

Compliance through Competence

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Abstract

Competence assurance is essential in providing customer confidence in manufacturing operations and engineering service delivery. Customers have the right to expect that products and services are not only delivered fit-for-purpose but are safe to use, and will remain so for their specified lives. Welding is a special process, in that it requires knowledge, skill and expertise in planning and executing its application, and its quality cannot be readily verified after the weld is made, because much of the evidence of process control will have been concealed or lost once the weld has been completed.

It is the employer's responsibility to ensure that all personnel are competent to discharge their allocated roles and responsibilities prior to authorising them to work, and third-party certification has a significant part to play in ensuring that appropriate education, training, skill, experience and behaviours are validated and verified prior to authorisation, and are subject to surveillance to assure continued competence. Welding is an essential process for the joining of materials in manufacture, fabrication and repair, and competence assurance of welding personnel is an essential feature in the quality assurance of welded products.

IIW-Thesaurus keywords: Welding; Fusion welding; Quality; Quality assurance; Personnel qualification.

1 An Increasing Focus on Personnel Competence

Personnel competence requirements are being increasingly specified in standards relating to welding and welded products. Welding is possibly one of the most highly regulated manufacturing processes in common use, and the need for this apparent increase in controls is often challenged by practitioners.

Because competence is concerned with personal attributes that affect the employability of an individual, it is an emotive subject [1]. To clarify the competence assurance process, it is essential that specific language and terminology is applied. The first point to recognise is that, in this context, a lack of competence does not mean incompetence; a lack of competence means that there is a knowledge, skill, experience or behaviour gap that must be closed before the individual can be authorised to undertake the full range of responsibilities for the appointed role. Such gaps may be closed by one or a combination of formal or informal education, formal or informal training, on-the-job training, or work under supervision.

The roots for this systems approach to personnel competence assurance are set out in ISO 9001 [2] clause 6.2.1, which states that, 'personnel performing work affecting conformity to product requirements shall be competent on the basis of appropriate education, training, skills and experience.' The associated note makes the very important point that, 'conformity to product requirements can be affected directly or indirectly by personnel performing any task within the quality management system.'

The systems approach to competence assurance is expanded into process steps by ISO 9001 clause 6.2.2, where it is stated that the organization shall:

- a) determine the necessary competence for personnel performing work affecting conformity to product requirements,
- b) where applicable, provide training or take other actions to achieve the necessary competence,
- c) evaluate the effectiveness of the actions taken,
- d) ensure that its personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the quality objectives, and

- e) maintain appropriate records of education, training, skills and experience.

The benefits of competence assurance now start to become clearer as we recognise that the process requires the organization (manufacturer, fabricator, repairer) to understand the competences necessary for each role and set of responsibilities within their quality management system (QMS), and their effect on realisation of product quality. The QMS must include a process to ensure that all personnel allocated to those roles possess the requisite competences and understand their responsibilities for product quality. This approach to competence assurance is designed to develop an organization that comprises personnel who are able to satisfactorily perform their tasks with minimum supervision, and is able to show the benefit of competence assurance in performance (ability/capability) and quality outcomes (customer confidence); both of which are business winning attributes.

If an organization's responsibility for competence assurance is so clearly set out in ISO 9001, it might be reasonable to question the introduction of additional standards specifying personnel competence requirements for welding and welded products. The roots of the development of the most significant of these standards, ISO 3834 [3], are also within ISO 9001. In the 1994 version, the term 'special process' was used to refer to processes that produce outputs for which the quality cannot be verified before being released to the customer. The term 'special process' was not included in the 2000 version of the standard and, today, discussion of special processes has been superseded by ISO 9001:2008 clause 7.5.2, which sets requirements for, 'validation of processes for production and service provision.'

The first part of clause 7.5.2 sets the requirement that, 'the organization shall validate any processes for production and service provision where the resulting output cannot be verified by subsequent monitoring or measurement and, as a consequence, deficiencies become apparent only after the product is in use or the service has been delivered.' The very nature of the welding process, with many of the process variables unrecorded and lost once the weld has been completed, identifies welding as a special process that requires validation. The second part of clause 7.5.2 sets the requirement that, 'validation shall demonstrate the ability of these processes to achieve planned results'. The need to validate welding is acknowledged in the specification and qualification of welding procedures, where welding trials in accordance with the welding procedure are demonstrated and undergo non-destructive and destructive tests to ensure that the procedure will work in practice and fulfil its intended function.

