

汇专科技集团

CONPROFE Technology Group



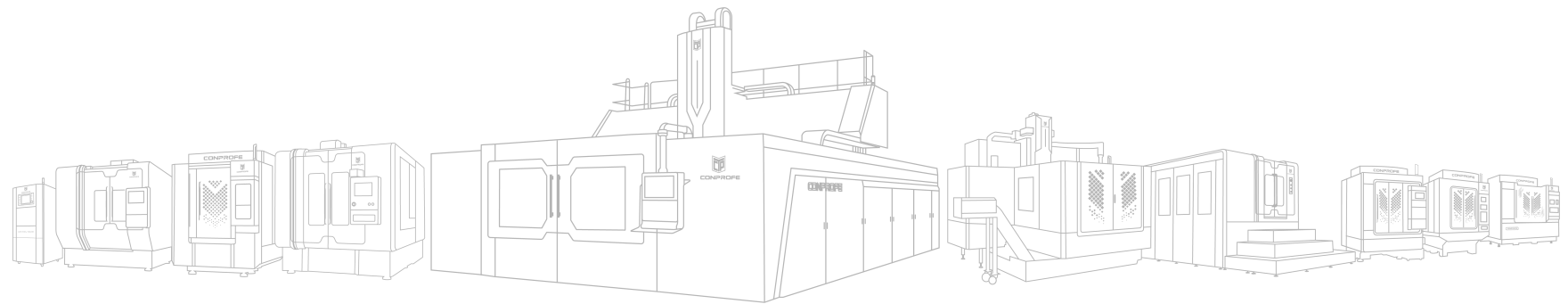
汇全球资源 专行业领先

Converging of Global Resources, Professional as Industry Leader

Case Sharing | SCP5000 Probe Card

Conprofe Technology Group Co., Ltd.

Updated Date / Version: 2025.08.31 / VE2.5



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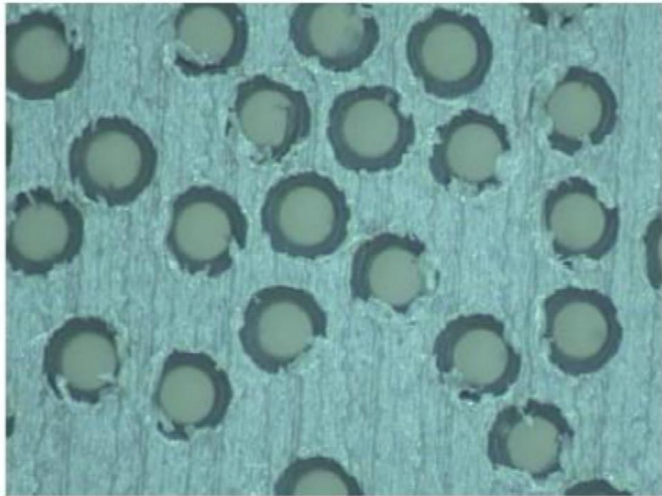
01

Requirements

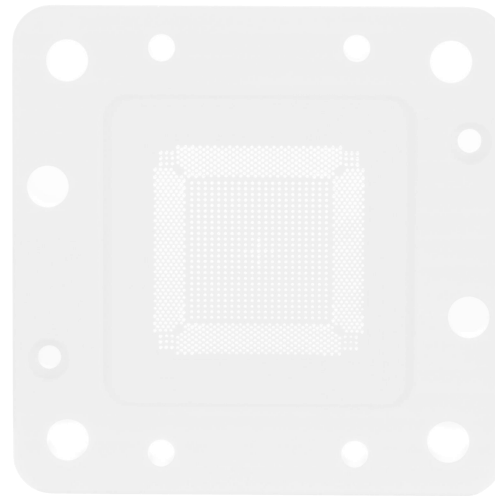


1.1 Test Requirements | Workpiece Information

- Workpiece: Probe Card
- Material: DuPont Engineering Plastic | VESPEL SCP5000
- Objective: **To solve the severe burring after CNC processing**
- Burrs appearance:



✗ NG





1.2 Test Requirements | Hole Tolerances



Machining Feature	Diameter Tolerance	Roundness	Positional Tolerance	Concentricity	Depth
D0.22 Through Hole	±0.01mm	≤0.01mm	≤0.03mm	/	/
D0.22x0.7 □ D0.32x1.89 Step Hole	±0.01mm	≤0.01mm	≤0.03mm	≤0.03mm	/
Chamfer	/	/	/	/	+0.07/0

02

Solution



2.1 Solution | Ultrasonic Machining Solution

- Ultrasonic Engraving and Milling Center UEM-500
- HSK-E25 Ultrasonic Spindle
- Z-Axis driven by Linear Motor
- Carbide Tools



Ultrasonic Engraving and Milling Center
UEM-500



Ultrasonic Generator

UEM-500 Specification:

- Travel | X:500mm; Y:400mm; Z:300mm
- Spindel Max. Speed(Short-Duration) | 50,000rpm
- Spindel Max. Speed(Long-Duration) | 40,000rpm
- Total Weight (incl. Accessories) | 3,500kg



2.2 Solution | CNC0 Profile Milling Parameters



No.	Tool Spec.	Tool Type	Machining Method	Cooling Method	a_p (mm)	a_e (mm)	Q	S (rpm)	F (mm/min)	Ultrasonic
CNC0-1	D6*8	Tungsten Carbide Flat End Mill	Milling	Oil	/	2	/	12,000	500	On



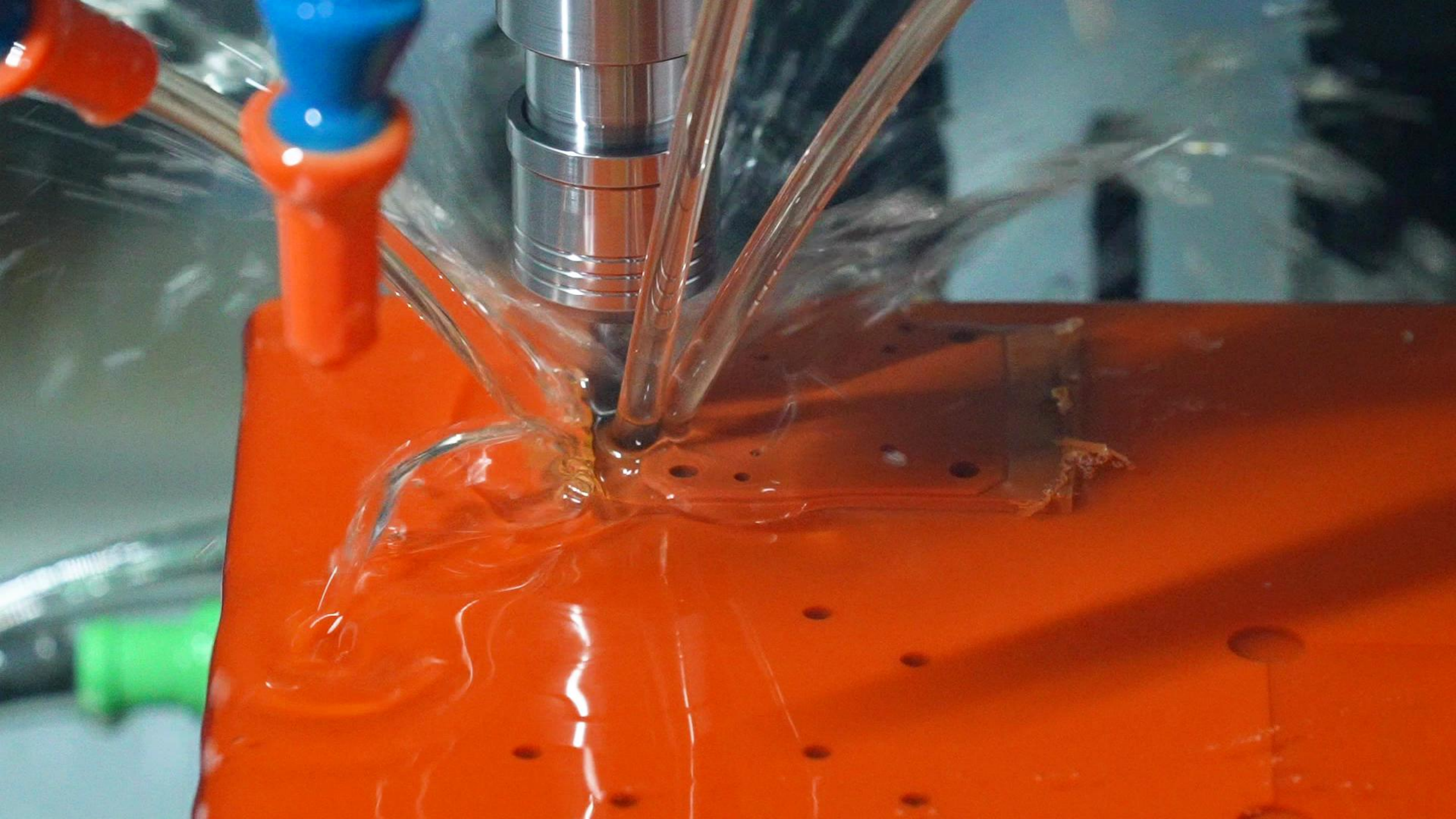
2.3 Solution | CNC1 Milling & Drilling Parameters

