

3D SPI

Equipment Advantage & Function Introduce



- **Part 1: 3D SPI Machine in Our SMT Line**
- **Part 2: Specification & Principle Introduce of 3D SPI**
- **Part 3: Product Test**
- **Part 4: Poor Solder Paste Test Verify**
- **Part 5: Equipment Accuracy Verify**
- **Part 6: Special Functional Introduce**
- **Part 7: Detail Introduce of SPI**

3D SPI Specification And Working Principle



3D SPI inspection machine in our SMT line:

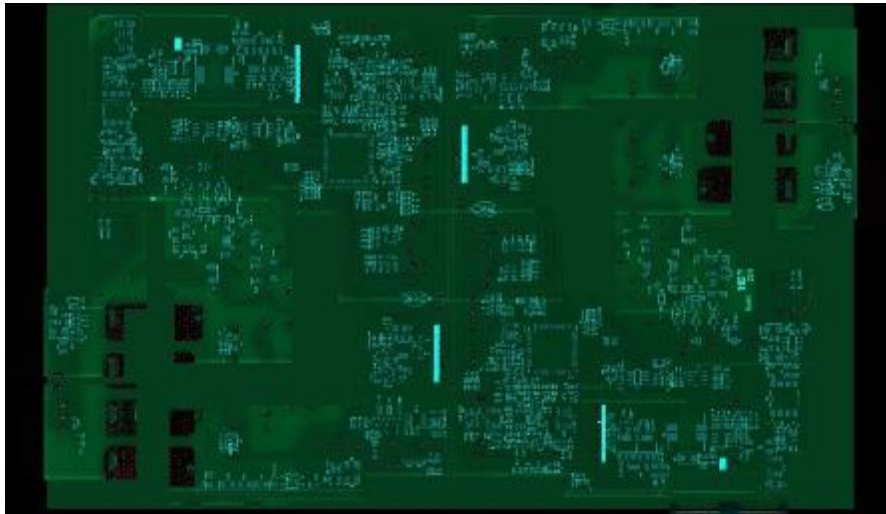


3D SPI Specification And Working Principle



Part Number	S8080		
Inspection Principle	PSLM PMP		
Inspection Item	Volume, area, height, XY offset, shape		
Defective Type	Missing print, insufficient solder, excess solder, bridging solder, deviation, poor shape, surface contamination		
Industry Camera	5M pixel	LED Color	Red/Blue/White
X/Y Resolution	15um	Inspect Speed	FOV/0.42s (25*20mm)
Height Inspection Range	$\pm 350\mu\text{m}$ ($\pm 1200\mu\text{m}$ available)	Z-axis Resolution	0.37 μm
Height Accuracy	<1 μm	Measurement repetition rate	<1% at 6sigma
Gage R&R	<10%		
PCB Size	Monorail mode: 50*50-460*460mm		
PCB Flow Direction	Left - Right OR Right - Left		
PCB Warpage	$\pm 5\text{mm}$		
PCB Loading Height	900 $\pm 40\text{mm}$		
Loading Height	3mm		
Operating System Support	WINDOWS 10 (64 bit)		
Gerber & CAD Import	Gerber Data 274D/274X, Manual Teach Mode CAD X, Y, Part No. Package Type Import		
Operating Mode	Mouse + Keyboard		
Equipment Dimension	W1000*D1150*H1580mm		
Equipment Weight	1050KG		
Voltage	200-240V AC, 50/60HZ		
Air Pressure	5kgf/cm ²		
Environment Temperature	5-40°C		
Environment Humidity	25%-80%		