Relative to the safety criticality of the application and the complexity of the welding, the ISO 3834 series determines, at three levels, the specific quality requirements for fusion welding of metallic materials. ISO 3834 addresses all of the following arrangements for a special process that are given in the third part of ISO 9001 clause 7.5.2:

- a) defined criteria for review and approval of the processes,
- b) approval of equipment and qualification of personnel,
- c) use of specific methods and procedures,
- d) requirements for records, and
- e) revalidation

and requires consideration of sufficient other elements of ISO 9001 to enable an effective welding quality management system (WQMS) to be implemented in conjunction with an ISO 9001 QMS, in conjunction with a QMS in accordance with requirements other than ISO 9001, or as a stand-alone WQMS.

Having recognised welding as a special process requiring validation, we must acknowledge that validation of welding requires special competence. Within its five parts, ISO 3834 provides requirements, and Part 6 [4] provides guidelines, that refer to a substantial number of standards that support the validation process but it also sets the competence requirements for personnel involved in the validation and application of welding. It is the way that ISO 3834 adds detail to the human aspects of welding quality requirements that is its greatest strength and most important benefit, and it is this strength and benefit that has resulted in ISO 3834 being used as the core or main reference for other standards aimed at quality control for welded products, including EN 15085, Railway applications – Welding of railway vehicles and components [5], and EN 1090, Execution of steel structures and

aluminium structures [6]. ISO 3834 is being increasingly specified in regulations, standards and specifications, and an understanding of routes to compliance with its competence requirements is essential for organizations involved in welded manufacture, fabrication and repair.

2 Routes to Compliance with Competence Requirements

In most cases, the application of ISO 3834 remains voluntary and, as the standard does not mandate third-party assessment or certification, it is incumbent upon the organization to operate a process as described in ISO 9001 clause 6.2.2 to provide objective evidence of compliance with the personnel competence requirements. ISO 3834 Parts 2 and 3 (ISO 3834-2 and ISO 3834-3), the comprehensive and standard quality requirements, identify the need for competent welders and welding operators, welding coordination personnel, and inspection and testing personnel. The elementary quality requirements of ISO 3834 Part 4 (ISO 3834-4) do not set any specific requirements for welding coordination personnel, only for welders, welding operators and inspection and testing personnel. ISO 3834 Part 5 (ISO 3834-5) specifies the ISO documents with which it is necessary to conform to claim conformity to the quality requirements of ISO 3834-2, ISO 3834-3 or ISO 3834-4. A recent interpretation of ISO 3834-5 clause 2.1 has clarified that the manufacturer's responsibility to demonstrate technically equivalent conditions applies only to adoption of other documents in accordance with sub-clause b), and not to sub-clause c), which provides for the 'adoption of different supporting standards, where these are required in application standards used by the manufacturers' [7].

Manufacturers, fabricators and repairers may well be familiar with qualification of welders in accordance with EN 287-1 [8] and ISO 9606-2 [9] but, bearing in mind the responsibility for the organization to 'determine the necessary competence for personnel performing work affecting conformity to product requirements', and that, 'personnel performing work affecting conformity to product requirements shall be competent on the basis of appropriate education, training, skills and experience', consideration should be given to the non-mandatory job knowledge recommended in the informative Annex C of each standard. Whilst it may be common practice to examine the welder's skill in a practical test that follows a preliminary welding procedure specification (pWPS) or welding procedure specification (WPS), it is likely that the competence requirements of the role also demand demonstration of adequate relevant knowledge to support decision making during production. Unless the requisite knowledge has been gained during education or an apprenticeship, and demonstrated through a relevant vocational qualification, such as a technical certificate or diploma, a test of job knowledge as recommended by EN 287-1 or ISO 9606-2 should be considered.

The tasks and responsibilities of welding coordination personnel are defined in ISO 14731 [10]. Welding coordination is defined as, 'coordination of manufacturing operations for all welding and welding-related activities', including welding inspection, and a person responsible and competent to perform welding coordination is termed a welding coordinator. ISO 14731 identifies the tasks that may be allocated to welding coordination personnel to address all relevant quality requirements set out in ISO 3834. Whilst it is stipulated that at least one person will be made responsible for welding coordination, it is recognised that the organization may choose to allocate responsibility for welding coordination to a number of personnel, including subcontractors. It remains the responsibility of the manufacturer (fabricator, repairer) to achieve compliance with ISO 14731 so, as long as all welding coordinators are competent to undertake their allocated tasks, their roles and responsibilities are clearly defined, and they have the authority to discharge their responsibilities effectively, no specific organizational structure or competence requirements are imposed.