No.	Tool Spec.	Tool Type	Machining Method	Cooling Method	a _p (mm)	a _e (mm)	Q	S (rpm)	F (mm/min)	Ultrasonic
CNC1-1	D6*8	Tungsten Carbide Flat End Mill	Milling	Oil	/	2	/	12,000	500	On
CNC1-2	D3*90°	Tungsten Carbide Chamfer Tool	Spot Drilling	Oil	/	/	/	3,000	100	On
CNC1-3	D1.5*4F	Tungsten Carbide Flat End Mill	Milling	Oil	0.05	/	/	8,000	500	On
CNC1-4	D1.5*4F	Tungsten Carbide Flat End Mill	Milling	Oil	/	0.075	/	8,000	500	On
CNC1-5	D3.2*118°	Tungsten Carbide Drill	Peck Drilling	Oil	/	/	0.5	3,000	100	On
CNC1-6	D3*90°	Tungsten Carbide Chamfer Tool	Milling	Oil	/	/	/	3,000	50	On
CNC1-7	D0.8*90°	Tungsten Carbide Chamfer Tool	Spot Drilling	Oil	/	/	/	3,000	50	On
CNC1-8	D2.8*60°	Tungsten Carbide Chamfer Tool	Spot Drilling	Oil	/	/	/	3,000	100	On
CNC1-9	D6*8	Tungsten Carbide Flat End Mill	Milling	Oil	0.3	/	/	12,000	500	On
CNC1-10	D3*90°	Tungsten Carbide Chamfer Tool	Milling	Oil	/	/	/	3,000	100	On
CNC1-11	D6*8	Tungsten Carbide Flat End Mill	Milling	Oil	0.3	/	/	12,000	500	On



2.4 Solution | CNC2 Milling & Drilling Parameters

No.	Tool Spec.	Tool Type	Machining Method	Cooling Method	a_p (mm)	a_e (mm)	Q	S (rpm)	F (mm/min)	Ultrasonic
CNC2-1	D6*8	Tungsten Carbide Flat End Mill	Milling	Oil	/	2	/	12,000	500	On
CNC2-2	D1.5*4F	Tungsten Carbide Flat End Mill	Milling	Oil	/	0.75	/	8,000	500	On
CNC2-3	D1.5*4F	Tungsten Carbide Flat End Mill	Milling	Oil	0.05	/	/	8,000	500	On
CNC2-4	D1.5*4F	Tungsten Carbide Flat End Mill	Milling	Oil	/	0.075	/	8,000	500	On
CNC2-5	D3*90°	Tungsten Carbide Chamfer Tool	Spot Drilling	Oil	/	/	/	3,000	100	On
CNC2-6	D3*90°	Tungsten Carbide Chamfer Tool	Milling	Oil	/	/	/	3,000	100	On
CNC2-7	D0.8*90°	Tungsten Carbide Chamfer Tool	Spot Drilling	Oil	/	/	/	3,000	50	On
CNC2-8	D0.8*90°	Tungsten Carbide Chamfer Tool	Spot Drilling	Oil	/	/	/	3,000	50	On
CNC2-9	D0.31*130°	Tungsten Carbide Drill	Peck Drilling	Oil	/	/	0.05	18,000	800	On
CNC2-10	D0.22*118°	Tungsten Carbide Drill	Peck Drilling	Oil	/	/	0.05	18,000	800	On