B2190 SPI Machine

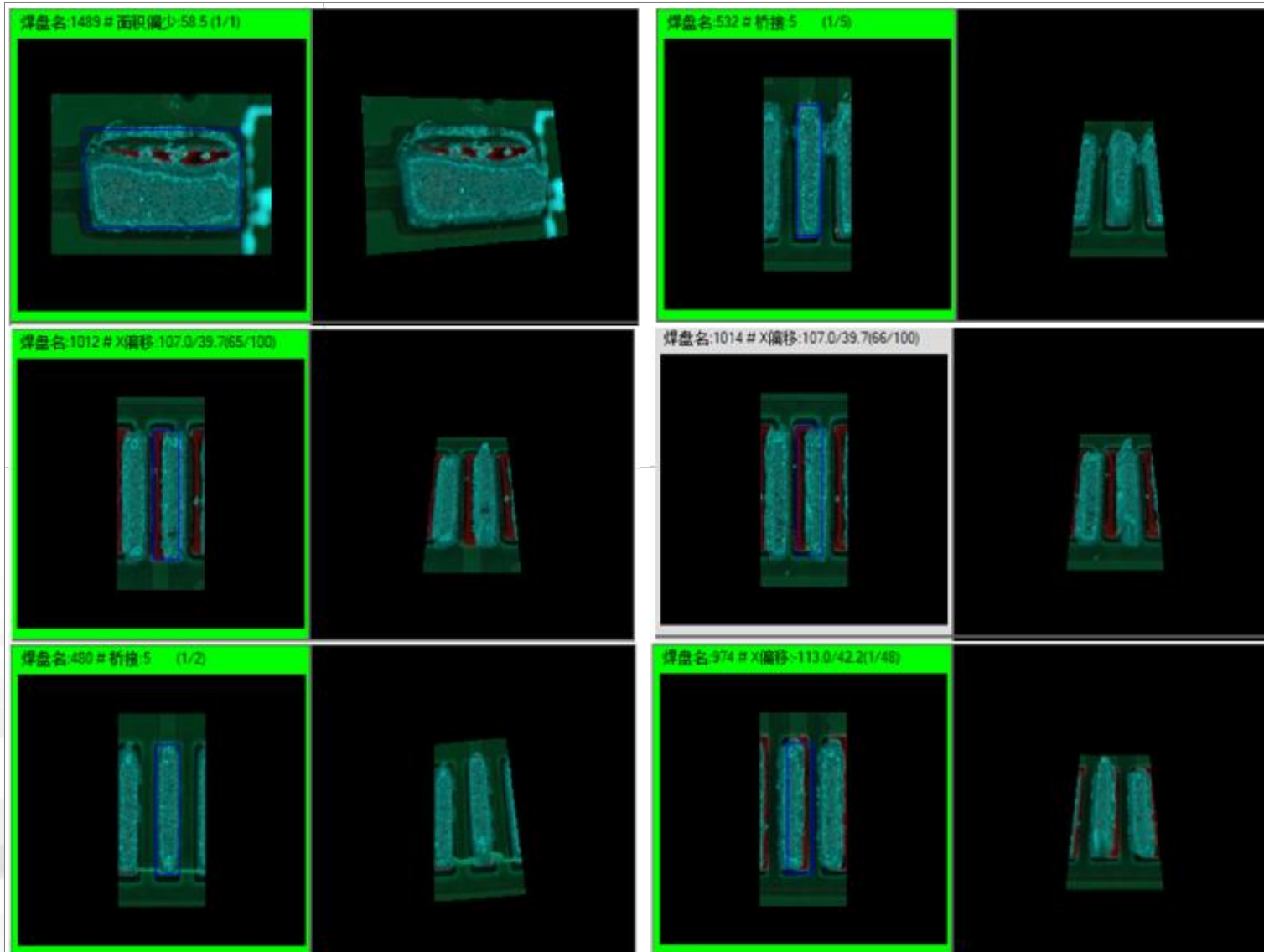


Total PAD Qty	1506
FOV Qty	33
Testing Time	14.63s
Stencil Thickness	120um

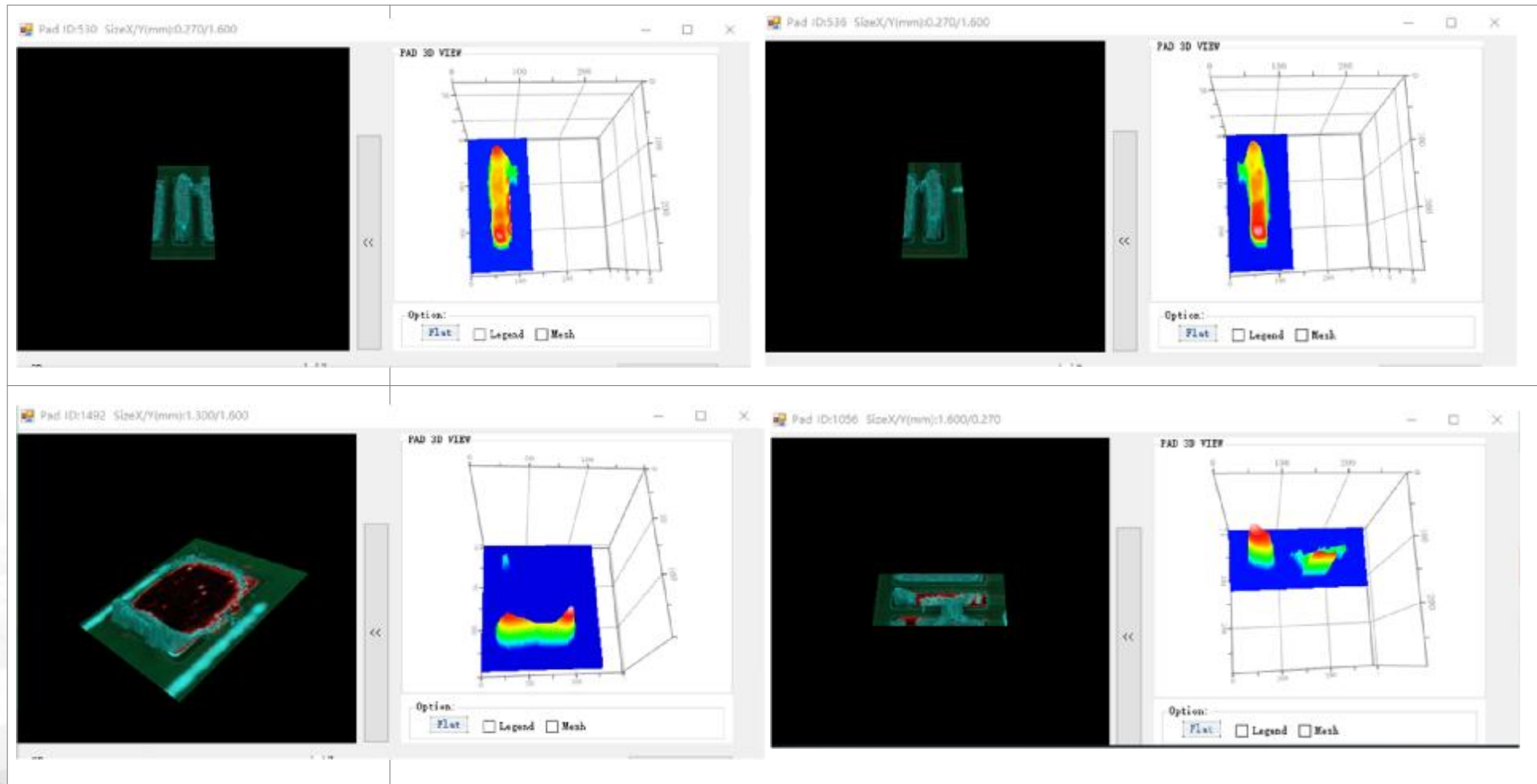
