Smarter Geomembrane Welders & CQA Equipment

June 25, 2025
Written by: Brian Fraser and Evan Bao (IAGI Board of Directors)

This article highlights some of the benefits and capabilities of newer generation thermal wedge and hot air welders including the features of data recording. It discusses similar technology being incorporated into CQA testing equipment primarily used for electrical leak detection surveys.

What is data recording?

Data recording in geomembrane welding involves the use of either thermal wedge and hot air welding equipment that can monitor and document critical welding parameters including temperature, speed, pressure and distance during the welding process. This ensures improved quality control by providing a record of these parameters, allowing for verification that the weld meets specified standards and enabling troubleshooting of equipment if issues arise. Data recording equipped welders obtain important live data which is captured and stored within the welder using Bluetooth technology. The acquired data can be used in the construction quality control / construction quality assurance program to compare against established historical welding values and established welding parameters. The data can then be uploaded into the cloud and generated into reports for future review and analysis. These important data parameters are supported and controlled by special software and user apps.

Leister GEOSTAR Data Control Welder with user App.

Data recording is supported by **ASTM D8468-23:** This ASTM provides guidelines for data recording during thermal fusion welding of geomembranes, emphasizing minimum data requirements and post-welding analysis. There is also **GRI-GM32** which is a Standard Practice for Geomembrane Seaming Using Data Acquisition Hot Wedge Welding Devices.

Data recording enables post welding analysis that can be cross referenced with previous data. It works on geomembrane polymers that can be thermally wedge or hot air welded including HDPE, LLDPE, CSPE, PVC/EIA, RPE and RPP. This information recorded provides the following important benefits.

- **Setting of parameter range with visual and acoustic alerts**
- **Indication for potential error location**
- **Recording GPS location of the seams**
- **Reports for Third-party or customers**

History

Geomembrane wedge welders were first introduced in North America in around 1987 to support the emerging use of HDPE and LLDPE geomembrane liner being manufactured and installed for environmental containment. These early machines allowed for the manual control of machine heat, speed and roller pressure. Data recording has been used in parts of western Europe for over thirty years in the plastic pipe industry. In many countries including Germany, its use today is mandatory by government regulators for critical water and hazardous waste containment applications. In North America, we are starting to see some leading industry geosynthetic installers and fabricators proactively incorporate the use of data recording welding equipment as part of the factory and construction quality control and construction quality assurance programs.

How does it work?

Data recording systems provide continuous output of the monitored parameters, allowing operators and inspectors to observe and adjust settings as needed during the welding process. Equipment can be set up with welding parameter ranges allowing operator visual and acoustic alerts identifying potential errors and leaks. This includes the use of GPS technology for GPS location of the seams. Certain equipment also has 3D GPS E-mapping and artificial intelligence (AI) capabilities. This supports post data analysis of the retained welding information where potential irregularities in equipment temperatures, speed and pressure can be pinpointed for further investigation and review. The recorded and stored data is used for creating welding reports, verifying weld quality, and for future reference.

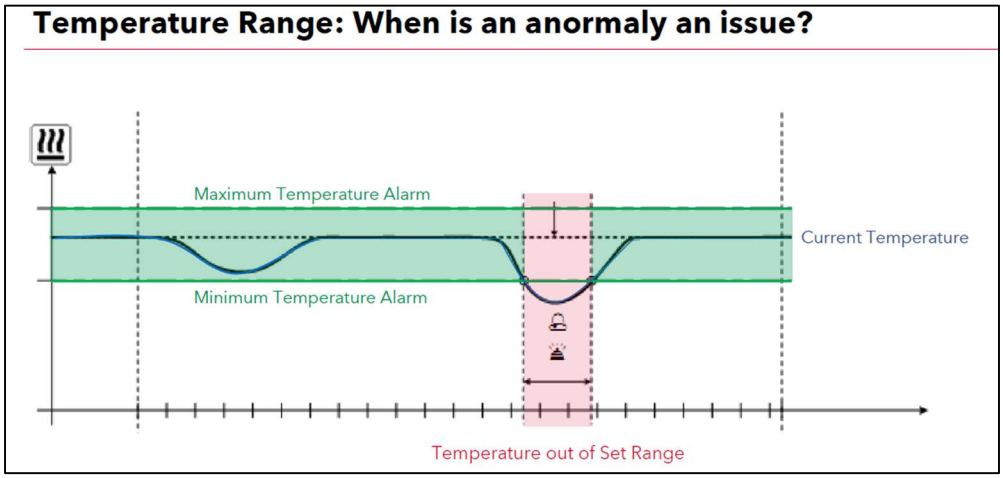

Chart showing controlled range of welding temperatures and an abnormality. Photo courtesy of Leister.

