2	96.0	2308	19.25	18.02	6.46	GOOD	20			
3	59.5	119.0	119.5	2308	19.20	18.25	4.99	GOOD	20			
4	71.4	142.8	143.0	2308	19.12	18.39	3.83	GOOD	20			
5	83.3	166.6	166.5	2308	19.15	18.52	3.31	GOOD	20			
6	95.2	190.4	190.0	2308	19.11	18.68	2.26	GOOD	20			
7	107.1	214.2	215.0	2308	19.16	18.70	2.41	GOOD	20			
8	119.0	238.0	238.0	2308	19.10	18.82	1.47	GOOD	20			
9	130.9	261.8	262.0	2308	19.14	18.90	1.26	GOOD	20			
10	142.8	285.6	285.5	2308	19.10	18.94	0.84	GOOD	20			
11	154.7	309.4	309.0	2308	19.12	18.89	1.21	GOOD	20			
12	166.6	333.2	333.0	2308	19.13	18.95	0.94	GOOD	20			
RESULT	<div style="border: 1px solid black; padding: 2px;"> REVIEWED BY  WITNESSED BY  2024. 12. 04  S. M. KIM </div> <div style="border: 1px solid black; padding: 2px; margin-top: 5px;"> PMS  Q.A  WITNESSED BY  REVIEWED BY </div>			INSPECTED BY WOOJOO BEN-TECH Co.,LTD <div style="text-align: center;">   Manager S.Y. Ahn </div>					CUSTOMER OR AUTHORIZED INSPECTOR		WOOJOO QUALITY CONTROL DEPARTMENT	

WOOJOO		DIMENSION INSPECTION REPORT (2 / 2)								
										
(Unit:mm)										
POSITION	RADIUS SPEC (Pitches 95.25 < ± 1.0 mm 95.25 > ± 1.5 mm)			STL (-0~+3.2)	U-bend OD Ovality 19.05 (1.905) (10%)			VISUAL	Q'TY	
SPEC & TOL	R	P	ACT	ACT	Do	d	%	Dent Scratch	139	
Tag NO	13	178.5	357.0	357.5	2308	19.12	18.85	1.42	GOOD	20
14	190.4	380.8	381.0	2308	19.08	18.89	1.00	GOOD	20	
15	202.3	404.6	405.0	2308	19.10	18.93	0.89	GOOD	16	
16	214.2	428.4	428.5	2308	19.17	18.87	1.57	GOOD	20	
17	226.1	452.2	452.0	2308	19.15	18.94	1.10	GOOD	16	
18	238.0	476.0	477.0	2308	19.11	18.91	1.05	GOOD	16	
19	249.9	499.8	500.5	2308	19.20	18.86	1.78	GOOD	12	
20	261.8	523.6	524.0	2308	19.18	18.90	1.47	GOOD	12	
21	273.7	547.4	548.0	2308	19.14	18.95	1.00	GOOD	7	
- BLANK -										
<div style="display: flex; justify-content: space-between;"> <div> <p>REVIEWED BY WITNESSED BY ✓</p> <p>2024.12.03</p> <p>S.M. KIM</p> </div> <div> <p>INSPECTED BY</p> <p>WOOJOO BEN-TECH Co.,LTD</p> <p>Manager S.Y. Moon</p> </div> </div>										
<p>RESULT</p> <p>PMS Q.A</p> <p>WITNESSED BY</p> <p>REVIEWED BY</p>					<p>CUSTOMER OR AUTHORIZED INSPECTOR</p>					
<p>WOOJOO QUALITY CONTROL DEPARTMENT</p>					<p>WOOJOO QUALITY CONTROL DEPARTMENT</p>					





# Calibration Certificate

Korea Instruments Co., Ltd. Branch

45, Gwangjang-ro 56beon-gil, Sasang-gu, Busan, Korea

Tel : 051-322-0880, Fax : 051-322-4066

Certificate No : 24000582-2

Page : ( 1 ) of ( 2 )



## 1. Client

Name : WOJOO BEN-TECH CO.LTD

Address : 9, Daedong-ro 180beon-gil, Sasang-gu, Busan, Korea

## 2. Calibration Subject

Description : Callipers, inside/outside

Manufacturer and Model Name : Mitutoyo / ( 0 ~ 200 ) mm, 0.01 mm

Serial Number : A20182443

## 3. Date of Calibration : 2024. 01. 16.

## 4. Environment

Temperature : ( 20 ± 0.2 ) °C - Humidity : ( 38 ± 2 ) % R.H.

- Location ☒ Permanent Calibration Lab ☐ Mobile Lab ☐ On Site Calibration  
( Address : 45, Gwangjang-ro 56beon-gil, Sasang-gu, Busan, Korea )

## 5. Traceability

Calibration method and/or brief description

The above instrument is calibration obtained by using standard equipment which traceability is maintained to SI units by National Calibration Laboratory on the basis of the standard calibration procedure of Inside/Outside calipers (KIC-106-01-1).