PCB Size: 173mm*270mm

Min Pad Package: 0603

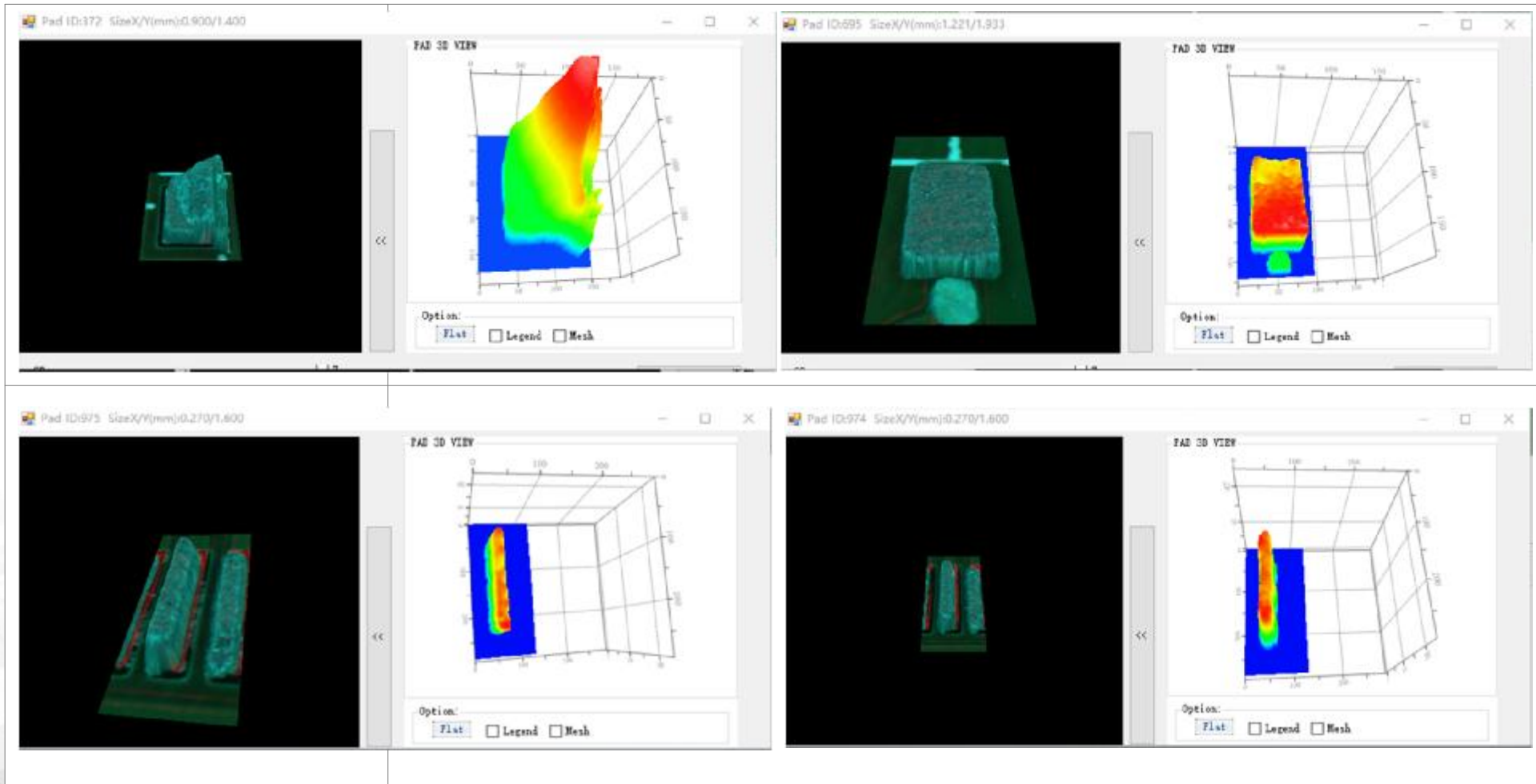
B2190 SPI Inspection Result



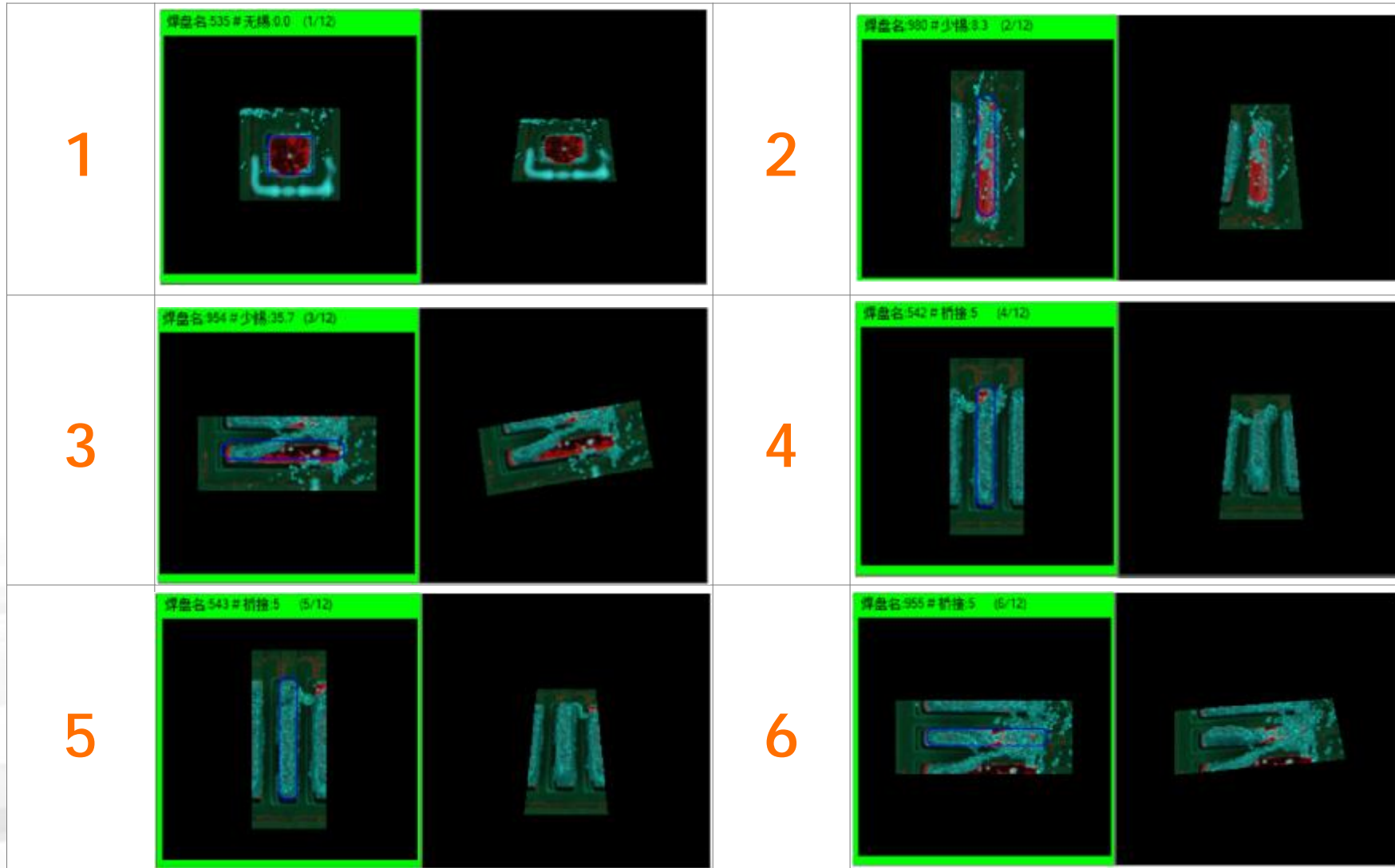