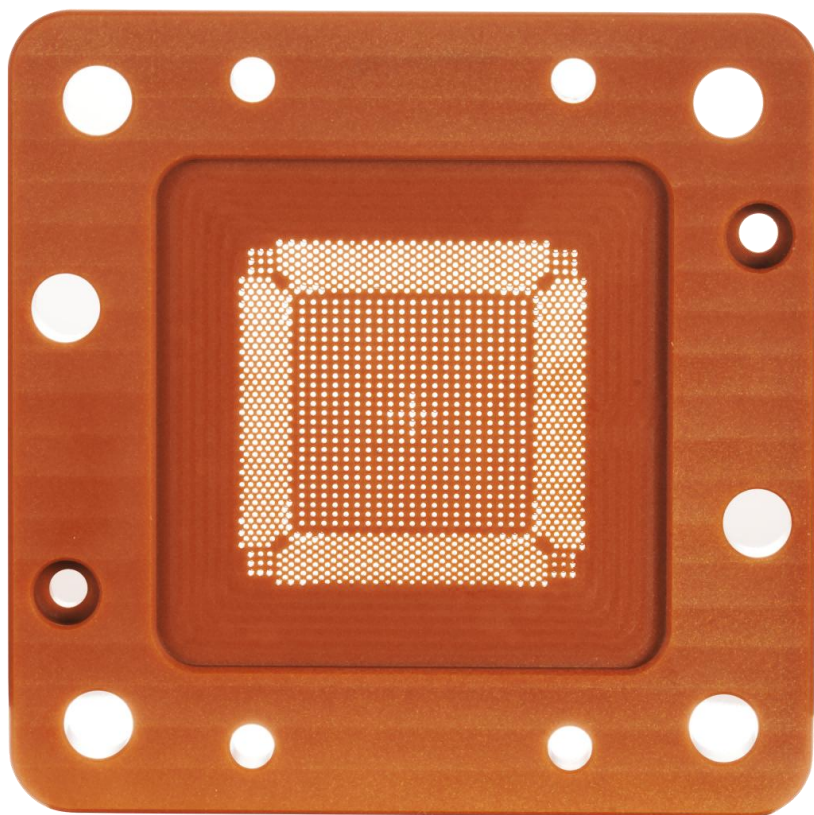
03

Results

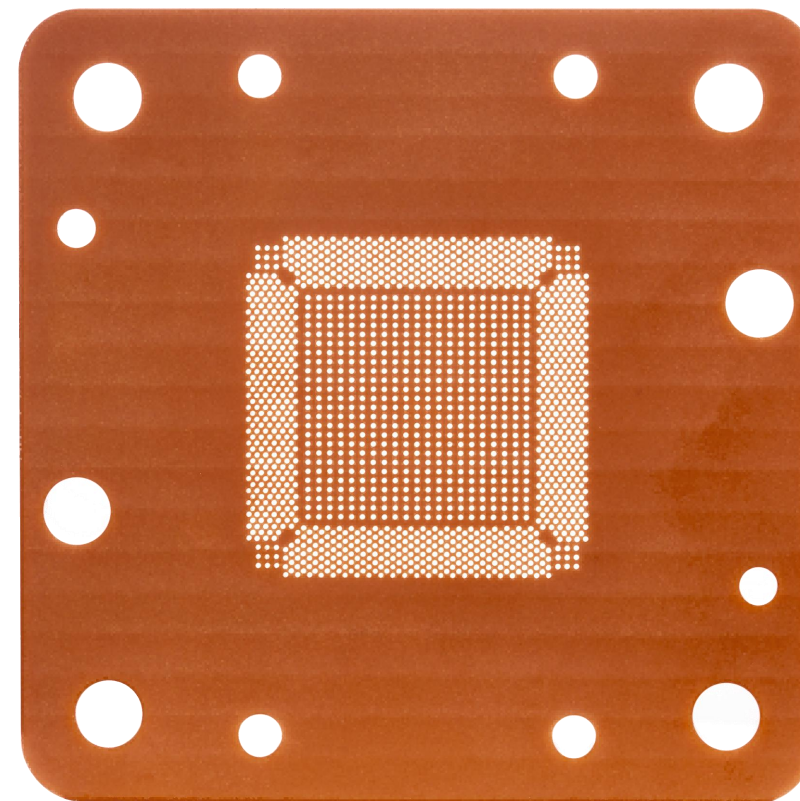


3.1 Results | Finished Product

Front View



Back View





3.2 Results | Measuring Instrument & Method

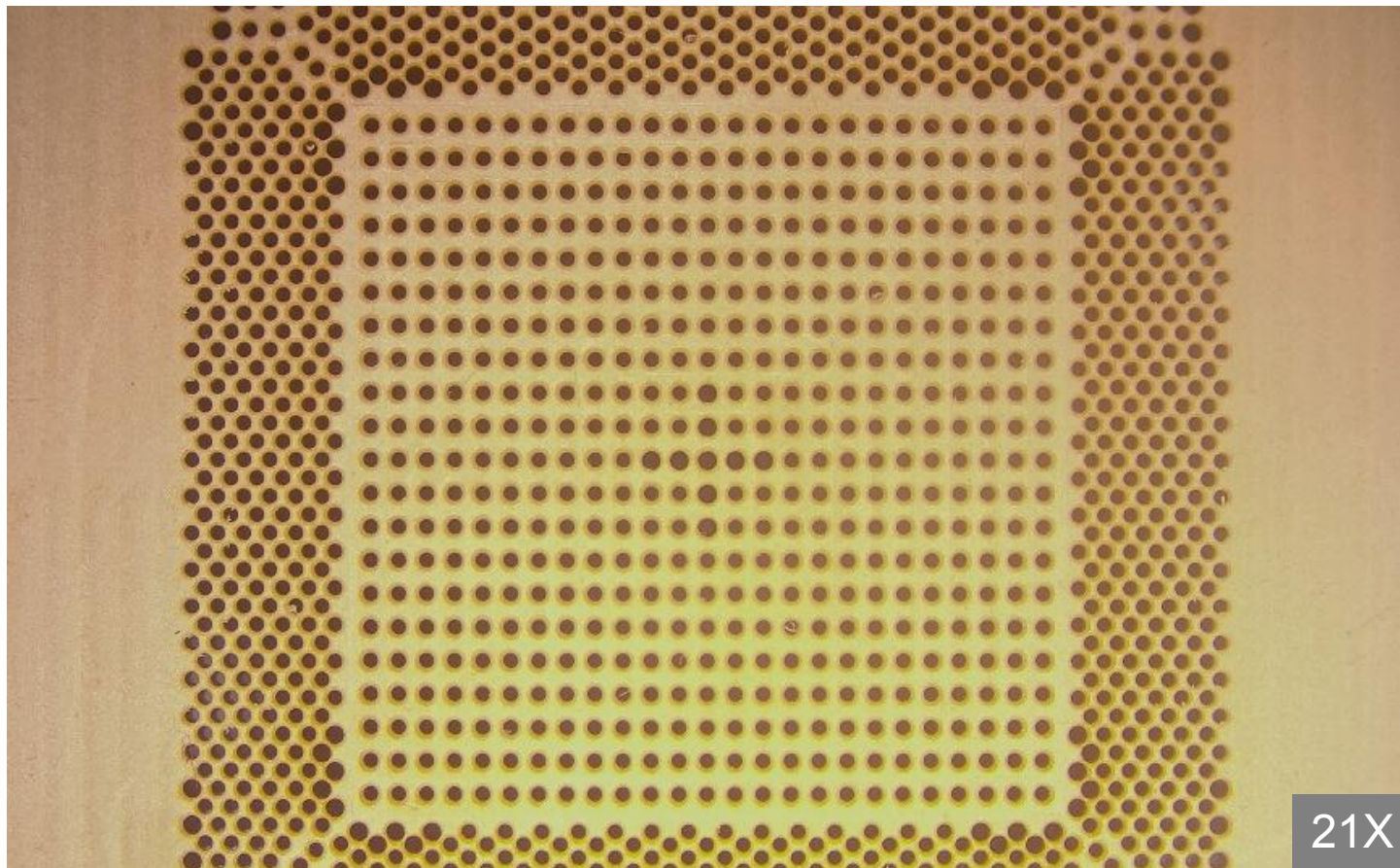
- Hexagon Optical CLASSIC VMM
- Magnified inspection of surface quality and burr condition





3.3 Results | Front View at 21x Magnification

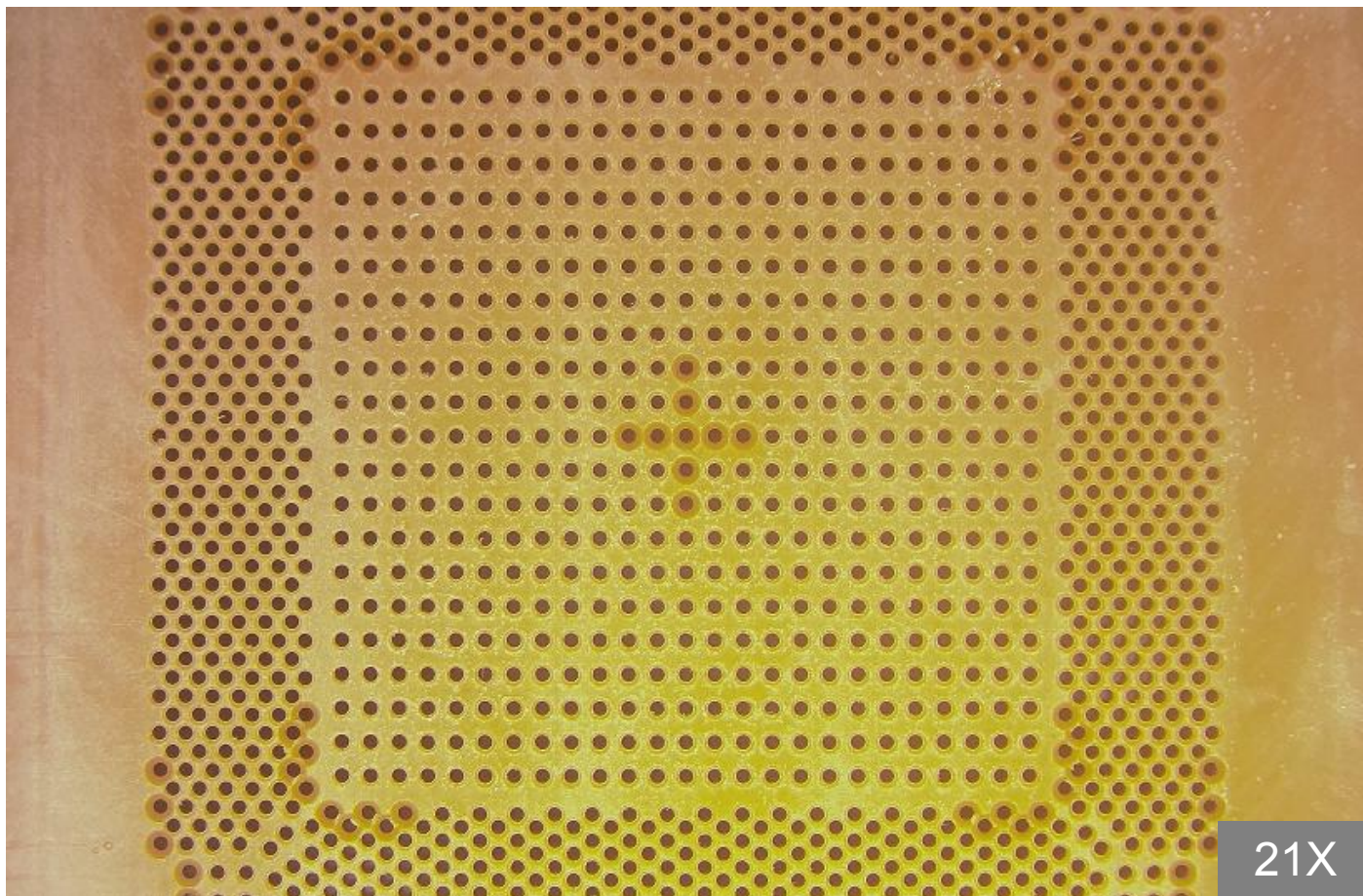
- All holes in the DuPont SCP5000 workpiece were inspected.
- Burrs were identified in **3%** of the holes on the front view.





3.3 Results | Back View at 21x Magnification

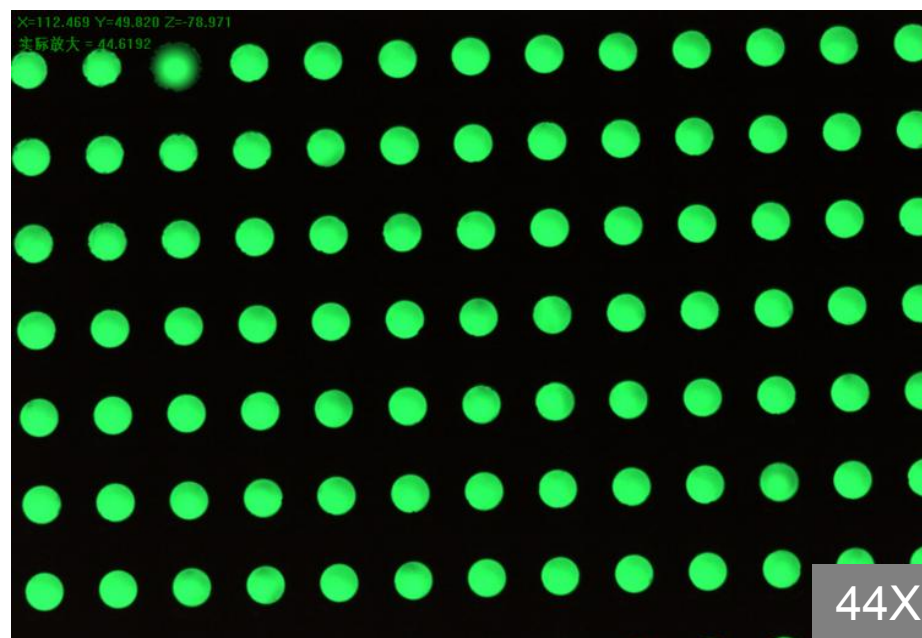
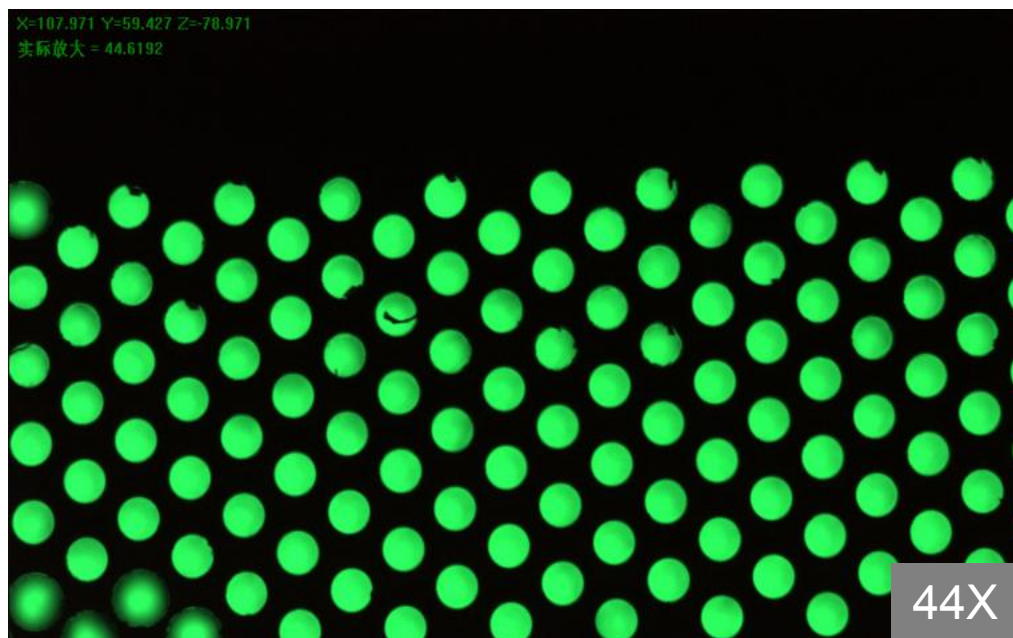
- All holes in the DuPont SCP5000 workpiece were inspected.
- Burrs were identified in **1%** of the holes on the back view.





