

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		

REVIEWED BY
WITNESSED BY
2024.12.04
S. M. KIM

CERTIFICATE NO: 20241016-03 PAGE: 1 DATE: 2024-10-16

CUSTOMER: PMS

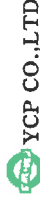
P/O NO. (W/O NO.): PMS-24-050-01

COMMODITY: SEAMLESS COLD-DRAWN CARBON STEEL TUBE FOR LOW-TEMPERATURE SERVICE

SPECIFICATION: ASME SA334 GR.6/SA1016(2023ED.)

INSPECTION CERTIFICATE

According to EN10204 3.1



1519-2, DADAE-DONG, SAHA-GU, BUSAN, KOREA
TEL: (051)264-9300 FAX: (051)264-9200

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°C	G: GOOD * 1 : CHEMICAL COMPOSITION 2 : * 100 3 : * 1000								
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> REVIEWED BY WITNESSED BY 2024.12.03 S. M. KIM </div>																		
NO	LOT NO	CHEMICAL COMPOSITION				TENSILE TEST			HEAT NO	DIMENSION	FLATTENING	STRAIGHT	FLATTENING	IMPACT TEMP	CURRENT	STATISTIC	HARDNESS	* 2 : T.S: TENSILE STRENGTH (Mpa) Y.P: YIELD POINT STRENGTH (Mpa) * 3 : E.L: ELONGATION (%)
		C	Si	Mn	P	S	T.S (#2) MIN	Y.P (#2) MIN										
1	YC241010-01	16	29	123	15	8	512.3	349.8	37.0	B1-2313351	G	G	G	-	G	-	68.3	69.0
		16	30	122	14	9	508.9	348.7	38.0									

WITNESSED BY
PMS
Q.A
VIEWED BY
S.M.KIM

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

*NOTE:SA334-1 and SA334-6For 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%.



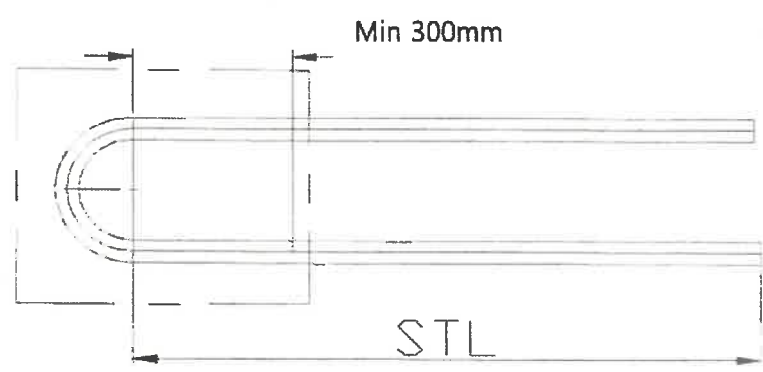
HEAT TREATMENT REPORT

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 TREATMENT	<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