B2190 SPI Inspection Result



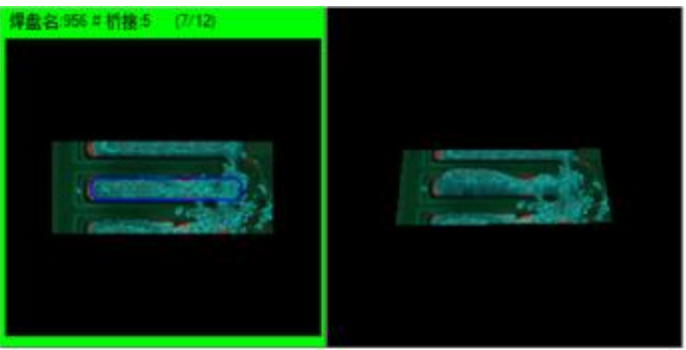
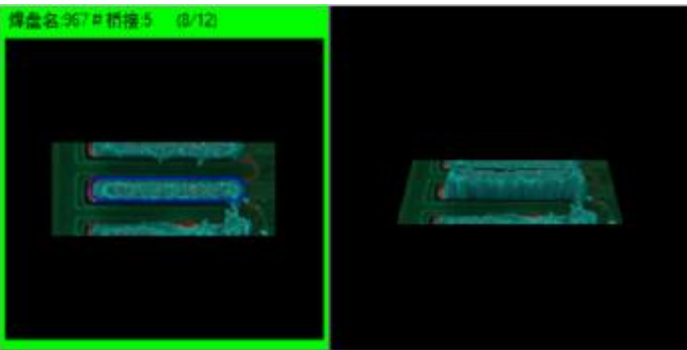
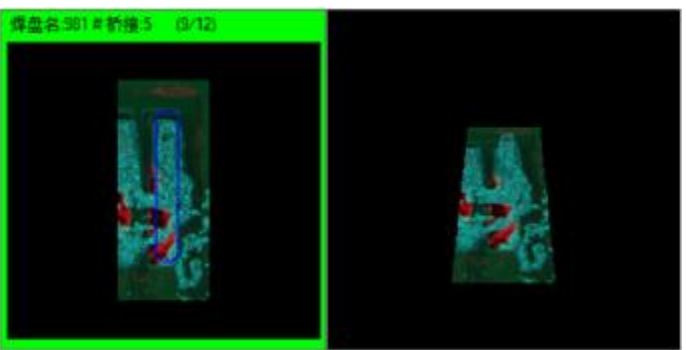
