

**PRECISION IMAGING / NANOLITHOGRAPHY TECHNICIAN
(Time-Based)**

APPENDIX A

O*NET CODE 51-2099.00

This training outline is a minimum standard for Work Processes and Related Instruction. Changes in technology and regulations may result in the need for additional on-the-job or classroom training.

WORK PROCESSES

	Approximate Hours
A. Workplace & Business Orientation	80
1. Demonstrate knowledge of workplace policies, procedures, etc.	
2. Work safely around equipment & chemicals.	
3. Recognize and minimize potential hazards.	
4. Maintain clean work environment.	
5. Follow workplace safety and clean room plans; use appropriate Personal Protective Equipment (PPE).	
6. Demonstrate awareness of First Aid, CPR, and bloodborne pathogens.	
7. Learn and understand the importance of products and applications to the customer.	
B. Macro Lithography	1200
1. Understand the curve of photographic materials and the density in relation to the exposure of light such as D vs LogE and contact response.	
2. Evaluate the photometric response based on the nature of the color of light that is used.	
3. Utilize different photographic surfaces based on the product design such as glossy, semi-gloss, and satin.	
4. Gain an understanding of the methods, operations and job set-up of image process equipment and machines.	
5. Use measuring instruments, such as reflection densitometer and barcode verifier.	
6. Demonstrate proficiency using multiple imaging methods/processes.	

7. Develop proficiency with parts production: from drawings/specifications/instructions through final part(s) production.
8. Become acquainted with the methods, operations, and job set-up of the finishing process such as cutting and mounting finished products using a laminator and plotter.
9. Create inserts for storage containers using 3D printer and fixtures.

C. Micro Lithography

1320

1. Gain an understanding of the methods, operations, and job set-up of imaging processes:
 - a. Understand and employ cleanroom procedures.
 - b. Contact printing which exposes the copied print.
 - c. Stepper.
 - d. Laser Lithography when developing a specific image.
 - e. Develop the exposed photoresist and etch away select portions of the metallic coating underneath, leaving only the desired image (Wet Lab).
2. Become aware of the methods, operations, and job set-up of the finishing processes:
 - a. Prepare workpiece(s) for subsequent operations, e.g., mounting.
 - b. Dice, cut, or groove semiconductor wafers, silicon, or glass using a diamond blade on a dicing saw.
 - c. Use scribing table to prepare parts.
 - d. Edge and polish glass using the glass processing machine.

D. Optical Component Assembly

400

1. Read and understand manufacturing drawings, specs, tolerance, and geometric dimensioning and tolerancing.
2. Follow proper work instructions and procedures for each area and operation.
3. Clean and inspect glass surfaces (optical surfaces) prior to assembly.
4. Properly align optical components for assembly by using visual, microscope aided or mechanical fixtures.
5. Mount/adhere optical components for assembly.
6. Perform Outgoing Quality Control (OQC).

E. Inspection, Measuring, Testing, Calibration, and Packaging	400
<ol style="list-style-type: none"> 1. Read, understand, and comply with quality control plans/ inspection plans: <ol style="list-style-type: none"> a. Incoming Quality Control (IQC) to ensure the quality of the raw materials and/or components. b. In-Process Quality Control (IPQC) to ensure product conforms to its specifications. c. Outgoing Quality Control (OQC); 2. Use appropriate metrology tools such as infrared interferometers, coordinate measuring machines (CMMs), and microscopes. to inspect and confirm dimensionality, surface quality, photometric performance, etc. 3. Organize and summarize final parts inspection and prepare reports using inspection forms and spreadsheets. 4. Package the product and protect component parts for storage or shipping. 5. Adhere to prescribed instrument calibration system and become individually qualified on each instrument with an approved repeatability and reproducibility (R&R) evaluation (calibration performed by others). 	
F. Barcode Calibration	400
<ol style="list-style-type: none"> 1. Learn, understand, and reference calibration standards. 2. Understand barcode quality parameters and grading by creating and analyzing the scan reflective profiles, the Edge Determination, Minimum Reflectance, Symbol Contrast, Minimum Edge Contract, Modulation, etc. 3. Use camera-based system when calibrating 1D Barcodes such as UPC or 2D Barcodes such as Data Matrix or QR Code, and linear system when calibrating 1D Barcodes. 	
G. Inventory and Material Processes	80
<ol style="list-style-type: none"> 1. Determine material(s) requirements from blueprint, drawings, and traveler specifications. 2. Review incoming material specifications and data. 3. Demonstrate awareness of in-plant material flows. 	
H. Continuous Improvement	120
<ol style="list-style-type: none"> 1. Participate in Green Belt training. 2. Execute process improvements – both business and manufacturing. 	

3. Participate in continuous improvement activity for professional growth.
4. Minimize and remove waste – environmental, material, processes, and manufacturing.
5. Apply root cause analysis to improve manufacturing process.
6. Adapt to process changes when introduced.
7. Participate in cross-training opportunities.

Approximate Total Hours 4000

Apprenticeship work processes are applicable only to training curricula for apprentices in approved programs. Apprenticeship work processes have no impact on classification determinations under Article 8 or 9 of the Labor Law. For guidance regarding classification for purposes of Article 8 or 9 of the Labor Law, please refer to <https://dol.ny.gov/public-work-and-prevailing-wage>.

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APPENDIX B

RELATED INSTRUCTION

Safety/Health/Environment

1. General Workplace Safety
2. Personal Protective Equipment (PPE)
3. Right-to-Know/ Safety Data Sheets (SDS)
4. First Aid & CPR (minimum 6.5 hours)
5. Sexual Harassment Preventing Training – must comply with Section 201-g of the Labor Law

Trade Theory, Science, and Math

1. Introduction to Imaging Science
2. Measurement and Fundamental Concepts of Metrology
3. Fundamentals of Technical Math and Metrology
4. Algebraic, Geometric and Trigonometric
5. Photo Science
6. Imaging Science
7. Blueprint Reading
8. Geometric Dimensioning & Tolerancing (GD&T)
9. Lithography
10. Photo Science
11. Image Quality Analysis
12. Quantitative Skills in Optics
13. Technical Writing
14. MS Office (Excel, Word)
15. Lean Six Sigma Green Belt Training

Other related topics as necessary

A Minimum of 144 Hours of Related Instruction is Required for Each Apprentice for Each Year.

Appendix B topics are approved by New York State Education Department.