3.4 Results | Sectional **Front View** at **44x** Magnification

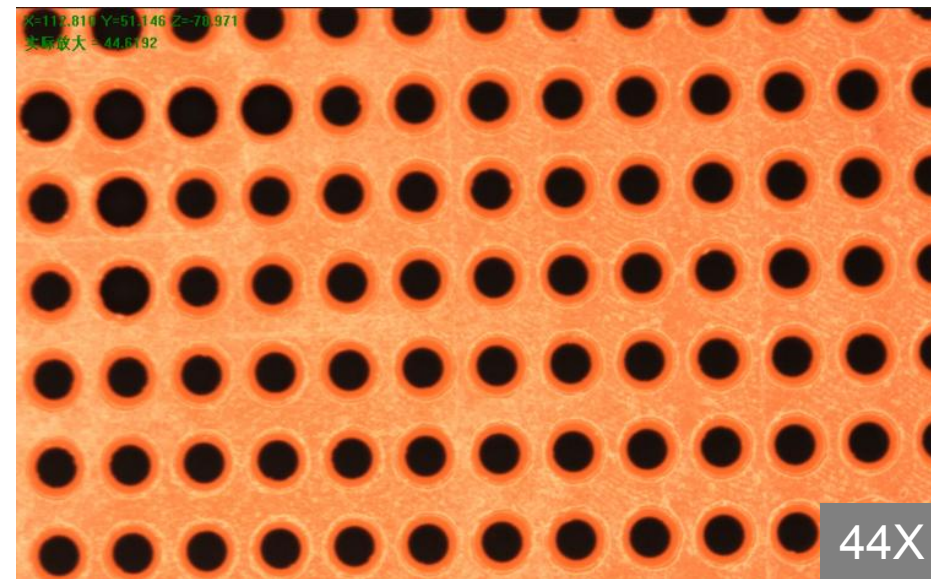
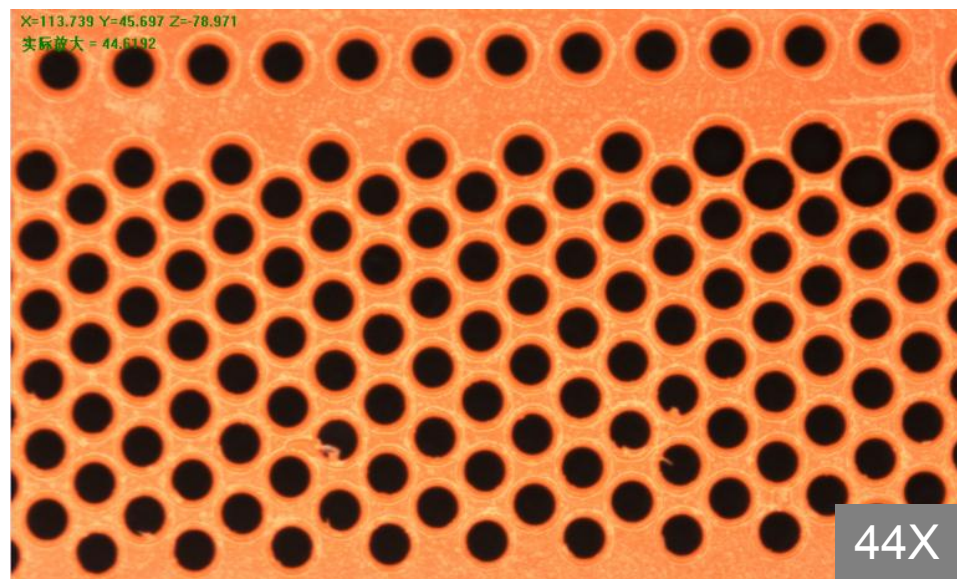
Captured using digital magnifier with backlighting





3.4 Results | Sectional **Back View** at **44x** Magnification

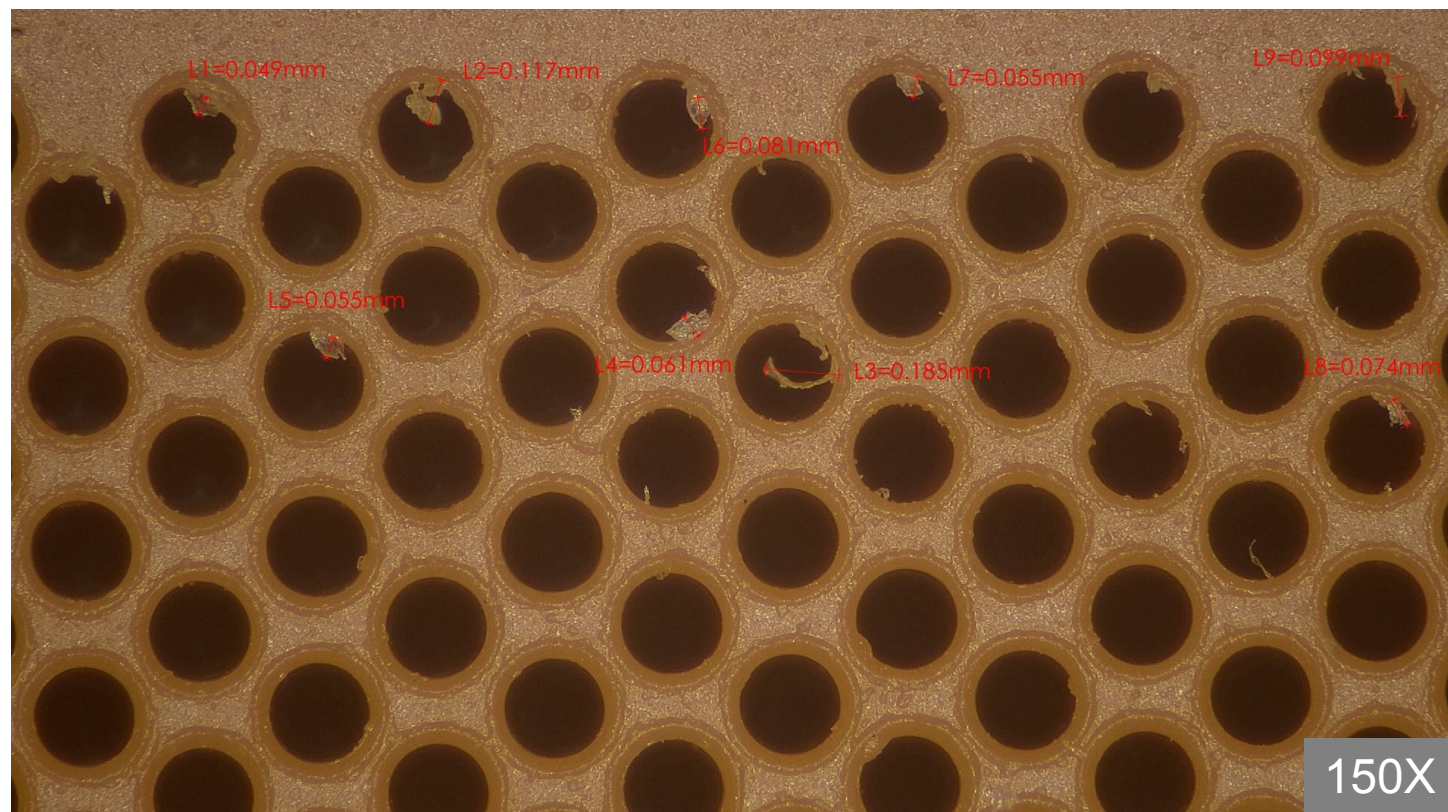
Captured using digital magnifier without backlighting





