Being critical to ensure compliance should be brought to bear, as the performance of high value weldments is dependent upon the integrity of their welds. Consider the volume of welds in the construction of bridges, skyscrapers, marine vessels, and so forth. Or, on a more personal level, think for a moment about a heart patient with an implanted pacemaker. The sensitive internal electronics of the pacemaker are reliant upon the hermetic seal quality of the casing seam weld to remain contamination free. Within various industries such as marine, oil and gas, aerospace, nuclear, defense, and medical, pivotal weldment performance relies upon the integrity of the welds (Figure 1).

Regardless of the industry, the criticality of being critical reflects a seriousness of purpose to ensure compliance such that welds and weldments meet intended service design and performance requirements.

Figure 1. Weld integrity is critical in high performance applications such as oil and gas pipeline and pipework welding: (a) gas tungsten arc welding of an oilfield facility pipe for gas transmission; and (b) gas tungsten arc welding of an oilfield facility stainless steel pipe for water transmission.
Being Critical to Ensure Compliance

Being critical does not mean you inspect to fail; or review to reject a procedure qualification record (PQR) or welding procedure specification (WPS); or perform a supplier weld audit to wittingly secure findings. Being critical means you have an attitude to exercise professional objectiveness (that is, obtaining objective evidence that can be substantiated). Namely, that entails employing a fact-finding mind to diligently perform, and with integrity, an objective evaluation of welds, weldments, contractors, documentation, and so on such as: providing a thorough assessment of welds during a weld inspection task, reviewing PQRs/WPSs for sufficient technical content where details and accuracy matter, and/or during a supplier audit obtaining objective evidence relative to a supplier’s capabilities and competencies. During an audit it is important to determine whether PQRs/WPSs, nondestructive testing (NDT) procedures, and NDT personnel qualifications are in compliance with respective codes and/or client specifications. Being critical also encompasses utilizing

Figure 2. Weld failures observed during onsite inspection activities: (a) an aluminum weld crack; (b) a structural angle iron weld crack; and (c) a fillet weld toe crack in a titanium pipe.

Figure 3. Faulty welding and fabrication production practices: (a) surface rust as the result of iron contamination from the use of a carbon steel wire wheel power brush to clean type 316L stainless steel pipe welds; (b) one of many unacceptable structural steel welds on a project; and (c) another of many unacceptable structural steel welds on a project. In Figures 3b and 3c the galvanized coating on the structural I-beam columns and attached plate members was not removed prior to welding. There was no in-process visual testing weld inspection/ supervision performed during fabrication activities.
trained, razor sharp eyes during auditing, construction site walkthroughs, pipeline hydrostatic testing, manufacturing oversight/surveillance activities, and so on, where weldment discrepancies and/or weld failures may be identified. Catastrophic weldment failure (for example, crane collapse) and service life deterioration are prejudiced by the type and extent of weld defects present. Weld defects that could potentially lead to a crack/fracture due to load stresses are the most severe (Figure 2). In addition to recognizing weld defects, identifying faulty welding and fabrication practices as they occur during production is crucial. Adverse welding and fabrication practices not identified during production pose a potential and hidden threat to user/public safety and to the service life and operational characteristics of a weldment. Examples include: the exposure of a stainless steel weldment to the harmful effects of carbon steel fabrication tools/processes and the ensuing negative impact on its aesthetic and corrosion resistance properties; or the welding of galvanized steel without first removing the galvanized coating prior to welding and the resulting injurious effects of welder exposure to zinc fumes and in weld pool contamination (Figure 3).

Ensuring Compliance through Experience, Knowledge, and Integrity

As noted previously, the criticality of being critical represents an attitude that reflects a seriousness of purpose to ensure compliance such that welds and weldments meet intended service design and performance requirements. However, to ensure compliance relative to meeting weldment drawing provisions and weld code, production contract, consent decree requirements, and so on, highly qualified and competent personnel are required. Insurance companies, municipalities, accreditation agencies, engineering authorities, and governmental agencies, among others, represent jurisdictional and governing body authorities that employ
The Importance of Being Critical

There is a disparaging saying within industry that you inspect not to achieve quality, but to achieve profits. However, weld quality can never be taken for granted or be assumed to be "good enough." Being critical could save someone’s life, or prevent injuries, property damage, and/or an environmental disaster from transpiring. Faulty welding or fabrication practices and weld defects all contribute to undermining the structural integrity and operational characteristics of a weldment. Based upon this author’s forensic experience and research, in many cases when a weld fails in a large weldment (that is, cracks/fractures), catastrophic things occur, for example, the Alexander L. Kielland North Sea platform collapse in 1980 (Hayes and Phaal, 1998). Why? Because when a weldment is in service, weld joints/welded connections are enduring some measure of stress via mechanical loading (cyclically or statically). During a weld inspection task or while performing manufacturing oversight/surveillance, auditing, PQR/WPS reviews, and so on, if something is not in compliance or is suspect then it is important to speak up. The adage “If you see something, say something” is key. Being critical facilitates the identification of nonconformities/nonconformance, which could otherwise remain undetected, possibly resulting in a terrible accident. For instance, as the following storylines denote, it is important to be critical (Allen, 2010; Ricard, 2011).

- "Defective Weld in PG&E’s Pipeline Led to Explosion"
- “The Man Who Killed Concorde: Welder Behind Disaster Which Claimed 113 Lives and Ended the Era of Supersonic Travel is Fined £1,700”

Essential Onsite Practices

To be critical, responsible “boots on the ground” and “roll up your sleeve” NDT personnel, engineers, welding inspectors, and the like are required to provide vital onsite skills, trained eyes, and knowledge during weldment construction, manufacturing, repair, and inspection activities (Figure 4). Welding workmanship quality and fabrication training, the performance of diligent in-process weld and post-weld inspection, as well as vigilant oversight and surveillance are essential practices to achieve a high-level weldment. For welding endeavors, it is best to do the right thing by doing things right.

Conclusion

There is a criticality to being critical in order to ensure compliance. Being critical verifies the integrity, or lack thereof, of a weld, thereby mitigating the potential tragic consequences of a weldment failure.

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