

CLEARWELD LASER WELDING SOLUTIONS

April 5, 2022

PRODUCT INFORMATION

Clearweld coatings include a series of solutions that are used to enable the welding of thermoplastic substrates through the use of infrared laser systems. Clearweld coatings contain infrared absorbing materials and are designed for use with lasers in a wavelength in the 800 to 1064nm range. When a Clearweld coating is applied to the surface of a plastic part, a thin, uniform layer of an infrared absorbing material is deposited onto the surface. If infrared energy is applied to the area that has been coated, the Clearweld material will absorb this energy and convert it to heat. As a result, a localized melting of the plastic will occur and weld joint will form. Since most plastics will not absorb infrared energy, only the areas where the Clearweld coating has been applied will melt and form a weld.

| Quick Reference | |
|---------------------------|----------------------------------------------------------------------------|
| Use: | Laser welding infrared transparent resin |
| Notes | Clearweld solutions are solvent based, flammable liquids |
| Coverage | ~ 60 – 120 nanoliters/mm ² |
| Application Method | Needle tip, Micro-solenoid, Spray, Ultrasonic spray, Ink Jet, Manual, etc. |
| Dry times | Typically, 1-10 seconds at room temperature |
| Solution Format | Solvent based infrared absorber |

DESCRIPTION

Clearweld coatings are low viscosity, solvent based liquids that are applied in production by liquid dispensing systems. Typical solvents that are used in Clearweld coatings include ethanol, acetone, and methyl ethyl ketone. The amount of coating applied is measured in terms of nanoliters per square millimeter. The solvent serves as a carrier and is flashed off rapidly, leaving a film of absorbing material on the surface of the plastic. Laser welding uses near-infrared (NIR) energy that passes through an IR-transmissive substrate to an IR-absorbing substrate, where the energy is converted to heat to produce a weld between the two substrates.

Infrared laser welding provides the following advantages:

- Produces a strong, hermetic seal.
- Resulting weld has low mechanical and thermal stress.
- Does not involve vibration, so electrical components are not damaged and particles are not generated.
- Permits pre-assembly of parts, high weld speeds, and three-dimensional contour joints.

APPLICATION GUIDELINES

Compatible resins with Clearweld solutions applied, in accordance with guidelines, will weld with use of a laser creating a strong and durable weld. Clearweld solutions must be applied and dried in a clean environment. Ensure that the resins are compatible with the Clearweld solution being used and the surfaces to be welded are smooth and maintain intimate contact during welding. In addition, dried Clearweld laser welding coatings can be sensitive to UV light, LED light, sunlight, high storage temperatures and other chemicals. Exposure to these conditions should be limited.

| Clearweld Product | Solvent base | Optimum laser wavelength | Color | Shelf Life |
|-------------------|---------------------|--------------------------|-------|------------|
| LD 120 A-Z | Acetone | 940 – 980 nm | Green | 12 Months |
| LD 140 A-Z | Ethanol | 940 – 980 nm | Green | 12 Months |
| LD 920 A-Z | Acetone | 940 – 980 nm | Green | 12 Months |
| LD 940 A-Z | Ethanol | 940 – 980 nm | Green | 12 Months |
| LD 130 A-Z | Methyl ethyl ketone | 940 – 980 nm | Green | 12 Months |

PRODUCT PROPERTIES

Requirements

Infrared laser (diode, Nd:YAG or fiber) 808-1090nm.

Even application of Clearweld absorber.

Fixtures to hold and apply pressure to the parts during the welding operation.

Thinning

Thinning of Clearweld solutions is not recommended. This will reduce the concentration of the IR absorbing components, resulting in decreased laser absorption performance, longer weld times, increased laser power requirements.

MIXING OF CLEARWELD SOLUTIONS

Clearweld solutions typically do not require any mixing prior to use.

Exposure to very low temperatures may cause precipitation of solids in some Clearweld solutions. If particulates are observed on the bottom of the container, the solution should be warmed to approximately 35°C (95 °F) for 30 – 60 minutes with subsequent mixing. This process will re-dissolve components that have precipitated.

APPLICATION EQUIPMENT

Clearweld solutions are supplied ready for application. Clearweld coatings may be applied to substrates by various methods. The use of proper dispensing methods and equipment is critical to the success of each Clearweld process implementation. The optimum method for a particular production process is determined by factors such as process speed, surface geometry and the area to be coated. The application method which is selected should provide a uniform film across the entire area that is being coated. Recommended lay-down is 60-120 nl/mm².

There are many methods that can be used for the application of Clearweld coatings. Some typical applications methods are:

- **Manual:** A felt tip marker containing Clearweld solution or paint brush can be used to manually apply the solution to a resin for proof of concept and trials.
- **Needle Tip:** Needle tip dispensing controls the flow of fluid by means of a pneumatic valve and a needle-like attachment at the outlet orifice of the valve.
- **Microsolenoid:** A microsolenoid valve is a miniature valve that opens and closes very rapidly in order to dispense droplets of liquid onto a surface.
- **Spray:** A pneumatic valve with an atomizing air cap is used to create a fine spray. A spray nozzle can be used to uniformly coat large surface areas, such as sheets or films.
- **Ultrasonic Spray:** An ultrasonic nozzle combines the benefits of the needle tip and microsolenoid valves while dispensing a uniform mist of liquid. It can be used to deposit narrow lines at lower coating weights than either a needle tip or microsolenoid dispensing system.
- **Inkjet Printing:** Inkjet printing allows precise application of Clearweld solution using a specialized inkjet printer and cartridge system.

DRYING

The solvent serves as a carrier and is flashed off rapidly, leaving a film of absorbing material on the surface of the plastic. Typical drying times are between 1 and 10 seconds.

It is possible to use assisted drying such as pre-heating of parts or post-heating with an infrared lamp to flash solvents off more quickly. In an enclosed work area, a localized air exhaust is recommended to eliminate the buildup of low levels of solvent vapor at the application station. Coatings may be applied off-line.

STABILITY

Excess exposure to UV light, sun light, intense LED light can degrade the Clearweld solution and the dried absorbers.

STORAGE AND HANDLING

Solution: All Clearweld solutions should be stored in a cool, dry place. Shelf life of Clearweld solutions coatings is 12 months from the date of manufacture, as indicated by the expiration dated

marked on each container. It is recommended that Clearweld solutions be stored at room temperature, between 20°C and 25°C (68 – 77 °F). Avoid open flames and prolonged contact with strong ultraviolet light. All Clearweld coatings should be stored in their original containers and taped closed when not in use.

Printed Sheet: Resins with Clearweld applied and dried (printed sheet) should be stored out of direct sunlight and intense LED lighting, preferably in the dark, to minimize the impact on the Clearweld absorbers. In general, once printed the IR Inks and their internal components are extremely stable. Printed sheets should be maintained in a humidity, temperature, and light controlled environment. A temperature of 20 - 25°C (68 – 77 °F) is preferable, with the printed sheets being protected from UV light and intense LED light. Under these conditions, printed sheets are stable for 12 months. Ensure the printed sheets are completely dry prior to storage.

SAFETY INFORMATION

Clearweld solutions are a highly flammable liquid and vapor. Keep away from heat, sparks, open flames, hot surfaces, and sources of ignition. – No smoking.

Safety Data Sheets are available upon request.

All applications using this product should be thoroughly tested prior to approval for production.

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