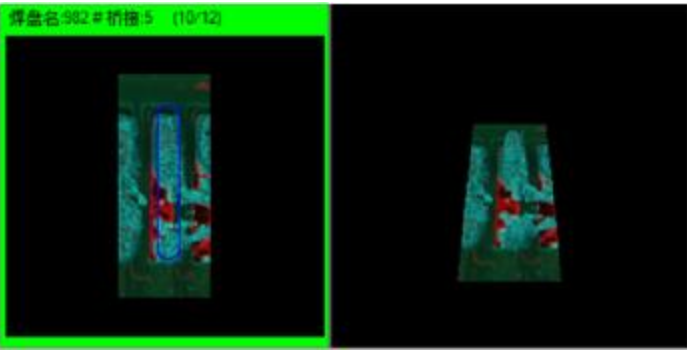
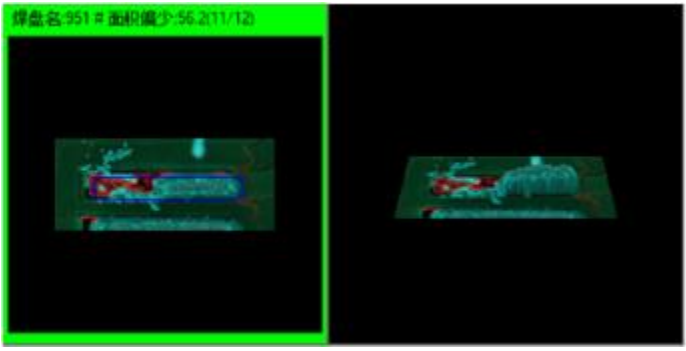
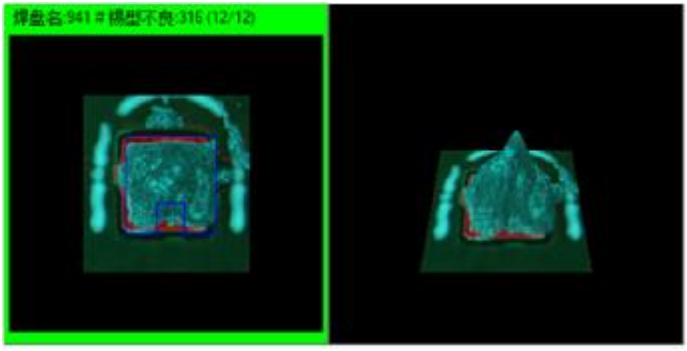
B2190 SPI Inspection Result