List of used standards/specifications

Description	Manufacturer and Model	Serial Number	The due date of next calibration	Calibration Laboratory
Caliper testers	Mitutoyo / 600 mm	1510042	2025.07.19	Korea Instrument Co., Ltd. Branch



## 6. Calibration Result : Refer to Calibration Result

## 7. Measurement uncertainty : Refer to Calibration Result

affirmation	Measurements performed by	Approved by
	Name : Jeong-Seok Lee	Title : Technical Cal. Manager Name : Sang-Hyun Park

The above calibration certificate is the accredited calibration items by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.



2024. 01. 16

Korea Instruments Co., Ltd. Branch Calibration Laboratory  
Accredited by KOLAS, Republic of Korea



(NOTE) If any significant instability or other adverse factor (overload, temperature, humidity etc.) manifests itself before, during or after calibration, and is likely to affect the validity of the calibration.



RF7108-01(04)



# Calibration Results

Korea Instruments Co., Ltd. Branch

45, Gwangjang-ro 56beon-gil, Sasang-gu,  
Busan, Korea

Tel : 051-322-0880, Fax : 051-322-4066

Certificate No : 24000582-2



\* Description : Calipers, inside/outside

\* Manufacturer : Mitutoyo

\* Serial Number : A20182443

## 1. Accuration calibration of graduations

Nominal value (mm)	Correction value (mm)		Measurement uncertainty ( $\mu\text{m}$ ) (Confidence level is approximately 95 %, $k = 2$ )
	Outside	Inside	
0	0.00	-	-
50	0.00	0.00	11
100	0.01	0.00	11
150	0.01	0.00	11
200	0.00	0.00	11 -- End.





# Calibration Certificate

Korea Instruments Co., Ltd. Branch

45, Gwangjang-ro 56beon-gil, Sasang-gu, Busan, Korea

Tel : 051-322-0880, Fax : 051-322-4066

Certificate No : 24000582-1

Page : ( 1 ) of ( 2 )



## 1. Client

Name : WOJOO BEN-TECH CO.LTD

Address : 9, Daedong-ro 180beon-gil, Sasang-gu, Busan, Korea

## 2. Calibration Subject

Description : Outside micrometer(Tube)

Manufacturer and Model Name : Mitutoyo / (0 ~ 25) mm, 0.01 mm

Serial Number : 86414438

## 3. Date of Calibration : 2024. 01. 16.

## 4. Environment

Temperature : ( 20 ± 0.2 ) °C - Humidity : ( 38 ± 2 ) % R.H.

- Location ☒ Permanent Calibration Lab ☐ Mobile Lab ☐ On Site Calibration  
( Address : 45, Gwangjang-ro 56beon-gil, Sasang-gu, Busan, Korea )

## 5. Traceability

Calibration method and/or brief description

The above instrument is calibration obtained by using standard equipment which traceability is maintained to SI units by National Calibration Laboratory on the basis of the standard calibration procedure of Outside micrometers (KIC-106-13-1).

List of used standards/specifications

Description	Manufacturer and Model	Serial Number	The due date of next calibration	Calibration Laboratory
Gauge blocks	Mitutoyo / K GRADE(56P)	0005259	2025.05.25	Korea Instrument Co., Ltd. Branch



## 6. Calibration Result : Refer to Calibration Result

## 7. Measurement uncertainty : Refer to Calibration Result

affirmation	Measurements performed by	Approved by
	Name : Jeong-Seok Lee	Title : Technical Cal. Manager Name : Sang-Hyun Park

The above calibration certificate is the accredited calibration items by Korea Laboratory Accreditation Scheme, which signed the ILAC-MRA.



2024. 01. 16

Korea Instruments Co., Ltd. Branch Calibration Laboratory  
Accredited by KOLAS, Republic of Korea



(NOTE) If any significant instability or other adverse factor(overload, temperature, humidity etc ) manifests itself before, during or after calibration, and is likely to affect the validity of the calibration.



# Calibration Results

Korea Instruments Co., Ltd. Branch

45, Gwangjang-ro 56beon-gil, Sasang-gu,  
Busan, Korea

Certificate No : 24000582-1

Tel : 051-322-0880, Fax : 051-322-4066



\* Description : Outside micrometer(Tube)  
\* Manufacturer : Mitutoyo  
\* Serial Number : 86414433

## 1. Accuration calibration of graduations

Nominal value (mm)	Correction value ( $\mu\text{m}$ )	Measurement uncertainty( $\mu\text{m}$ ) (Confidence level is approximately 95 %, $k = 2$ )	
0	0	-	
5	0	1.1	
10	0	1.1	
15	0	1.1	
20	0	1.1	
25	0	1.1	End