3.5 Results | Sectional **Front View** at **150x** Magnification (1/2)

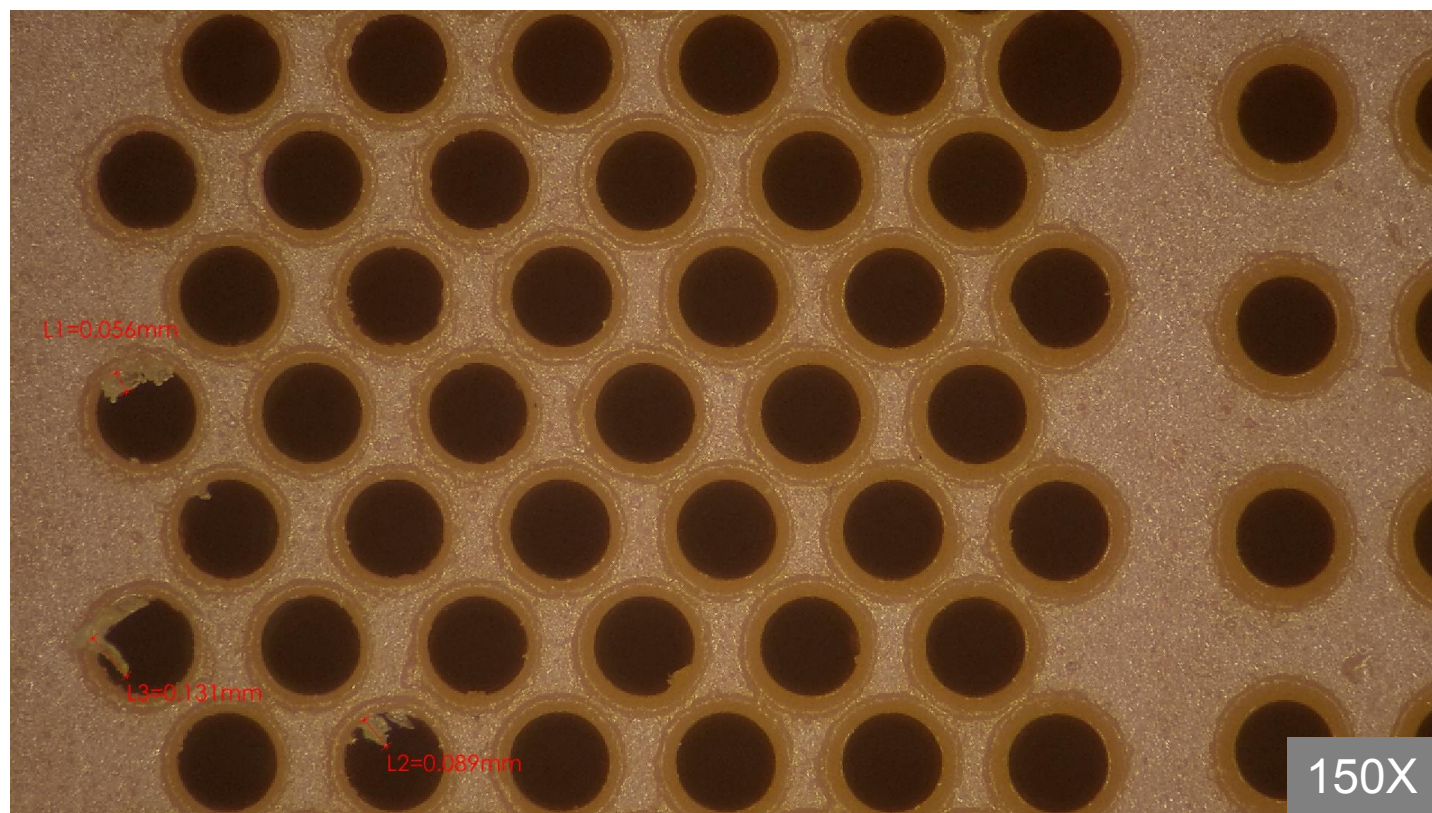
Inspection **Area 1** | Burr Sizes: 0.049mm~0.185mm





3.5 Results | Sectional **Front View** at **150x** Magnification (2/2)

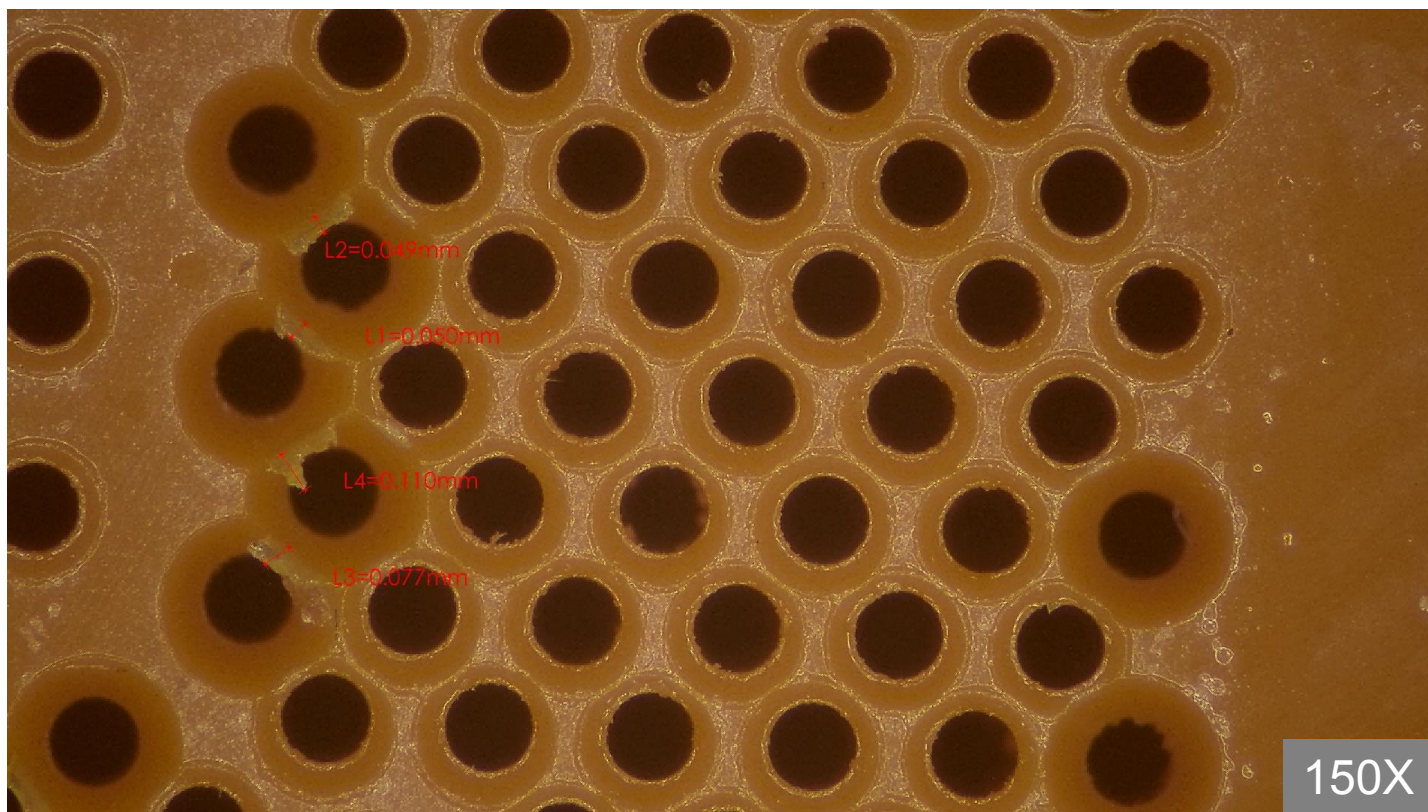
Inspection **Area 2** | Burr Sizes: 0.056mm~0.131mm





