

General description

Laser Weld Monitoring (LWM) Technology

This US Patent Pending **Pulsed Laser Weld Monitoring** technology was invented, developed, tested and is sold by HDE Technologies, Inc.

The HDE LWM technology captures the images of each weld plume generated by each laser pulse. These images provide information about the weld geometry, power density and many other laser weld process parameters.

The captured images are digitized and analyzed to determine if the images of the production welds match the saved image (template) of an acceptable weld.

Installation.

Option 1. The HDE LWM systems are designed to be retro-fitted to existing laser welding systems, using the beam delivery optics already in place.

Option 2. The HDE LWM systems may be installed in new laser welding systems, with the high quality optics provided by HDE.

Accuracy. The accuracy of the measurements made by the HDE LWM systems is 'beyond' the capabilities of metallographic examination.

Weld schedules. The HDE LWM-s work well with established, current laser weld schedules. However, the optimum laser weld parameters may be computed using the **Pulsed Laser Weld Algorithms** (mathematical Model) that were also developed by HDE. The parameters computed with the HDE Algorithms are also used for programming the laser system controller plus the HDE LWM! No changes to the computed parameters – this provides a good traceability of the weld schedule.

Calibration. The HDE LWM-s may be calibrated as often as the PQ (Procedure Qualification) specifies, or whenever the EQ (Equipment Qualification) is performed. Thus the HDE LWM systems comply with the requirements for laser weld monitoring systems as required in the revised issue of the AWS C7.4 Laser Welding Standard.

DOE – Design of Experiments. With the use of the HDE Pulsed Laser Algorithm and the HDE Pulses LWM the laser weld portion of the DOE for each weld is performed in a matter of hours – not days or weeks. The accuracy of the Correlation Values yields good statistical results.

Data and statistics generated by the HDE LWM systems. Please return to the Main page of this web site and click on '*Data and Statistics*' icon.

Causes for rejection of welds. Since each image is labeled with its own serial number, it is easy to identify the location of the particular weld nugget in the seam weld.

1. Correlation Values are too LOW for one or more weld nuggets.
2. Too many pulses.
3. Too few pulses.
4. Missing pulses.
5. Low power density.
6. Changes in the overlap of the weld nuggets.
7. Changes in the weld geometry (gaps, voids, misalignment, etc.)

For more details, please return to the Main page of this web site and click on '*Process variables detected*'.

LWM Models

Currently HDE offers two (2) models of LWM systems. Both use basically the same algorithms and techniques for monitoring. The GUI and operating instructions for both models are essentially the same, too!

The **Spot Weld Monitoring System** (Model HDEm LWM) designed to monitor spot welds and short seam (stitch) welds very efficiently and inexpensively.

The **Spot and Seam Weld Monitoring System** (Model Gen2HDE LWM) acquires, processes and delivers the evaluation data of the laser weld significantly faster and is designed for higher volume and shorter duty cycle production welds. Please see 'Specifications...' on the opening page of this web site to learn more about the performance of the two (2) HDE LWM systems.

HDE offers to evaluate the intended application of the LWM system to help select the most suitable model. This service is provided at no cost to the client, given that the client is expected to have the laser beam diagnostic devices on hand. Please return to the Main page of this web site and click on '**Application questionnaire**' icon.

Configurations

Both HDE LWM systems are offered in two (2) configurations:

1. Configuration 1 is designed to work on laser welding systems that **do NOT** use auto-seam-track vision systems. The HDE LWM camera replaces the current CCTV on the laser welding system and using imaging optics already in place plus additional optical devices provided by HDE, the HDE camera performs both as the targeting camera and the LWM.
2. Configuration 2 is designed to work on laser welding systems that **DO** have auto-seam-track vision systems. The current CCTV camera is left in place to perform as it was intended. An HDE Image Splitter is installed in the current vision system and a low percentage of the target image is sent to the HDE LWM camera. Some additional optical devices provided by HDE are added to the HDE camera to control and pre-calibrate the LWM functions.

Customer support and service

HDE Technologies, Inc. was the first company in the USA (1978) to design, build and deliver industrially rated multi-axis laser welding and laser drilling systems. HDE learned, developed and sustained the type of customer support that few companies in the industry ever achieved and this experience has been applied to the development, construction and delivery of the HDE LWM systems. Key steps to achieve and maintain this successful business model are as follows:

1. Site survey. HDE evaluates the customer's laser application (volume and duty cycle) and also the configuration of the current laser beam focusing hardware and optics.
2. Costing proposal. Within a few days HDE will send the potential client the Costing proposal for the recommended LWM system.
3. Delivery schedule. Typical delivery schedule is within 45 days ARO.
4. Installation. To date most customers installed the HDE LWM systems by themselves. However, HDE offers a professional installation service as well, where the technical people performing the installation are highly trained by HDE.
5. Documentation. HDE provides with the LWM system purchased, at the time the LWM system is delivered, a hard copy and an electronic copy of the comprehensive Operators' Manual. Working copies of the HDE Laser Welding Algorithms are also included.
6. Training. HDE believes in good training of the Customer so that the Customer will become knowledgeable and able to operate the LWM system with confidence. Besides the documentation supplied with the LWM system, HDE offers free registration of at least one person from the company that purchased the HDE LWM system in one of HDE's well established 'Laser Welding Technology EQ and PQ' classes. For schedules and details of the HDE Laser

Welding classes, check the web site: www.laserweldtraining.com.

Disclaimers

The HDE Pulsed Laser Weld Monitor (LWM) systems are designed to identify changes and variations in the laser welding process with great accuracy in real time, analyze the data and report it to the end user. The accuracy of the data and the reports are subject to a number of process related variables and their interactions with each other and the process limits set by the end user.

The end user is advised to NOT use the HDE Pulsed LWM systems as devices to determine the absolute final quality of the welded product. HDE recommends that the end user continues the normal inspection and testing of the laser welds and the laser welded product as the end user has been doing in the past and as it was approved by the Industry Specific Regulatory Agency.

HDE is not accepting any responsibility as to the accuracy of the HDE Pulsed LWM systems and the final quality and utility of the laser welded components.

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