



# Plastic Welding Certification Process



## Executive Summary

Foresight Technologies (US) and Foresight Asia Pacific Sdn. Bhd. (Malaysia) are global leaders in precision CNC machining, plastic welding and high purity assembly. With a combined staff of 250 employees, 50+ CNC machine tools and 30 Certified Plastic Welders, Foresight strives to be the preferred supplier and collaborative partner of our customers.

As a provider of critical plastic systems to semiconductor, aerospace and chemical equipment markets, we struggled fitting the somewhat “Artisan Craft” of plastic welding into our process driven quality systems. We understand the criticality of the chemical systems; any leak could expose operators to unsafe conditions, cause significant downtime for wafer fabs, and potentially damage millions of dollars of product.

While plastic welding has many applications, in the semiconductor industry it has an additional cosmetic requirement which conflicts with many of the standard certifications. Not only must the weld be strong, it must also have minimal pits, capillaries and fluctuations in wake flow. These cosmetic imperfections can provide dead spots where bacteria and contaminants can accumulate, and this can have a major impact on wafer device performance and yield.

This white paper looks at Foresight’s process of plastic welding certification, industry standards that provide the framework for plastic welder certification and explains the necessity of repeating these processes and ensuring that they meet process requirements of advanced quality OEMs.



# Plastic Welding Certification Process

## **Foresight's History of Plastic Welding**

Years ago, Foresight recognized the wide variability in plastic welding quality, even among 20-year veterans of the trade. Everyone had their own process and unfortunately, this caused variability in the final product. Before we considered certification, Foresight worked to eliminate as many process variables as possible.

Over time, we designed, built, and developed a custom Plastic Weld Controller that forced each operator to have consistent air flow, input heat and validated output temperatures at the weld tip for each unique plastic welded. In addition, we performed “break tests” on all welders’ test samples to verify weld quality and strength.

Unfortunately, the actual certification process required significantly more analysis and even more structure to have a real program to certify the process.

## **Industry Standards for Plastic Welder Certification**

There are two primary industry standards that provide a framework for plastic welder certification: the American Welding Society AWS B2.4:2012 and the German Welding Society's DVS 2200-2220 standards. Either standard can serve as the foundation of the plastic welding certification process.

After doing our research and studying the standards, we chose to certify to the AWS standard.



## Our Process

Our first step was to hire an outside consultant; while Foresight knows a lot about plastic welding, as the saying goes, “you don’t know what you don’t know.” We spent three days with the consultant discussing our process, running weld quality tests and evaluating the additional requirements we would need to achieve. The consultant provided a strong understanding of the specifications and test criteria for certification. However, one of the biggest issues is the different objectives.

## Meeting the Standards

The Industry Standards are primarily focused on welding with structural strength, but precision plastic welding has the additional requirements for cosmetically perfect welds with no discoloration, no wake features that would encourage dead spots and the need to limit excessive heat that would cause warpage of precision dimensioned products.

It was easy to meet the Standard, but not to meet the Standard while achieving the visual quality required. We ran dozens of tests to fine-tune our Plastic Weld Controller parameters to a narrow range of inputs for each plastic material. The result is strong welds that meet the structural standard, while meeting our customers’ visual expectations, for each different type of material.





## Foresight's Advantage

Currently, Foresight has approximately 30 Certified Plastic Welders using the following basic steps in their training and Certification process:

- Training to internal Standard Operating Procedures (SOP) defining a fixed process for how to perform plastic welding to our specific requirements.
- Use of internally developed Plastic Weld Controllers that allow the precise and repeatable welding setup of power, air flow and output temperature for each unique plastic material. This eliminates many of the variables in the plastic welding process.
- Internal training and On-The-Job training on non-critical work until ready for Certification.
- When ready for Certification, applicant's weld (6) samples for each of our common plastic materials, including; polypropylene, PVC, FM4910 PVC, PVDF, Polycarbonate and other materials. Welders certify to one or all of the materials.

- Outside testing labs performed specific break tests to validate both the strength as well as visual inspection of the quality of the weld for each person, and each material.
- Formal tracking in the Performance Qualification Test Record (PQTR) system provides formal tracking of all welder qualifications.
- Plastic welder's document the Plastic Weld Controller setup parameters EVERY DAY and EVERY TIME they change the plastic they are welding. This ensures the welding process is performed using the prescribed settings for that material every time we weld, not just once a year.

## Conclusion

The Plastic Welding Certification process is an important step in ensuring plastic weld processes are repeatable and meet process requirements of advanced quality OEMs.



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