

Smart Welding Documentation: Digitalization in Plant Engineering

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Digitalization of welding documentation in the highly regulated pharma industry is the goal of JAG. Hence, a new paper-less process together with an application using near-field communication (NFC) for user identification of welders, inspectors and project managers has been prototyped and tested in the field on a real project.

Introduction and Context

The traditional management of paper based welding documentation is proving to be inefficient, difficult to control and cost-intensive (see Fig. 1). The aim of this work was therefore to digitise the handling of welding documentation. The focus was on developing a user-orientated application that is easy and reliable in welder's everyday working usage. One of the biggest challenges in requirements engineering was the strong regulation of the pharmaceutical industry, as the system needs to meet FDA and GMP guidelines as well as the needs of the different end users.

Research Design

Based on a comprehensive literature review of the applicable standards, regulations, and guidelines, the legal framework was first defined. Through detailed stakeholder interviews and an extensive analysis of the target and as-is processes, the needs and requirements for the application were developed, and the major sources of errors were identified. This approach was crucial for subsequently developing the prototype application within the correct framework and conducting field tests.

Result

The analysis of the as-is process identified the Weld Log, a paper form with legally binding signatures for ensuring the quality of the weld seam, as the most complex part of the documentation for digitalisation. A fast login process with a personalised NFC

tag, which can also be used for digital signatures as well, proved to be handy for welders. Based on these findings, a prototype application was developed using MS PowerApps. This application enables the login process, user management, the selection and management of projects and welding documents, the digital documentation of welding and inspection processes, and storage in the company's SharePoint. Critical and error-prone data entries of pipe sections (see Fig. 2) can be transferred into the system using Data Matrix codes. Various design reviews based on evaluations of successful open field tests confirmed the developed solution as a proof of concept and a potential of an return on invest up to 41%.

Implications and Recommendations

The developed application proofs the technical feasibility to digitalise the welding documentation process within the legal boundaries. With this prototype the JAG Jakob AG can test the paperless documentation in order to find further improvements for a final implementation, making welder's everyday work easier and more efficient.



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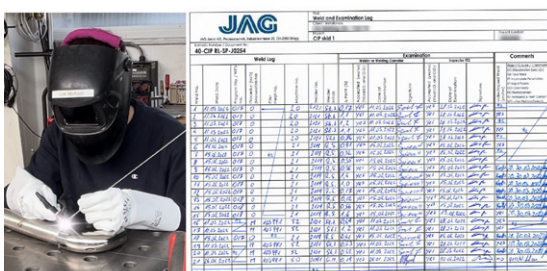


Figure 1: Welder at work and Weld Log in paper form with all the welding data and signatures of the welders and inspectors.



Figure 2: Prototype application with NFC tags and Matrix code on a pipe, that will be welded into a pharmaceutical plant.