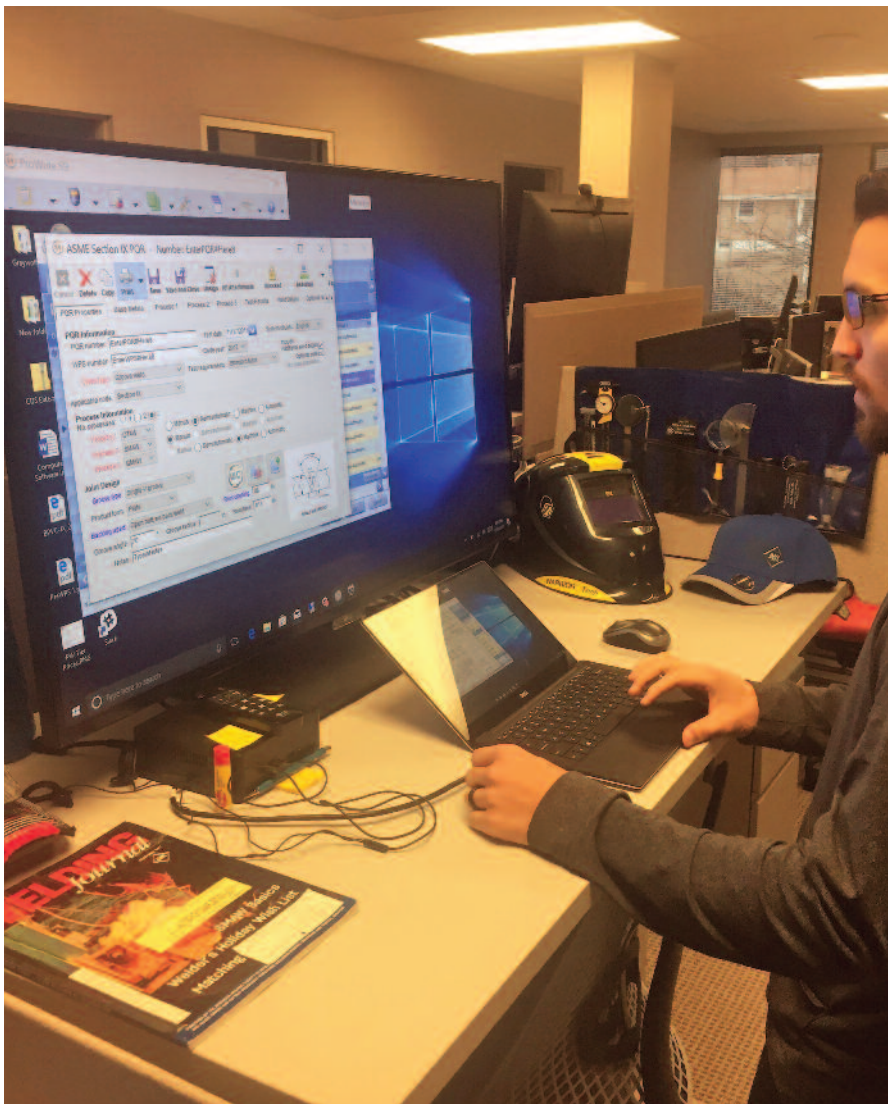# How Software Increases Welding Process Efficiency

Highlights include a greater ability to create code-compliant documentation and track welder continuity

BY ANTONIO HOWARD

Mechanical Engineer in Training Tiradej Bunyarattaphantu uses ProWrite™ welding software to create ASME Boiler and Pressure Vessel Code *Section IX welding documents.*

With the first edition of the American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code* recently celebrating its 100th anniversary, a motivation the industry standards committees share is to not only increase welding process efficiency, but also ensure the uniform application of generally accepted safe welding practices in the manufacturing and fabrication of boilers and pressure vessels.

It should come as no surprise that, throughout this time, welding companies, engineers, AWS Certified Welding Inspectors (CWIs), quality control/assurance managers, and foremen have developed welding documentation processes. Using computer software assists in those endeavors by helping to increase welding process efficiency, manage welding process documentation, and meet code demands (see lead photo).

The Importance of Record Keeping

In many cases, a company might have a CWI or welding engineer who's responsible for developing and implementing the documentation process.

On average, several challenges must be overcome, including the following:

1) Single point of contact failure. The CWI who evolved the process leaves the company, and the incoming CWI has to adopt or adapt the inherited approach without transition or explanation.

2) Partial modernization. The company, with the help of the CWI, has attempted a transition from paper-based documents to electronic template forms in Word or Excel. Or perhaps an advanced company has invested in an access database or home-grown tool, but has not migrated the legacy information.

3) Code update maintenance. The code is not static, and the CWI has a day job in the shop, so finding time to stay updated with code changes and finding the time for adapting the process can be challenging.