SPI Inspection Capability Verify



Defective Solder Verify

7	<p>焊盘名: 356 # 引脚 5 (7/12)</p> 	8	<p>焊盘名: 367 # 引脚 5 (8/12)</p> 
9	<p>焊盘名: 381 # 引脚 5 (9/12)</p> 	10	<p>焊盘名: 382 # 引脚 5 (10/12)</p> 
11	<p>焊盘名: 351 # 面积偏少: 56.2(11/12)</p> 	12	<p>焊盘名: 341 # 桥脚不良: 316 (12/12)</p> 

Device Accuracy Verify



CPK Testing Result CPK=4.68 (Qualify)

厦门思泰克智能科技股份有限公司
 Xiamen Sinic-Tek Intelligent Technology Co., Ltd.
 厦门火炬高新区(翔安)产业区同龙二路583号101单元
 Tel: 0592-7263060, Mail Address: info@sinictek.com

COMPANY: Sinic-Tek Intelligent Technology Co., Ltd.

CERTIFICATE OF CALIBRATION
INSTRUMENT CALIBRATED
 Instrument Calibrated: 3D SPI
 Instrument Serial Number: SPI216920H
 Date of Calibration: 2022/12/15
 Next Date of Calibration:
 General Condition of this Instrument: **First**

Environment Information
 Ambient Temperature: (° C) 20
 Relative Humidity: (%) 65

Standard Calibration Jig Result:
 Accuracy & Repeatability:
 Calibrator Serial Number: SNK43 120µm
 Height: 0.21 SPEC < 1µm (4 sigma)
 Volume: 0.43 SPEC < 1% (5 sigma)
 CPK: 4.68 Tolerance: ±1µm

Result: **Pass**

Sinic-Tek Solder Paste Inspector certifies that the above listed equipment meets or exceeds
 All Purchased specifications.

Signature:
 Date: 2022/12/15

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COMPANY: Sinic-Tek Intelligent Technology Co., Ltd.

CERTIFICATE OF CALIBRATION
INSTRUMENT CALIBRATED
 Instrument Calibrated: 3D SPI
 Instrument Serial Number: SPI216920H
 Date of Calibration: 2022/12/15

Test ID	PosX (µm)	PosY (µm)	SizeX (µm)	SizeY (µm)	ABSHeight (µm)	PerArea(%)	PerVolume(%)
1	197000	199636	3500	3500	119.7	100.5	100.5
2	197000	199636	3500	3500	119.7	100.5	100.5
3	197000	199636	3500	3500	119.7	100.5	100.5
4	197000	199636	3500	3500	119.7	100.5	100.5
5	197000	199636	3500	3500	119.7	100.5	100.5
6	197000	199636	3500	3500	119.7	100.5	100.5
7	197000	199636	3500	3500	119.7	100.5	100.5
8	197000	199636	3500	3500	119.7	100.5	100.5
9	197000	199636	3500	3500	119.7	100.5	100.4
10	197000	199636	3500	3500	119.6	100.6	100.6
11	197000	199636	3500	3500	119.7	100.4	100.5
12	197000	199636	3500	3500	119.8	100.4	100.5
13	197000	199636	3500	3500	119.8	100.5	100.4
14	197000	199636	3500	3500	119.8	100.3	100.3
15	197000	199636	3500	3500	119.7	100.4	100.4
16	197000	199636	3500	3500	119.6	100.5	100.7
17	197000	199636	3500	3500	119.7	100.5	100.6
18	197000	199636	3500	3500	119.7	100.6	100.6
19	197000	199636	3500	3500	119.7	100.4	100.4
20	197000	199636	3500	3500	119.7	100.4	100.4
21	197000	199636	3500	3500	119.7	100.6	100.6
22	197000	199636	3500	3500	119.7	100.4	100.4
23	197000	199636	3500	3500	119.7	100.3	100.3
24	197000	199636	3500	3500	119.8	100.4	100.4
25	197000	199636	3500	3500	119.7	100.6	100.6
26	197000	199636	3500	3500	119.8	100.4	100.5
27	197000	199636	3500	3500	119.8	100.6	100.5
28	197000	199636	3500	3500	119.7	100.3	100.4
29	197000	199636	3500	3500	119.7	100.6	100.6
30	197000	199636	3500	3500	119.7	100.3	100.3

GR&R Testing Result Height GR&R=3.83% (Qualify)

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SINIC-TEK
思泰克智能

COMPANY: Sinic-Tek Intelligent Technology Co., Ltd.