Within the scope of his/her responsibilities, each welding coordinator must possess sufficient technical knowledge to recognise and correct causes or effects that affect product quality, and must have the confidence and authority to stop the production if necessary. With ISO 3834-2 being applied to the most safety critical applications and/or to complex welding applications in terms of materials, metallurgy or process, it is essential that personnel responsible for welding coordination are allocated a substantial position in the organization and have comprehensive technical knowledge relevant to the production and the product. Clause 6 of ISO 14731 sets out the technical knowledge requirements for welding coordination personnel and the informative Annex A recommends the application of the International Institute of Welding (IIW) diplomas, International Welding Engineer (IWE), International Welding Technologist (IWT), and International Welding Specialist (IWS) to satisfaction of the specific knowledge requirements of responsible welding coordinators. The IWE/T/S diplomas provide effective

education in welding engineering in accordance with an internationally harmonised syllabus, IAB-252 [11] but do not confer any assurance of competence. Even if the IWE diploma is used to provide objective evidence of the specific knowledge of an individual welding coordinator, further evidence of relevant training, skills and experience to exemplify the competences identified by the manufacturer for that appointed role and allocated set of responsibilities is necessary to achieve compliance with ISO 14731 and ISO 3834. It is also essential to acknowledge that, directly in line with the competence assurance principles we have followed from their roots in ISO 9001 through ISO 3834, ISO 14731 states that, 'the extent of required manufacturing experience, education and technical knowledge shall be decided by the manufacturing organization, and shall depend on the assigned tasks and responsibilities.' Whilst the informative Annex A of ISO 14731 recommends consideration of the IIW diplomas to evidence appropriate levels of education in welding engineering, it is clear in the normative text of the standard that all methods of learning, to gain the requisite level of technical knowledge, are able to support objective evidence of compliance with requirements. The IIW diplomas, IWE/T/S, should be seen as a useful route to provide objective evidence to satisfy the knowledge requirements of ISO 14731, not a route to compliance with ISO 14731.

ISO 3834 requires a manufacturer (fabricator, repairer) to, 'have at his disposal sufficient and competent personnel for planning, performing and supervising the inspection and testing of the welding production according to specified requirements.' Non-destructive testing (NDT) personnel are required to comply with ISO 9712 [12]. Unless specifically called up by an application standard, such as an ASME code, ASNT SNT-TC-1A qualification of NDT inspectors is not accepted as technically equivalent to ISO 9712, because it does not comply with the independence and impartiality requirements for third-party certification of personnel. Although qualification and certification of NDT personnel in accordance with ISO 9712 is readily available, it still cannot be accepted as satisfying all ISO 3834 competence requirements for inspection and testing personnel. The visual testing method (VT) according to ISO 9712 does not adequately address direct unaided visual inspection, as is commonly applied in welding inspection in accordance with ISO 17637 [13]. Similarly, for all relevant NDT methods, it is incumbent upon the manufacturer to ensure that education and training deliver sufficient welding technology, materials and applications knowledge necessary to support the competences identified for the allocated role and responsibilities.

ISO 3834 addresses the human aspects of welding quality requirements, and references ISO 14731 to define the welding coordination tasks and responsibilities necessary to deliver those requirements. Both standards clearly allocate the responsibility for conformity to the manufacturer, and allocation of welding coordination tasks only to competent personnel is essential in achieving compliance. Whilst welding coordination and compliance with ISO 3834 and ISO 14731 remain the responsibility of the manufacturer, the burden of producing and maintaining objective evidence of conformity for contract negotiation, to show compliance with specification, or for second-party audit, can be substantially reduced through the use of third-party certification.

3 The Role of Certification in Compliance

Independent assessment, verification, validation, certification and surveillance by a third-party conformity assessment body (CAB) may provide a route to conformity that is effectively structured and documented, and can offer significant benefit in generating objective evidence of compliance with ISO 3834 and ISO 14731. However, in the same way that customers of welding services and welded products have the right to expect that they are delivered to the required level of quality by competent personnel, manufacturers seeking certification to ISO 3834 also have the right to expect that third-party auditors, and conformity assessment bodies also possess the competences necessary to validate their compliance with requirements.