3.5 Results | Sectional Back View at 150x Magnification (1/2)

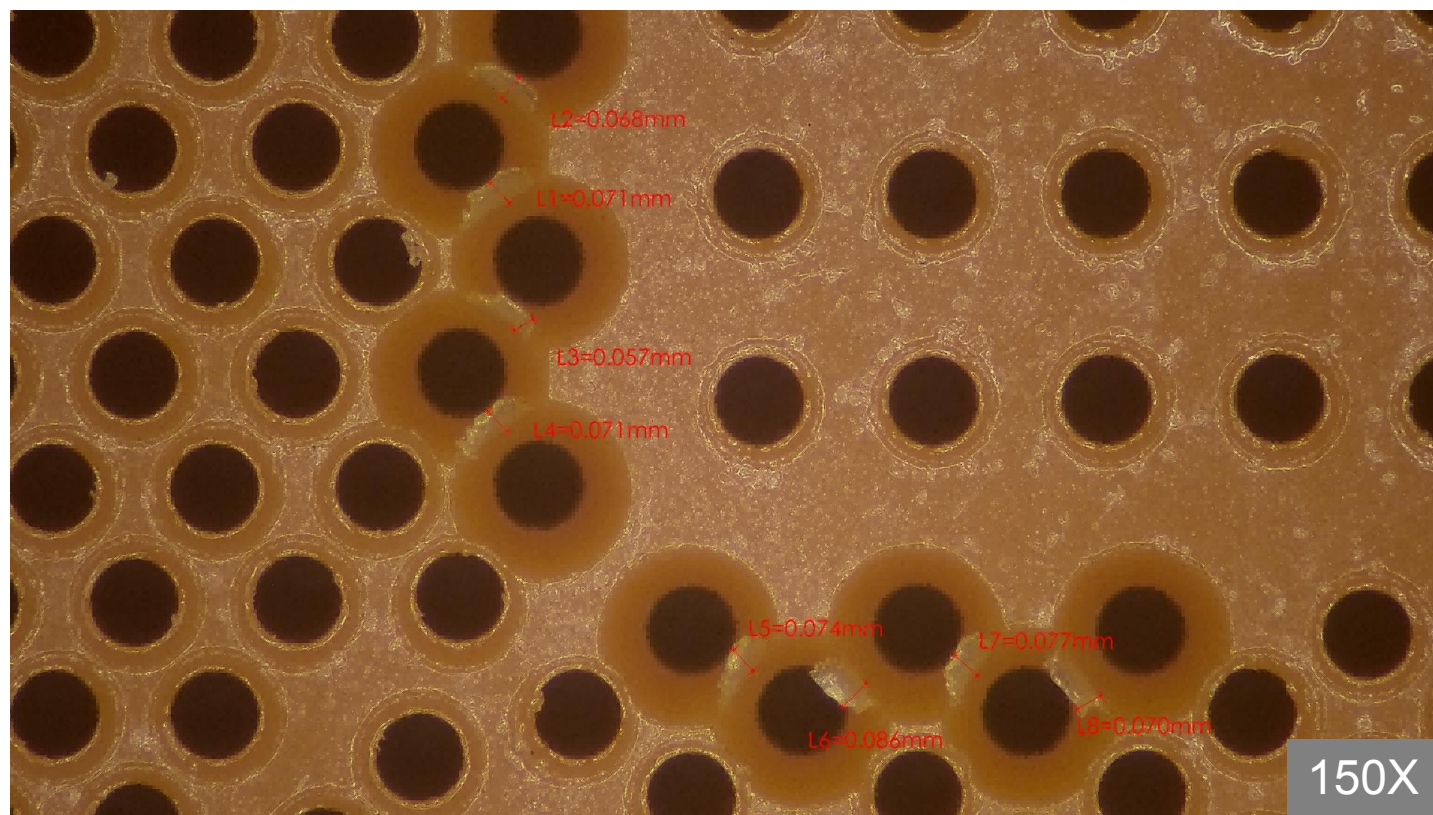
Inspection Area 3 | Burr Sizes: 0.049mm~0.110mm





3.5 Results | Sectional **Back View** at **150x** Magnification (2/2)

Inspection **Area 4** | Burr Sizes: 0.057mm~0.086mm





3.6 Results | All Inspected Dimensions within Tolerance

Inspection Data - 84 Through Holes (D0.22mmx2.59mm)

1st~42th Holes

No.	Diameter 0.22±0.01 mm	Roundness ≤0.01mm	Standard Value		Measured Value		Positional Tolerance ≤0.03mm
			X-Axis	Y-Axis	X-Axis	Y-Axis	
1	0.225	0.004	-23.570	-8.355	-23.577	-8.349	0.018
2	0.223	0.004	-22.757	-8.355	-22.760	-8.345	0.021
3	0.222	0.005	-23.163	-7.785	-23.169	-7.777	0.020
4	0.226	0.004	-21.944	-8.355	-21.947	-8.345	0.021
5	0.226	0.004	-22.351	-7.785	-22.355	-7.776	0.020
6	0.224	0.004	-21.538	-7.785	-21.541	-7.776	0.019
7	0.227	0.004	-15.750	0.117	-15.755	0.123	0.016
8	0.228	0.004	-15.750	-1.103	-15.753	-1.095	0.017
9	0.225	0.004	-15.465	-0.087	-15.470	-0.081	0.016
10	0.222	0.005	-15.465	-0.899	-15.468	-0.890	0.019
11	0.223	0.004	-15.180	-0.696	-15.184	-0.686	0.022
12	0.224	0.004	-15.180	-0.290	-15.185	-0.281	0.021
13	0.225	0.003	-8.743	-8.925	-8.747	-8.918	0.016
14	0.223	0.005	-9.149	-7.215	-9.154	-7.208	0.017
15	0.226	0.005	-9.149	-9.495	-9.154	-9.487	0.019
16	0.226	0.004	-8.743	-7.785	-8.748	-7.778	0.017
17	0.225	0.004	-8.337	-8.355	-8.341	-8.349	0.014
18	0.226	0.004	-16.890	-14.304	-16.895	-14.298	0.016
19	0.225	0.004	-15.750	-15.117	-15.757	-15.113	0.016
20	0.226	0.005	-14.610	-14.304	-14.616	-14.295	0.022
21	0.226	0.004	-16.320	-14.710	-16.326	-14.704	0.017
22	0.223	0.005	-15.180	-14.710	-15.186	-14.703	0.018
23	0.228	0.004	-19.238	-4.380	-19.237	-4.377	0.006
24	0.224	0.005	-17.494	-4.900	-17.492	-4.888	0.024
25	0.223	0.004	-18.802	-5.420	-18.800	-5.415	0.011
26	0.222	0.003	-17.930	-7.500	-17.922	-7.495	0.019
27	0.222	0.003	-20.546	-5.940	-20.541	-5.938	0.011
28	0.226	0.003	-20.546	-8.540	-20.541	-8.539	0.010
29	0.224	0.005	-19.238	-6.980	-19.233	-6.977	0.012
30	0.238	0.003	-17.058	-5.940	-17.055	-5.937	0.008
31	0.227	0.004	-15.750	-2.300	-15.748	-2.288	0.024
32	0.230	0.005	-16.186	-3.340	-16.180	-3.344	0.014
33	0.223	0.004	-14.878	-2.300	-14.874	-2.302	0.009
34	0.221	0.004	-15.314	-3.860	-15.319	-3.867	0.017
35	0.229	0.004	-16.186	-4.380	-16.180	-4.386	0.017
36	0.232	0.005	-11.390	-3.340	-11.392	-3.344	0.009
37	0.221	0.004	-12.262	-3.860	-12.260	-3.867	0.015
38	0.225	0.004	-13.134	-3.340	-13.137	-3.348	0.017
39	0.226	0.004	-13.570	-4.380	-13.574	-4.380	0.008
40	0.225	0.004	-11.390	-4.900	-11.398	-4.904	0.018
41	0.226	0.004	-12.698	-5.420	-12.690	-5.420	0.016
42	0.226	0.004	-14.878	-5.940	-14.874	-5.942	0.009

43rd~84th Holes

No.	Diameter 0.22±0.01 mm	Roundness ≤0.01mm	Standard Value		Measured Value		Positional Tolerance ≤0.03mm
			X-Axis	Y-Axis	X-Axis	Y-Axis	
43	0.226	0.004	-15.314	-6.980	-15.314	-6.980	0.000
44	0.223	0.004	-13.570	-6.980	-13.577	-6.980	0.014
45	0.228	0.004	-13.570	-8.020	-13.578	-8.023	0.017
46	0.225	0.003	-16.622	-8.020	-16.624	-8.027	0.015
47	0.234	0.005	-18.366	-10.100	-18.368	-10.107	0.015
48	0.231	0.004	-16.622	-10.100	-16.621	-10.109	0.018
49	0.229	0.004	-15.314	-10.100	-15.311	-10.108	0.017
50	0.223	0.005	-18.366	-11.140	-18.362	-11.147	0.016
51	0.224	0.004	-19.238	-11.140	-19.237	-11.148	0.016
52	0.223	0.003	-16.186	-11.140	-16.181	-11.147	0.017
53	0.233	0.004	-12.262	-9.580	-12.261	-9.588	0.016
54	0.227	0.003	-10.954	-9.580	-10.957	-9.584	0.010
55	0.228	0.005	-11.390	-10.620	-11.397	-10.623	0.015
56	0.229	0.005	-13.134	-10.100	-13.134	-10.109	0.018
57	0.231	0.004	-14.006	-10.620	-14.006	-10.628	0.016
58	0.225	0.003	-14.006	-9.060	-14.000	-9.066	0.017
59	0.224	0.006	-12.262	-11.140	-12.262	-11.149	0.018
60	0.228	0.005	-13.134	-11.660	-13.131	-11.660	0.006
61	0.226	0.005	-11.390	-11.660	-11.397	-11.660	0.014
62	0.222	0.004	-10.518	-11.140	-10.518	-11.140	0.000
63	0.229	0.004	-12.262	-12.180	-12.262	-12.180	0.000
64	0.221	0.005	-13.134	-12.700	-13.137	-12.709	0.019
65	0.222	0.005	-11.390	-12.700	-11.398	-12.702	0.016
66	0.228	0.004	-12.045	-13.288	-12.045	-13.280	0.016
67	0.223	0.004	-13.470	-13.897	-13.477	-13.890	0.020
68	0.223	0.003	-14.895	-14.101	-14.895	-14.109	0.016
69	0.225	0.004	-14.895	-14.913	-14.890	-14.919	0.016
70	0.226	0.004	-12.615	-14.507	-12.610	-14.501	0.016
71	0.227	0.006	-15.750	-12.700	-15.754	-12.705	0.013
72	0.221	0.004	-17.058	-12.700	-17.058	-12.703	0.006
73	0.226	0.004	-19.674	-12.700	-19.671	-12.750	0.100
74	0.226	0.004	-18.366	-12.700	-18.361	-12.700	0.010
75	0.222	0.004	-20.546	-11.660	-20.547	-11.666	0.012
76	0.226	0.004	-20.110	-10.100	-20.115	-10.103	0.012
77	0.223	0.005	-18.802	-8.540	-18.800	-8.545	0.011
78	0.224	0.006	-16.186	-8.540	-16.181	-8.547	0.017
79	0.222	0.005	-18.366	-4.380	-18.360	-4.382	0.013
80	0.224	0.003	-20.800	-15.523	-20.809	-15.529	0.022
81	0.225	0.006	-20.595	-13.288	-20.590	-13.280	0.019
82	0.223	0.005	-21.538	-2.655	-21.531	-2.651	0.016
83	0.224	0.004	-10.620	-7.509	-10.627	-7.501	0.021
84	0.225	0.004	-7.727	-2.370	-7.721	-2.371	0.012