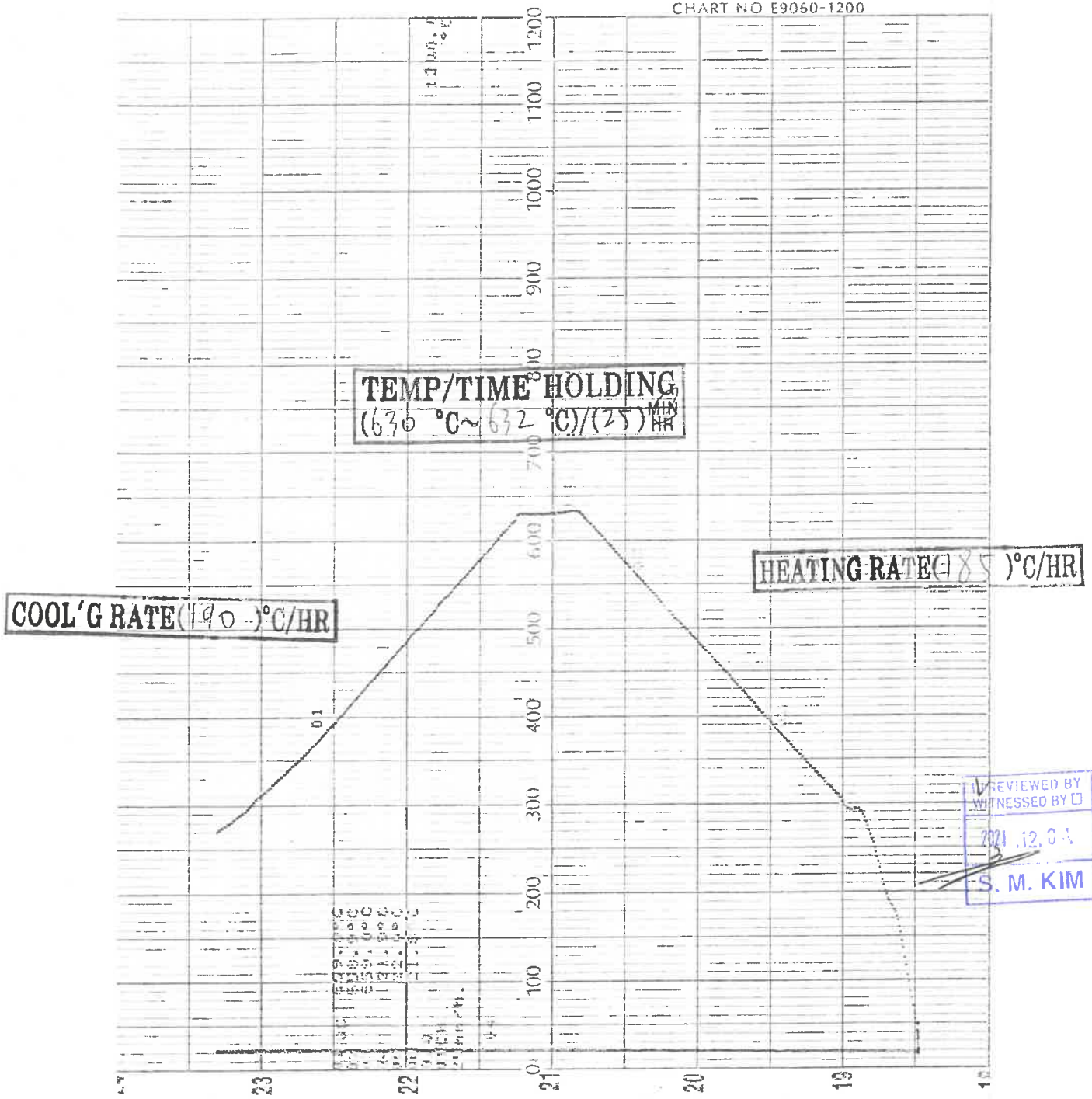
CONDITION	SPECIFICATION	ACTUAL	
1. LOADING TEMPERATURE(부하온도)	300°C	290°C	
2. HEATING RATE(가열율) Max	Max.220°C / Hr	185°C / Hr	
3. HOLDING TEMPERATURE(유지온도)	600°C~650°C	630°C ~ 632°C	
3. HOLDING TEME(유지시간) Min	15 min	25 min	
4. COOLING RATE(냉각율) Max	278°C / Hr	190°C / Hr	
5. UNLOADING TEMPERATURE(추출온도)	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 accordance with DWG NO	WOOJOO STANDARD ITP		

LOCATION OF THERMOCOUPLE



RESULT <div style="border: 1px solid black; padding: 5px; width: fit-content;"> REVIEWED BY WITNESSED BY 2024. 12. 04. <i>S. M. KIM</i> </div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;"> PMS <input type="checkbox"/> WITNESSED BY Q.A <input checked="" type="checkbox"/> REVIEWED BY <i>[Signature]</i> </div>	INSPECTED BY WOOJOO QUALITY CONTROL DEPT. <i>[Signature]</i> Manager S.Y. Moon
CUSTOMER OR AUTHORIZED INSPECTOR	WOOJOO QUALITY CONTROL DEPARTMENT


CHART NO E9060-1200



RECORD OF HEAT TREATMENT	
CUSTOMER	PMS
SIZE	19.05 x 1.65 T x 2.705 STL
TEMP & HOLDING	630 °C ~ 632 °C / 25 MIN
DATE	2024.10.20
LOT NO	HT-PMS

PMS WITNESSED BY
Q.A. REVIEWED BY
[Signature]

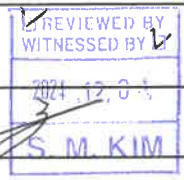
4

		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

- * TEMA RCB-2.3
- Ovality at the bend shall not exceed 10% of the nominal tube outside diameter.
 - Tube wall thinning in the bends should not exceed a nominal 17% of original tube wall thickness.