Accurately Documenting Work Activities

Through vigorous attention to detail, and perhaps good luck, companies that haven't dealt with major issues yet as a result of inaccurate documentation might be living by the motto "If it ain't broke, don't fix it" without recognizing the potential exposure to vulnerabilities associated with inaccurate documentation.

Although other companies might be actively managing or coping with the impact of a single one of these vulnerabilities, the real challenge is when more than one exists, leading to an inefficient and cost prohibitive out-of-control or out-of-date process.

In these types of situations, consequences can surface during audits that result in the need for costly and time-consuming remedial intervention.

Ensuring Welder Qualification

An example of how a CWI or quality control manager might fail to keep a welder qualified is as follows:

• The welder initially qualified to use multiple welding processes at the company, and continued to weld daily, but he/she failed to weld with gas metal arc welding for more than six months. This terminated the welder's qualification to use that process.

In the event the welder is subsequently placed on a job using gas metal arc welding, an independent authorized inspector for the job is obliged to refuse to sign off on the project, with the structure welded by the nonqualified welder instantly becoming scrap metal waste, which may cost thousands of dollars. With job margins already under pressure, an error of this magnitude could result in the ending
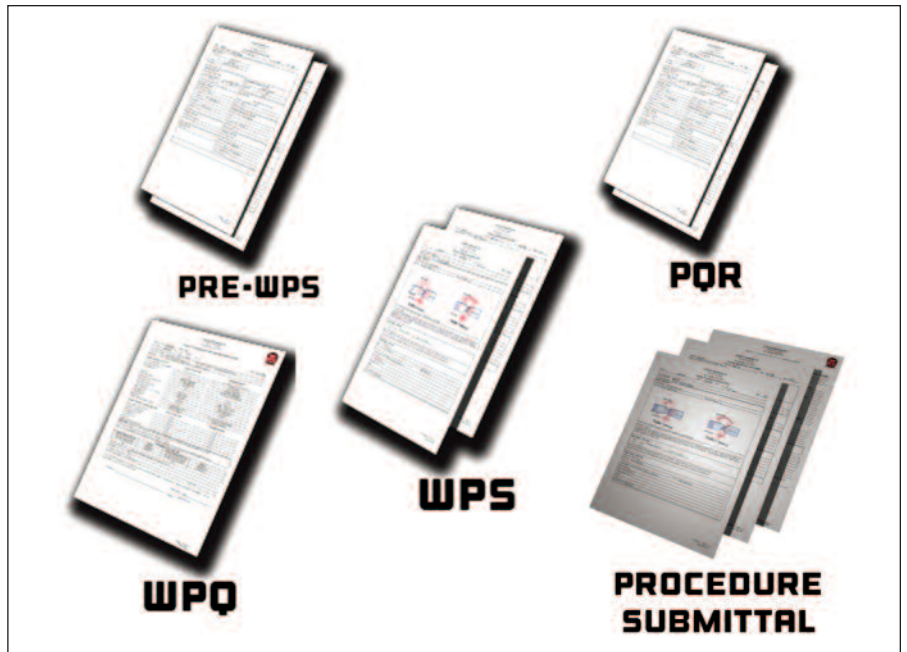

Fig. 1 — Common welding documents associated with code work include the pre-WPS, PQR, WPS, WPQ, and procedure submittal.

of a career or even the demise of an entire company.

Code Compliance for Boilers, Pressure Vessels, Pipelines, and More

Throughout the years, various codes have been created to adhere to the construction of different structures.

ASME publishes the *Boiler and Pressure Vessel Code*. The American Petroleum Institute (API) has many pipeline standards including 1104, *Welding of Pipelines and Related Facilities*.

In addition, AWS publishes a host of different welding standards such as D1.1, *Structural Welding Code — Steel*; D1.2, *Structural Welding Code — Aluminum*; D1.5, *Bridge Welding Code*; D15.1, *Railroad Welding Specification for Cars and Locomotives*; and D17.1, *Specification for Fusion Welding for Aerospace Applications*.

There are also international welding codes for British and European standards.

Typically, committees meet to release code updates on a frequency from annually to every five years. This provides up-to-date rules and guidelines on a structured schedule.

Given the amount of detail that must be adhered to in order to legally perform construction under these

codes, and the penalties or fines that come with noncompliance, welding documentation has become an essential variable when code-level fabrication is involved. In most cases, the documents required for construction will remain with the structure for the entire existence in an operating production capacity.

Documentation such as procedure qualification records (PQRs), welding procedure specifications (WPSs), welder performance qualification records (WPQRs), nondestructive examination documents, weld logs, and weld maps must be generated and performed to specification — Fig. 1.

Using Software to Help Craft Welding Documents

Advancements in computer software, and the benefits of cloud technology, add layers of code assistance for the creation of code-compliant welding documentation — Fig. 2A–C.