Third-party certification of personnel can provide appropriate competence assurance that will support the manufacturer's allocation of welding, welding coordination, and inspection and testing responsibilities. Conformity assessment bodies operating certification of personnel should be expected to comply with ISO/IEC 17024, Conformity assessment – General requirements for bodies operating certification of persons [14] and should be accredited by an accreditation body that is a member of the International Accreditation Forum (IAF). The scope of accreditation of a CAB should also be reviewed to ensure that the body has demonstrated the competence to operate certification schemes that support the manufacturer's specific competence requirements. Accreditation by an IAF member in accordance with ISO/IEC 17024 not only provides independent confirmation of the

competence of the personnel certification body but also provides international recognition via the IAF Multilateral Recognition Arrangement (MLA) in accordance with IAF PR 4, Structure of the IAF MLA and list of IAF endorsed normative documents [15].

To illustrate how third-party certification may or may not address competence requirements, we can use the UKAS document RG0, Guidelines on the competence of personnel undertaking engineering inspections [16] to construct an example. RG0 provides guidelines on the application of Section 8 (Personnel) of ISO/IEC 17020, General criteria for the operation of various types of bodies performing inspection [17]. An inspection body may be an organization or part of an organization that performs inspection and RG0 provides guidance on the means by which inspection bodies can determine the competence of their inspection staff. Consistent with ISO 9001 and ISO 3834, RG0 states that the organization should demonstrate management control over the following process stages to ensure that it has appropriately competent personnel:

- A) Identify the range of inspection activities
- B) Identify the competence required for each activity
- C) Train and assess against the competence criteria
- D) Authorise persons for activities under appropriate supervision
- E) Monitor performance to re-assess competence

Whether using in-house inspection provision or sub-contracting to an inspection body, the manufacturer would be expected to understand the purpose of inspection and the scope of application. It is possible that a third-party personnel certification scheme could offer full compliance with the requirements in B), C) and E). For example, an NDT operator with Level 2 UT certification in accordance with ISO 9712 might be assumed competent to undertake volumetric inspection of a welded joint. In the same way that D), authority to work, remains the responsibility of the manufacturer, so does the identification and assurance of ALL competences necessary to perform the appointed role and discharge the associated responsibilities. Within stage B), identification of the competences required, RG0 highlights the need to consider personal attributes, detection of defects, evaluation of defects, decision making, and inspection scheme development, interpretation and review. Personal attributes such as visual acuity will be addressed by general ISO 9712 certification but the ability to work alone or the physical capability to undertake inspection by ladder access, are attributes that are highly unlikely to be covered under the NDT personnel certification and need to be included in the manufacturer's competence requirements. Similarly, an ISO 9712 Level 2 UT operator will be competent in defect detection for the samples and applications they have experience of but not necessarily for the materials, joint geometries and equipment relevant to a new role. The manufacturer's competence requirements should make these requirements clear, for example by stating, 'ISO 9712 Level 2 in UT plus critical defect sizing endorsement plus two years' experience in UT inspection of welds in C-Steel of up to 50mm thickness plus familiarity with XYZ equipment in combination with ABC probes.' It is clear to see that such detailed assessment of competence requirements can help to specify recruitment advertisements, training needs, experience duration, and scope of personnel certification. On that last point, an effective conformity assessment body providing personnel certification should welcome the involvement of industrial representation to ensure that their certification schemes address industry requirements. TWI Certification Ltd has industry-led scheme management committees and also operates an employer-specific certification scheme, which enables an employer or operator to have an ISO 9712 compliant CSWIP scheme developed to meet the specific requirements of their own NDT procedures and applications. Such a specifically targeted scheme is able to comply with stages A), B), C), and E) of the RG0 competence management process.

Whilst compliance with ISO 3834 does not require certification of the manufacturer, certification has proven to be a particularly efficient method of providing objective evidence of conformity with requirements. Certified manufacturers have found that independent third-party assessment and certification in accordance with recognised standards has made contract negotiation easier, has helped to satisfy customer preferences, has contributed to meeting risk management objectives, and has offered business advantage through improved self-esteem and marketing profile. Unlike ISO 3834, certification is required for welding of railway vehicles and components in accordance with EN 15085-2, and for factory production control systems in accordance with EN 1090-1. Manufacturers working across these product areas could see an even stronger business case for certification of all of their welded production under ISO 3834, especially if bundled with EN 15085 or EN 1090.