3.6 Results | All Inspected Dimensions within Tolerance

Inspection Data - 30 Stepped Holes (D0.22x0.7 □ D0.32x1.89)

D0.22mmx0.7mm								D0.31mmx1.89mm							
No.	Diameter 0.22±0.01 mm	Roundness ≤0.01mm	Standard Value		Measured Value		Positional Tolerance ≤0.03mm	Diameter 0.32+0/-0.02 mm	Roundness ≤0.01mm	Standard Value		Measured Value		Positional Tolerance ≤0.03mm	Concentricity ≤0.03mm
			X-Axis	Y-Axis	X-Axis	Y-Axis				X-Axis	Y-Axis	X-Axis	Y-Axis		
1	0.217	0.005	-22.020	-15.523	-22.028	-15.532	0.024	0.303	0.004	-22.020	-15.523	-22.026	-15.526	0.013	0.013
2	0.220	0.005	-21.450	-15.523	-21.459	-15.533	0.027	0.303	0.005	-21.450	-15.523	-21.456	-15.525	0.013	0.017
3	0.219	0.005	-23.335	-15.085	-23.344	-15.096	0.028	0.300	0.005	-23.335	-15.085	-23.340	-15.087	0.011	0.020
4	0.219	0.005	-22.897	-15.085	-22.903	-15.092	0.018	0.302	0.005	-22.897	-15.085	-22.904	-15.086	0.014	0.012
5	0.223	0.005	-20.880	-13.491	-20.890	-13.495	0.022	0.303	0.005	-20.880	-13.491	-20.886	-13.493	0.013	0.009
6	0.222	0.005	-21.165	-13.288	-21.172	-13.297	0.023	0.303	0.004	-21.165	-13.288	-21.171	-13.289	0.012	0.016
7	0.221	0.004	-23.773	-1.800	-23.781	-1.811	0.027	0.300	0.005	-23.773	-1.800	-23.777	-1.804	0.011	0.016
8	0.221	0.004	-23.773	-1.230	-23.780	-1.241	0.026	0.301	0.005	-23.773	-1.230	-23.776	-1.234	0.010	0.016
9	0.216	0.005	-22.020	0.523	-22.024	0.517	0.014	0.301	0.005	-22.020	0.523	-22.022	0.520	0.007	0.007
10	0.215	0.005	-21.450	0.523	-21.456	0.518	0.016	0.301	0.005	-21.450	0.523	-21.453	0.519	0.010	0.006
11	0.222	0.005	-21.165	-1.712	-21.168	-1.724	0.025	0.301	0.004	-21.165	-1.712	-21.169	-1.714	0.009	0.020
12	0.223	0.005	-20.880	-1.509	-20.887	-1.520	0.026	0.302	0.005	-20.880	-1.509	-20.884	-1.510	0.008	0.021
13	0.215	0.005	-10.050	0.523	-10.052	0.514	0.018	0.300	0.005	-10.050	0.523	-10.054	0.519	0.011	0.011
14	0.214	0.005	-9.480	0.523	-9.484	0.511	0.025	0.301	0.005	-9.480	0.523	-9.483	0.518	0.012	0.014
15	0.216	0.005	-8.165	-0.353	-8.164	-0.363	0.020	0.300	0.005	-8.165	-0.353	-8.169	-0.360	0.016	0.012
16	0.210	0.005	-8.165	-0.792	-8.168	-0.804	0.025	0.302	0.005	-8.165	-0.792	-8.168	-0.797	0.012	0.014
17	0.220	0.005	-10.335	-1.712	-10.341	-1.721	0.022	0.303	0.005	-10.335	-1.712	-10.338	-1.715	0.008	0.013
18	0.222	0.004	-9.962	-2.085	-9.971	-2.092	0.023	0.303	0.005	-9.962	-2.085	-9.967	-2.088	0.012	0.011
19	0.221	0.005	-9.042	-15.085	-9.046	-15.088	0.010	0.302	0.004	-9.042	-15.085	-9.048	-15.089	0.014	0.004
20	0.223	0.005	-8.165	-14.646	-8.166	-14.659	0.026	0.302	0.005	-8.165	-14.646	-8.170	-14.651	0.014	0.018
21	0.223	0.004	-9.759	-12.630	-9.761	-12.620	0.020	0.303	0.005	-9.759	-12.630	-9.766	-12.632	0.015	0.026
22	0.221	0.005	-7.727	-13.770	-7.730	-13.784	0.029	0.302	0.005	-7.727	-13.770	-7.732	-13.774	0.013	0.020
23	0.221	0.005	-10.620	-15.523	-10.626	-15.532	0.022	0.302	0.005	-10.620	-15.523	-10.627	-15.526	0.015	0.012
24	0.222	0.004	-10.620	-13.491	-10.627	-13.496	0.017	0.303	0.004	-10.620	-13.491	-10.627	-13.494	0.015	0.004
25	0.222	0.004	-15.750	-7.500	-15.757	-7.509	0.023	0.303	0.005	-15.750	-7.500	-15.755	-7.502	0.011	0.015
26	0.222	0.005	-16.186	-7.500	-16.192	-7.508	0.020	0.303	0.004	-16.186	-7.500	-16.190	-7.502	0.009	0.013
27	0.220	0.005	-15.750	-8.020	-15.755	-8.027	0.017	0.303	0.005	-15.750	-8.020	-15.755	-8.021	0.010	0.012
28	0.221	0.005	-14.878	-7.500	-14.885	-7.511	0.026	0.303	0.005	-14.878	-7.500	-14.883	-7.501	0.010	0.020
29	0.220	0.005	-15.750	-6.460	-15.760	-6.466	0.023	0.303	0.004	-15.750	-6.460	-15.756	-6.462	0.013	0.011
30	0.220	0.005	-16.622	-7.500	-16.626	-7.508	0.018	0.303	0.005	-16.622	-7.500	-16.622	-7.506	0.012	0.009



3.6 Results | All Inspected Dimensions within Tolerance



Inspection Data - 15 Hole Chamfer (Depth 0.16mm+0.07/0)

No.	Left	Top	Right	Bottom
1	0.184	0.197	0.220	0.208
2	0.201	0.196	0.210	0.215
3	0.201	0.220	0.199	0.178
4	0.175	0.187	0.210	0.220
5	0.168	0.197	0.191	0.220
6	0.208	0.196	0.166	0.185
7	0.178	0.187	0.211	0.185
8	0.170	0.215	0.168	0.220
9	0.215	0.194	0.187	0.170
10	0.210	0.197	0.171	0.175
11	0.203	0.191	0.185	0.189
12	0.203	0.204	0.177	0.196
13	0.191	0.197	0.185	0.194
14	0.180	0.210	0.208	0.178
15	0.175	0.197	0.204	0.175
AVRG	0.191	0.199	0.193	0.194
MAX	0.215	0.220	0.220	0.220
MIN	0.168	0.187	0.166	0.170



3.7 Results | Summary

Requirements	Results
1. Burring Improvement after CNC Processing	With all holes inspected: • Front Side: approx. 3% burr coverage, with a max. burr of 0.185mm; • Back Side: approx. 1% burr coverage, with a max. burr of 0.110mm.
2. Hole Quality within Tolerance	• 84 <u>D0.22mm Through Holes</u> and 30 <u>D0.22x0.7 □ D0.32x1.89 Stepped Holes</u> inspected: all hole diameter, positional accuracy, roundness and concentricity within tolerances; • 15 sets of <u>Chamfer Depth</u> measurement within tolerance.

04

Improvement Tests



4.1 Improvement Tests | Proposal: Solid PCD Micro Drill

➤ **Improvement Approach:**

To replace the original Tungsten Carbide drills with Conprofe Solid PCD Micro Drills to test burr reduction performance.