GAUGE R&R ANALYSIS REPORT

Instrument Analysised: 3D SPI
Instrument Serial Number: SPI216920H
Date of Analysis: 2022/12/15
Sample for analysis: Testing PCB
Number of PCB: 1pc
Number of pads: 10pads
Analytical method: ANOVA

	GR&R	Ndc
Height	3.83%	31
Area	4.17%	32
Volume	3.97%	30

Result: Pass

Note:
The testing PCB is used in the analysis process, and the analysis results are for reference only.

Signature: Date: 2022/12/15

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Gage R&R分析表 (ANCOVA)

机种名称 / Name	20 01	测高编号 / Serial No.	SP1216920H	日期 / Date	2022/12/15
机种 / Model	PCB	特性参数	Height	单位 / Unit	um

ANCOVA table

Source	SS	DF	MS	F	P
Total	369.2374.87	20	18461.869	2442.227	
Operator	352.7	2	17638.5	1.80	0.428
Operator*Part	16.527	20	0.82635	0.102	0.999
Operator*Part*Part	1.0297	40	0.0257425		
Total	369.2374.87	20			

方差与标准差的估计
Estimate of Various and Std Dev.

Source	变异数估计 (Variance)	标准差的估计 (Std. Dev.)	% Contribution	MS	P
Total	0.0001	0.0100	0.000	0.000	0.000
Operator	0.0000	0.0000	0.000	0.000	0.000
Operator*Part	0.0000	0.0000	0.000	0.000	0.000
Operator*Part*Part	0.0000	0.0000	0.000	0.000	0.000
Total	0.0001	0.0100	0.000	0.000	0.000

GR&R = 3.83%
NDC = 31

Device Accuracy Verify



Area GR&R=4.17% (Qualify) Area GR&R=3.97% (Qualify)

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Gage R&R分析表 (ANOVA)

机器名称 Name	SP 1%	机器编号 Serial No.	SP120000	日期 Date	2022/12/18						
样品 Sample	特性参数		Area	单位 Unit	%						
A	零件										
	1	98.1	101.7	104	103.5	99.3	101.2	99.9	98.1	100.2	104
	2	98.1	101.7	104.2	103.5	99.4	101.3	99.9	97.7	100.8	104.3
	3	98.3	101.7	103.7	103.8	99.2	101.2	99.2	98	100.2	104.1
	平均值	98.17	101.71	103.67	103.69	99.31	101.27	99.97	97.83	100.27	104.13
	标准差	0.29	0.06	0.39	0.38	0.29	0.39	0.45	0.39	0.39	0.39
	变异系数	0.33	0.06	0.33	0.36	0.29	0.39	0.46	0.41	0.39	0.39
	总变异平方和	0.86	0.01	0.17	0.13	0.03	0.09	0.04	0.04	0.01	0.04
	1	98.4	101.7	104.1	103.2	99.1	101.3	99.6	98	100.7	104.2
	2	98.4	101.4	103.8	103.0	99.3	101.5	99.2	98.1	100.0	104.4
3	98.3	101.4	103.8	103.3	99.2	101.4	99.1	98.2	100.1	104.5	
平均值	98.37	101.51	103.91	103.17	99.27	101.41	99.31	98.11	100.07	104.37	
标准差	0.33	0.06	0.39	0.36	0.31	0.39	0.45	0.39	0.39	0.39	
变异系数	0.33	0.06	0.39	0.36	0.31	0.39	0.46	0.41	0.39	0.39	
总变异平方和	0.86	0.01	0.17	0.13	0.03	0.09	0.04	0.04	0.01	0.04	
零件变异平方和	0.86	0.01	0.17	0.13	0.03	0.09	0.04	0.04	0.01	0.04	
1	98.5	101.7	104.1	103.4	99.4	101.4	99.3	98.1	100.2	104.3	
2	98.4	101.6	104	103.8	99	101.2	99.2	97.9	100.0	104.4	
3	98.3	101.4	104.3	103.4	98.5	101.4	99.2	97.8	100.2	104.4	
平均值	98.41	101.57	104.21	103.54	99.31	101.34	99.23	97.93	100.07	104.41	
标准差	0.31	0.06	0.39	0.36	0.31	0.39	0.45	0.39	0.39	0.39	
变异系数	0.31	0.06	0.39	0.36	0.31	0.39	0.46	0.41	0.39	0.39	
总变异平方和	0.86	0.01	0.17	0.13	0.03	0.09	0.04	0.04	0.01	0.04	
零件变异平方和	0.86	0.01	0.17	0.13	0.03	0.09	0.04	0.04	0.01	0.04	

Gage R&R Report

MSD	MSA	MSL	MSU
MSD = (MSL - MSU) / 2 = 0.0027	MSA = (MSL - MSU) / 3 = 0.0018	MSL = 104.13	MSU = 98.01
MSL - MSU = 6.12	(MSL - MSU) / 3 = 2.04	(MSL - MSU) / 2 = 3.06	(MSL - MSU) / 3 = 2.04

ANOVA table

Source	SS	DF	MS	F
Part	0.86	2	0.43	20.75
Operator	0.01	2	0.00	0.07
Operator*Part	0.00	4	0.00	0.00
Repeatability	0.86	6	0.14	6.88
Total	0.87	8		

方差与标准差的估计
Estimate of Various and Std Dev.