Whatever the driver to choose certification in accordance with ISO 3834, the choice of certification body then becomes the highly important next step. Once again, it is essential to select a certification provider that has the demonstrated competence to provide the quality of service and product required. The European co-operation for Accreditation (EA) has produced EA-6/02, EA Guidelines on the Use of EN 45011 and ISO/IEC 17021 for Certification to EN ISO 3834 [18]. These guidelines make it clear that, 'the assessment and certification of the welding capability of a manufacturer in accordance with the requirements of EN ISO 3834 Part 2, 3, or 4, can be provided as an integral part of ISO 9001 assessment and certification, (ISO/IEC 17021), or as a stand-alone assessment and certification of the welding operations and associated activities which influence the integrity of welds (EN 45011).' Although the IIW Manufacturer Certification Scheme (MCS) does not mandate accreditation of its Authorised National Bodies for Company Certification (ANBCCs), it considers EA-6/02 to be an integral part of its rules for operation of the scheme, as stated in IAB-339 [19].

For combined certification to both ISO 9001 and ISO 3834, a manufacturer should expect the certification body to be accredited by an IAF member in accordance with ISO/IEC 17021, Conformity assessment – Requirements for bodies providing audit and certification of management systems [20]. It is essential that ISO 3834 is specified in the scope of accreditation of such bodies to ensure that the special competences relevant to assessment and certification of welding and welded production have been demonstrated and verified.

EA-6/02 is being revised to recognise that EN 45011 has been superseded by ISO/IEC 17065, Conformity assessment – Requirements for bodies certifying products, processes and services [21]. Stand-alone certification to ISO 3834 should, therefore, be undertaken by a certification body accredited by an IAF member in accordance with ISO/IEC 17065 or, during transition, in accordance with EN 45011, General requirements for bodies operating product certification systems [22].

4 Myths, Misnomers and Misconceptions

The majority of conformity challenges experienced by manufacturers seeking compliance with ISO 3834 arise out of unfamiliarity with the standard. It is essential that a manufacturer seeking compliance with ISO 3834 reads all parts of the standard, including the guidelines published as a technical report in Part 6, and in conjunction with ISO 14731 and other relevant documents listed in Part 5. The first major hurdle that manufacturers face is in selecting the level of quality requirements, Comprehensive, Standard or Elementary, relevant to their production. Whilst the requirements for selection of the appropriate quality level are given in ISO 3834-1, there is also additional guidance in ISO 3834-6. Ultimately, it may be necessary to discuss the requisite level of quality with customers to ensure that the choice is acceptable to them. It is important to understand that, in the case of third-party certification, neither the lead assessor nor the certification body is responsible for making the decision on which part of ISO 3834 should be applied. However, non-conformities identified during assessment may indicate that a higher level of quality requirements is necessary for adequate control of the welded production under assessment.

Possibly borne out of its association with ISO 9001, there is a common misconception that ISO 3834 is a quality management system standard, and that a perfect Welding Quality Management Manual can be created to demonstrate conformity. However, whilst document review is an important part of the assessment process, it is the focus on personnel competence that ensures that ISO 3834 demands demonstration of how a welding quality management system is applied in satisfaction of the quality requirements. As welding is a special process, it is important to remember that second and third-party assessors must be competent to assess the scope of work undertaken by a manufacturer, not just to assess the WQMS documentation.

Unfamiliarity with the terms 'welding coordination' and 'responsible welding coordinator' presents the most common challenges, and misinterpretation of the terms in guidance and specifications has led to significant conformity challenges. ISO 3834-1 stipulates that welding coordination personnel are required for compliance with ISO 3834-2 and ISO 3834-3, which both state that appropriate welding coordination personnel must be available, must have their tasks and responsibilities relating to quality activities clearly defined, and must be given sufficient authority to enable them to take necessary action. Compliance with ISO 14731 is then referred to via reference to ISO 3834-5.

Clause 4.2 of ISO 14731 adds the requirement that, 'the manufacturer shall appoint at least one responsible welding coordinator.' It is clearly not the intention of this clause to introduce a new term, simply to state that at least one person in the organization must hold responsibility for welding coordination. This interpretation is supported by clause 3 of ISO 14731, which defines a welding coordinator as a 'person responsible and competent to perform welding coordination.'

It is interpretation and implementation of ISO 14731 clause 6, 'Technical knowledge', and the informative Annex A that generates some complexity and confusion. In contrast with ISO 3834 and other clauses in ISO 14731, clauses 6.1 and 6.2 of ISO 14731 appear to draw a distinction between, 'welding coordination personnel', and, 'responsible welding coordination personnel', in requirements for general knowledge and specific knowledge. 'Responsible welding coordinator' as the title of a role or an individual is not defined anywhere in ISO 3834 or ISO 14731, yet the titles Responsible Welding Coordinator and RWC have entered common use in industry. Whether it is the Welding Engineer, Production Manager, Welding Shop Supervisor, or Senior Welding Inspector who is made responsible for welding coordination within an organisation, or whether their role is defined as Responsible Welding Coordinator, the responsibility can only be allocated to an appropriately competent individual, and it is an appointed role, not a transferable status.