Computer software may add "wizards" that present paths, leading users through a series of well-defined steps to help with step-by-step document creation. Creating the ability to generate code-compliant WPSs, the documents list all variables and processes required to perform a specific weld.
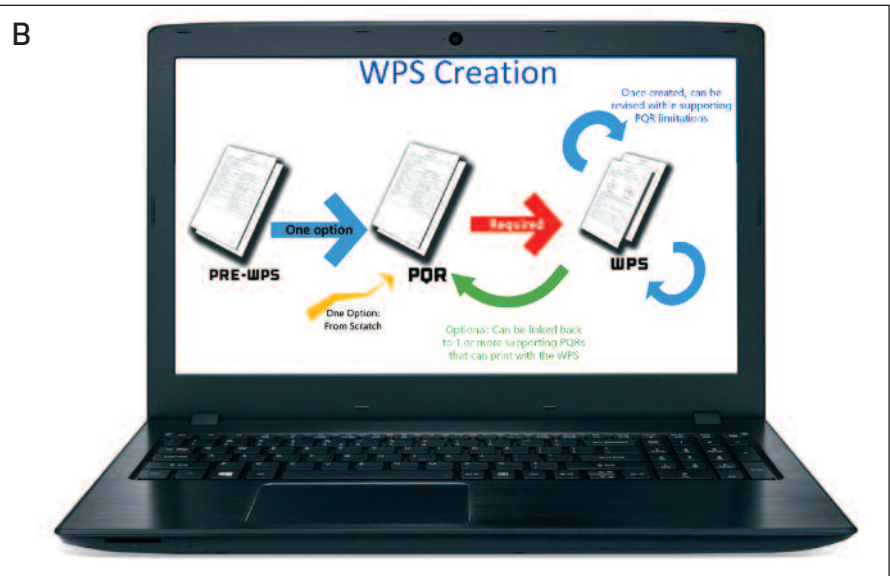
Fig. 2 — Document flows detail the creation of a PQR (labeled A), WPS (labeled B), and WPQ (labeled C).

What are Welding Procedure Specifications?

The WPSs are created to ensure repeatable acceptability of the weld, when the procedure is executed by trained and qualified professional welders.

The advantage of computer-assisted processes is in making sure that essential, supplementary essential, and nonessential variables are being followed to fulfill the requirements of ASME's *Boiler and Pressure Vessel Code* Section IX, AWS D1.1, API 1104, or any other code being used.

What are Procedure Qualification and Welder Performance Qualification Records?

These WPSs are, in most cases, qualified by a PQR, representing a record of the welding variables and the tests conducted to qualify the WPS. This document also includes destructive examination results of tests such as guided bend, tensile, hardness, toughness, and nick break methods. These results are based on acceptance criteria of the specific code to which the project is adhering.

With the emergence of computer software packages that create and manage the PQR and WPS documents, their capabilities have been extended into an area that is often overlooked, namely welder continuity and certification management. These advanced applications cover the analysis and storage of the welders, plus the WPQRs, which are the official records of a welder's ability to perform a weld according to a specific welding procedure specification.

The Ability to Track Welder Continuity, Include Databases

Using computer technology, a welding company is provided with a greater ability of creating code-compliant documentation, tracking welder continuity, and generating reports for upcoming expirations. This also helps to avoid the remedial costs associated with the scenario described earlier, where if a welder uses a process beyond the six-month expiration qualification date, it might lead to grinding out all welds on a project done by that

expired welder, or scrapping the project, causing the fabricating company to lose time, money, and credibility.

Ultimately, it is the welding company's responsibility to be sure its welders are qualified, and that they remain qualified at the start of any job they are contributing to.

In addition, the provision of a code-compliant software package that includes databases maintained as part of a subscription for less than the cost of buying a new copy of the code book, minimizes the overhead and impact of the CWI or welding engineer attempting to maintain code updates in addition to performing the required day-to-day duties.

As clients have insurance requirements to satisfy, and independent authorized inspectors continue to challenge vendors on their use of qualified welders and welding procedures, along with the use of approved methods and procedures to meet codes, the power of having computing technology with well-designed software can alleviate the pressure of proving compliance, driving an increase in welding process efficiency.

Conclusion

Throughout the years, industry has relied on the practical skills of welders to produce time and cost-efficient work. Now, welding industry leaders have started turning to computer software to help increase the efficiency of their welders as well as manage their welding products and mandatory welding documentation.

As computer software continues to develop and evolve, this shift will allow for more accessible resources in material and property databases, cost-effective welding practices, minimizing the potential for noncompliance, and, probably the most important benefit, time savings.

Practicing and understanding the value of efficiency is key in ensuring that your business aligns with the evolution of its industry. WJ

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