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

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

[Signature]

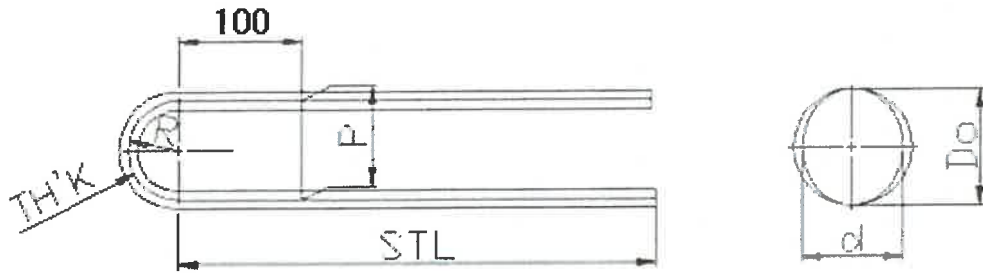
INSPECTED BY **WOOJOO BEN-TECH Co., LTD**

[Signature]

Manager *[Signature]*

CUSTOMER OR AUTHORIZED INSPECTOR WOOJOO QUALITY CONTROL DEPARTMENT

	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



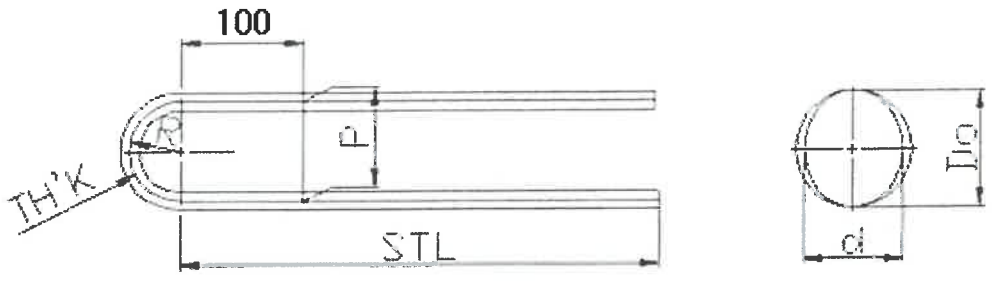
(Unit:mm)

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 <input checked="" type="checkbox"/> REVIEWED BY <input checked="" type="checkbox"/> WITNESSED BY 2024. 10. 29 S. M. KIM	<input type="checkbox"/> WITNESSED BY <input checked="" type="checkbox"/> REVIEWED BY PMS Q.A. 	INSPECTED BY WOOJOO BEN-TECH Co.,LTD Manager S.Y. Ahn
CUSTOMER OR AUTHORIZED INSPECTOR		WOOJOO QUALITY CONTROL DEPARTMENT



DIMENSION INSPECTION REPORT (2 / 2)



(Unit:mm)

POSITION SPEC & TOLERANCE	RADIUS SPEC (Pitches 95.25 $\pm 1.0\text{ mm}$ 95.25 >math>\pm 1.5\text{ mm}</math>)			STL (-0~+3.2)	U-bend OD Ovality 19.05 (1.905) (10%)			VISUAL	Q'TY
	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

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REVIEWED BY
 WITNESSED BY
 2021 12 03
 S. M. KIM

RESULT

PMS WITNESSED BY
 Q.A REVIEWED BY

INSPECTED BY

WOOJOO BEN-TECH Co.,LTD

김성민

Manager S.Y. Moon

WOOJOO QUALITY CONTROL DEPARTMENT



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

Certificate No : 24000582-2

Tel : 051-322-0860, Fax : 051-322-4066



- * Description : Calipers,inside/outside
- * Manufacturer : Mitutoyo
- * Serial Number : A20182443

1. Accuracy calibration of graduations

Nominal value (mm)	Correction value (mm)		Measurement uncertainty (μm) (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.

REVIEWED BY
 WITNESSED BY
 2021. 12. 04
 S. M. KIM



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 : 86414433

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

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

Certificate No : 24000582-1



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

1. Accuration calibration of graduations

Nominal value (mm)	Correction value (μm)	Measurement uncertainty(μm) (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

REVIEWED BY
 WITNESSED BY
 2021. 12. 04
 S. M. KIM