Source	方差估计 (Variance)	标准差的估计 (Std. Dev.)	% Contribution
MSD	0.0018	0.0424	0.21%
Repeatability	0.0014	0.0374	0.16%
Operator	0.0001	0.0100	0.01%
Operator*Part	0.0000	0.0000	0.00%
Part	0.0016	0.0400	0.18%
Total	0.0035	0.0592	100.00%

设备: Gage system 0.1 量具系统 0.1 MS = 0

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Gage R&R分析表 (ANOVA)

机器名称 Name	SP 1%	机器编号 Serial No.	SP120000	日期 Date	2022/12/18					
样品 Sample	特性参数		Area	单位 Unit	%					
A	零件									
	1	117.4	123.4	126.1	122	126.5	126	125.4	126.8	124.5
	2	117.5	123.7	130	122.7	126.2	126.6	125.4	126.7	124.6
	3	117.8	123.9	126.1	123.6	126.1	126	125.6	126.5	124.5
	平均值	117.57	123.67	127.43	122.77	126.27	126.37	125.87	126.57	124.67
	标准差	0.37	0.27	0.33	0.32	0.37	0.40	0.39	0.38	0.37
	变异系数	0.32	0.22	0.26	0.26	0.29	0.31	0.31	0.30	0.30
	总变异平方和	0.83	0.01	0.09	0.09	0.09	0.09	0.09	0.09	0.09
	1	117.8	123.9	126.4	122.7	126.9	126.1	126.1	126.7	124.5
	2	118	123.5	126.7	122.9	126.2	126.7	126.6	126.9	124.7
3	118.2	123.5	126.1	122.8	125.8	126.5	125.5	126.6	124.5	
平均值	118.01	123.63	126.37	122.81	126.31	126.31	126.31	126.31	124.57	
标准差	0.36	0.26	0.32	0.31	0.36	0.40	0.39	0.38	0.36	
变异系数	0.30	0.21	0.25	0.25	0.28	0.30	0.30	0.30	0.29	
总变异平方和	0.83	0.01	0.09	0.09	0.09	0.09	0.09	0.09	0.09	
零件变异平方和	0.83	0.01	0.09	0.09	0.09	0.09	0.09	0.09	0.09	
1	118.1	123.4	126.1	122.9	126.4	126.6	126	126.7	124.5	
2	117.9	123.4	126.4	123.6	125.7	125.9	125.5	126.2	124.6	
3	117.6	123.4	126.4	122.9	125.9	125.5	125.7	126.1	124.7	
平均值	117.87	123.41	126.31	122.91	126.31	126.31	126.31	126.31	124.57	
标准差	0.36	0.26	0.32	0.31	0.36	0.40	0.39	0.38	0.36	
变异系数	0.30	0.21	0.25	0.25	0.28	0.30	0.30	0.30	0.29	
总变异平方和	0.83	0.01	0.09	0.09	0.09	0.09	0.09	0.09	0.09	
零件变异平方和	0.83	0.01	0.09	0.09	0.09	0.09	0.09	0.09	0.09	

Gage R&R Report

MSD	MSA	MSL	MSU
MSD = (MSL - MSU) / 2 = 0.0018	MSA = (MSL - MSU) / 3 = 0.0012	MSL = 126.57	MSU = 117.43
MSL - MSU = 9.14	(MSL - MSU) / 3 = 3.05	(MSL - MSU) / 2 = 4.57	(MSL - MSU) / 3 = 3.05

ANOVA table

Source	SS	DF	MS	F
Part	0.83	2	0.41	20.75
Operator	0.01	2	0.00	0.07
Operator*Part	0.00	4	0.00	0.00
Repeatability	0.83	6	0.14	6.88
Total	0.84	8		

方差与标准差的估计
Estimate of Various and Std Dev.

Source	方差估计 (Variance)	标准差的估计 (Std. Dev.)	% Contribution
MSD	0.0012	0.0346	0.15%
Repeatability	0.0009	0.0300	0.11%
Operator	0.0001	0.0100	0.01%
Operator*Part	0.0000	0.0000	0.00%
Part	0.0003	0.0173	0.04%
Total	0.0025	0.0500	100.00%

设备: Gage system 0.1 量具系统 0.1 MS = 0