The intention of ISO 14731 clause 6.1 is to establish the knowledge requirements to support the competence of welding coordination personnel, and to make it clear that specialized technical knowledge relevant to the assigned tasks will be necessary. Clause 6.2 then seeks to establish relationships between levels of specific welding knowledge and levels of complexity or criticality in welded production. The reference then to Annex A (informative) has led to the incorrect assumption that the three levels of IIW diploma, IWE, IWT and IWS correlate with the three levels of specific knowledge, comprehensive, specific and basic.

Although guidance on the level of welding knowledge required for each level of quality requirements is given in ISO 3834-6, the desire to interpret linearly the knowledge requirements of ISO 14731 clause 6 has resulted in standards clauses such as, 'All welding and related activities should satisfy the requirements of ISO 3834-2..... The responsible welding coordinator should be qualified as an IWE or as otherwise accepted as given in ISO 14731.' [23] Whilst this may be seen as expressing a preference, it detracts from the competence assurance focus of ISO 3834 and ISO 14731 by suggesting that the IWE diploma is the preferred and most important element for compliance, when in actual fact, the knowledge requirement is only one element in assuring competence for the allocated role. The same standard, ISO 13628-15, goes on to state that, 'welding inspectors shall be qualified in accordance with NS 477 or EWF/IIW or equivalent.' As welding inspection is part of welding coordination, such a requirement is wholly inadequate. NS 477 is a Norwegian national standard, 'Welding – Rules for qualification of welding inspectors' [24], which is only available in Norway and is not compliant with ISO/IEC 17024. 'EWF/IIW' is an incomplete reference to the IIW Guideline IAB-041, International Welding Inspection Personnel – Minimum Requirements for the Education, Examination and Qualification [25], which provides a curriculum for education only and provides no assurance of competence to fulfil the role of a welding inspector. Rather than delivering the intention of raising quality, expressions of preferences in standards create inappropriate restriction on means of compliance that may result in appointment of personnel without the competence to discharge the full range of their responsibilities.

Such expressions in standards have also impacted contract and product specifications in the vein of, 'the RWC must be an IWE'. Whilst preferences in specifications are perfectly acceptable, to avoid ambiguity and confusion, it is essential that standards and specifications express the requirement only and not the means of compliance; the what, and not the how. As is the intention of ISO 3834 and ISO 14731, the emphasis must be on the manufacturer to provide objective evidence of conformity with personnel competence requirements. High value educational qualifications like the IWE, IWT and IWS diplomas have a part to play in competence assurance but they should not be specified as the sole means of compliance. Perversely, the IIW Personnel Certification Scheme (PCS), described in IAB-341, IIW Scheme for Certification of Personnel with Welding Coordination Responsibilities [26], which was actually designed to recognise consolidation of learning through application of welding engineering knowledge in a defined scope of work, would be a more appropriate reference to identify personnel with competence in welding coordination.

5 Conclusions and Recommendations

The inability to verify weld quality after the weld has been made demands management of personnel competence for validation and coordination of the production. ISO 3834 sets the quality requirements for fusion welding, with specific emphasis on competence of welders, welding operators, welding coordinators, and inspection and testing personnel. Whilst compliance with ISO 3834 does not require certification, significant business benefits may be derived from use of a third-party conformity assessment body. To have confidence in their competence to operate relevant personnel and manufacturer certification schemes and to gain benefit from multilateral recognition arrangements, it is recommended that conformity assessment bodies accredited by an IAF member are used.

Irrespective of organizational structure or subcontracting arrangements, welding coordination remains the responsibility of the manufacturer, as does the requirement to provide objective evidence of relevant competence for personnel allocated and authorised to undertake welding coordination responsibilities. Restrictive means of compliance in standards and specifications should be challenged if the manufacturer believes that his/her organization and application of his/her welding quality management system provide adequate alternative means of compliance.

All organizations involved in fusion welding of metallic materials for manufacture, fabrication or repair should familiarise themselves with the ISO 3834 and ISO 14731 standards, and should consider the business benefits of achieving compliance.

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