Pros and Cons

The advantages of using data recording exceed the disadvantages. However, it is important to understand that the use of data recording systems does not replace the fundamental need for field or factory welding technicians to be properly trained on the welding equipment. This includes understanding the complexities of welding different polymers, thickness and structures including reinforced and unreinforced liners as well as welding during different weather conditions and challenging installation applications. As the data control systems are built into welding equipment, the standard operating requirements and required experience of a field technician do not change with the use of machines using automated data recording. Also, data recording does not guarantee that mistakes will not be made, including a bad quality seam as a result of poor workmanship or material and equipment problems. Proper prequalification of welds and Industry destructive and non-destructive testing standards are still required. Data recording should be used as a tool to help keep things on track. It can also help to eliminate human error as a result of translating information as a result of using more manual CQA systems.

Demtech Pro-Data Welders & App.

Other factors impacting the increased usage and demand include the need for further industry training and education and the increased costs of this equipment. Getting this technology mandated by government regulators and specified by consulting engineers will

help drive its growth and usage. Extra costs associated with data reporting welding will need to be a project cost and passed on to facility owners.

The following are some recent comments provided by a number of leading industry experts in the geomembrane welding equipment and CQA testing services industry on equipment data recording.

- **Eddie Weiser** of Leister stated, *"a black box in an airplane does not stop the plane from crashing but does provide important data to help determine what went wrong. Data recording will not guarantee that no mistakes will occur but post welding can help determine a vulnerable or failed seam."*
- **Demo Dave** from DMS Welding Solutions commented, "*while data recording is a very good tool, it may not pick up dirt or mud on the surface of a geomembrane which can potentially fail a seam. We still need properly trained and skilled welders."*
- **Gus Fauci** from Demtech Services stated, *"data collection will not replace the need for CQA practices and services and with automated data collection, you cannot fudge the data."*
- **Matthew Kemnitz** at Leak Location Services, "*in addition to finding leaks, our interest is also to know what caused the leaks. Post welding information from data recording is a helpful tool to improve overall industry quality."*
- **Glen Toepfer** – CQA Solutions, "I see data collection in welding as heading in the right direction however we need to overcome some hurdles including better understanding welding windows by material and education".

The advantages of data collection are in the post installation analysis.

- **Quality Assurances**
- **Traceability**
- **Compliance**
- **Risk Management**

While most data recording equipment incorporates the use of GPS technology, GPS accuracy can vary based on signal strength and accuracy levels can be plus or minus 3' (0.914 m). Solutions and techniques for GPS improved welding accuracy are being actively worked on by a number of equipment suppliers.

CQA Geomembrane Testing Equipment

In addition to welding equipment, the industry is also seeing some good new innovative advancements in CQA testing and monitoring equipment being used for detection of leaks in

geomembrane liners. This includes new smart technology solutions using data collection and 3D GPS digital mapping designed to support electrical leak detection used for exposed, backfilled and liquid submerged geomembranes. Today, this testing and monitoring equipment is becoming available globally by industry equipment suppliers. Numerous industry CQA service companies have been introducing this equipment technology to project owners, government regulators, installers and project jobsites.

ELISTECH eLagoon AI powered Robot for geomembrane leak detection surveys

Summary

Data control technology is built into geomembrane welding and testing equipment. It aids in providing improved post installation quality analysis and monitoring the performance of welding equipment. It does not replace the need to have properly trained and experienced welding technicians. Industry equipment manufacturers are working on further enhancements including the use of artificial intelligence (AI), GPS and digital reporting capabilities. Future automation advancements are expected to include extrusion welders and tensiometers. It is recommended that geosynthetic installers, fabricators and all industry stakeholders become more familiar with the benefits and features of data reporting welding equipment. IAGI is suggesting a future subcommittee be established to work on an updated guideline or best practice document supporting data control technology for welding and CQA testing. This information is provided for information purposes only and IAGI does not provide a preference for any specific supplier or equipment.

Acknowledgements

We would like to thank the following individuals for contributing information supporting this article.

- Eddie Weiser – Liester
- Gus Fauci – Demtech Services
- Demo Dave McLaury – DM Solutions
- Matthew Kemnitz – Leak Location Services
- Glen Toepfer – CQA Solutions