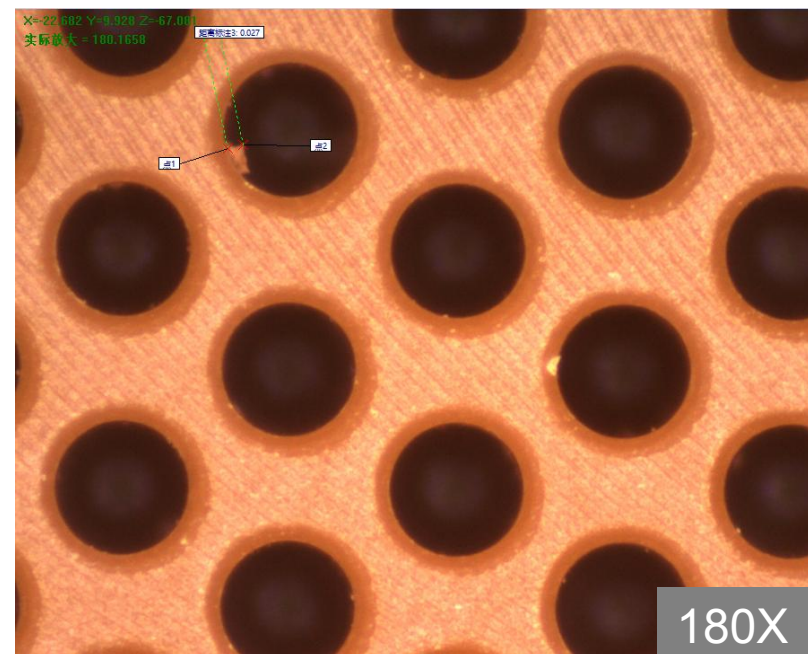
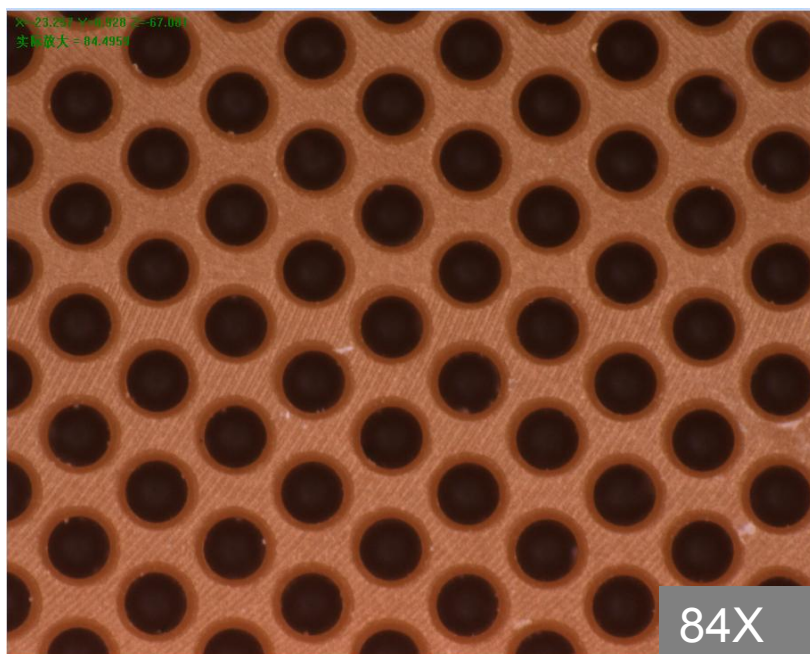
➤ **Test Results:**

Drilling tests on SCP5000 blanks with D0.31mm and D0.22mm **Solid PCD Micro Drills** showing **significant burr reduction** (see next pages).



4.2 Test with D0.22mm Solid PCD Micro Drill | Results

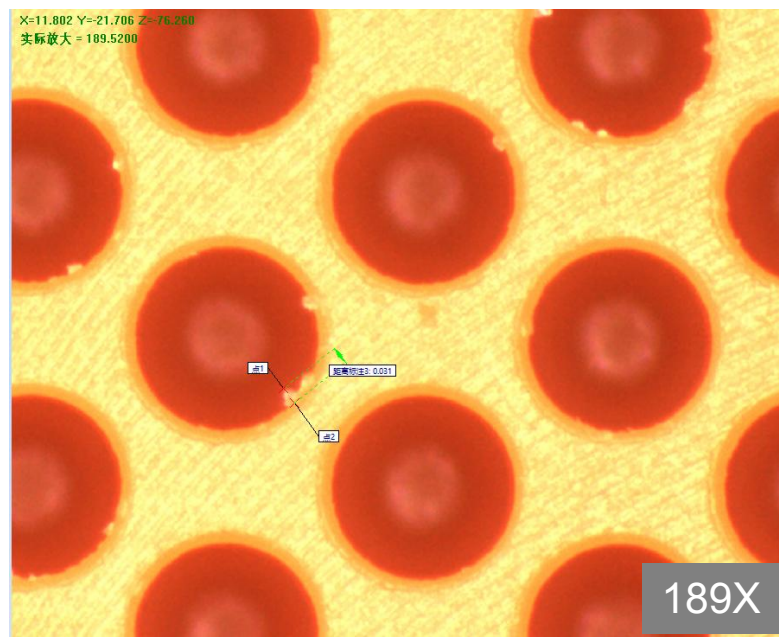
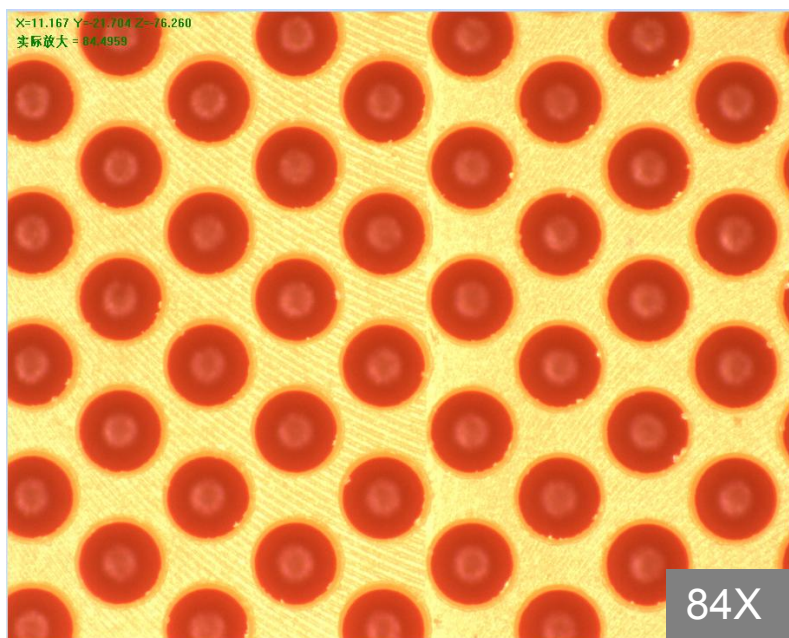
- Material: DuPont SCP5000
- Tool: D0.22mm Solid PCD Micro Drill
- Features: Drilling 1,900 D0.22mm*0.5mm Holes
- Results: **Max. Burr Size 0.027mm** (measured by Hexagon Optical VMM)





4.3 Test with D0.31mm Solid PCD Micro Drill | Results

- Material: DuPont SCP5000
- Tool: D0.31mm Solid PCD Micro Drill
- Features: Drilling 1,900 D0.31mm*0.5mm Holes
- Results: **Max. Burr Size 0.031mm** (measured by Hexagon Optical VMM)

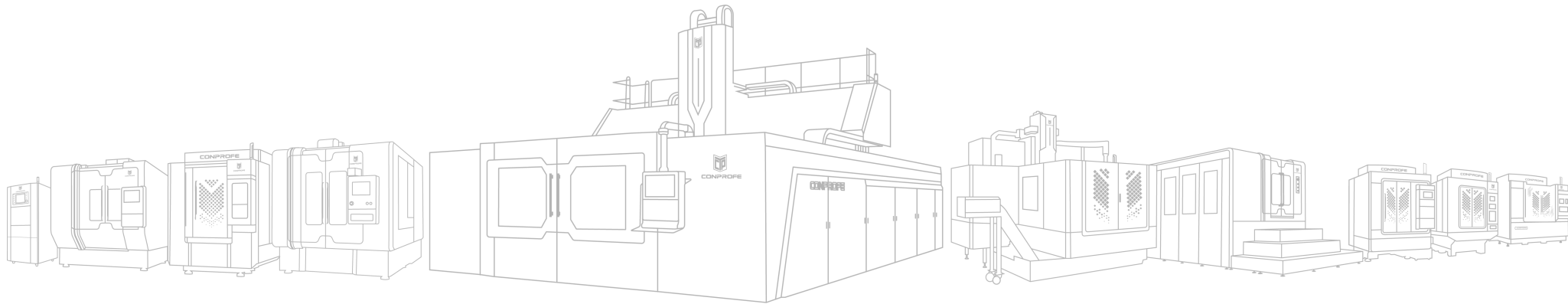


05

Spec Sheet

5 Spec Sheet | Ultrasonic Engraving and Milling Center UEM-500

No.	Item	Spec (Standard)	Unit
1	CNC Controller	Fanuc Oi-MF Plus	
2	Ultrasonic	Standard	/
3	X/Y/Z-Axis Travel	450 × 400 × 220	mm
4	Spindle Nose to Table	250 - 470	mm
5	Spindle Taper	HSK-E25	/
6	Spindle Diameter	Φ80	mm
7	Max. Speed (Short-Duration)	50,000	rpm
8	Max. Speed (Long-Duration)	40,000	rpm
9	Worktable Dimensions	500 × 400	mm
10	Max. Load	200	kg
11	Tool Holding Capacity	15	pc
12	X/Y/Z-Axis Rapid Speed	15/15/15	m/min
13	X/Y/Z-Axis Max. Feed	10/10/10	m/min
14	X/Y/Z-Axis Positioning Accuracy	0.005	mm
15	X/Y/Z-Axis Repeatability	0.003	mm
16	Weight (incl. Accessories)	3,500	kg
17	Machine Size (L×W×H)	1,650×1,880×2,405	mm



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