THE IMPORTANCE OF TRAINING AND EDUCATION IN DEVELOPING COMPETENT WELDING COORDINATORS

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Abstract: The ever growing requirement for skilled welding coordinators has risen alongside advancements in welding technologies and quality standards across various industries. International welding society has implemented the IIW Guideline IAB-252r5-19/SV-02 that provides a structured approach for the training and qualification of welding coordination personnel, emphasizing the importance of education in shaping competent professionals. This paper emphasizes the importance, role and structure of education and training in ensuring compliance with technical standards, fostering safety and quality, and addressing the challenges of modern industrial practices.

Key words: Welding coordination personnel, welding institute, quality assurance, quality control, training, skill education, safety

1. INTRODUCTION

Everyday industrial works include various joining technologies such as welding, adhesive bonding, brazing, bolting, etc. Most certainly, welding plays a vital role in numerous industries, including construction, manufacturing, energy and shipbuilding. The welding process is highly complex and demands strict adherence to quality and safety standards. Welding personnel involved in this process, such are welders, welding operators, non-destructive testing operators, etc. and their competence is playing crucial role in achieving demands of quality standards as well as internal quality. Welding coordinators are integral part of quality assurance processes as well as of production itself, ensuring that operations meet technical specifications and comply with relevant codes.

For this growing branch of industry and as welding is special process, the IAB-International Authorization Board based on the EWF, under the authority of the IIW-International Institute of Welding has prepared and issued The IIW Guideline IAB-252r5-19/SV-02 [1] which outlines the minimum requirements for education, training, and assessment of welding coordination personnel. It serves as a benchmark for producing qualified individuals capable of managing the complexities of welding operations. The guideline emphasizes a balanced approach combining theoretical knowledge, practical skills, and continuous professional development to prepare welding coordinators for industry demands.

2. THE IIW GUIDELINE IAB-252R5-19/SV-02

Welding coordination personnel is responsible for coordination of manufacturing operations for all welding and welding-related activities. It is a person or a group of people performing defined coordination tasks [2]. The IIW guideline is structured to address the diverse roles within welding coordination, and has drawn up different training pathways for different qualification levels. These levels are defined in the standard EN ISO 14731 [2].

This training is divided in several qualification levels depending on the requirement of the trained personnel and their further responsibilities:

- International Welding Engineer (IWE): Advanced technical and managerial expertise.
- International Welding Technologist (IWT): Focused on technical implementation and management.
- International Welding Specialist (IWS): Primarily responsible for quality assurance and execution.

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- International Welding Practitioner (IWP): Skilled personnel managing day-to-day welding tasks.

Demands for personal qualification are defined by the requirements of referent standard to be used in manufacturing process of welding structures in accordance with the series of standards EN ISO 3834 [3]-[8], which describes various levels for fusion welding of metallic materials in several elementary, standard and comprehensive quality requirements.

Each level of qualification builds upon a core curriculum encompassing the following modules:

- Welding Processes and Equipment: Covering manual, semi-automatic, and automated welding methods.
- Materials and Their Behavior During Welding: Analyzing material properties, heat treatment, and metallurgical changes.
- Construction and Design: Focused on weldability, joint design, and structural integrity.
- Fabrication, Application Engineering, and Quality Assurance: Addressing defect prevention, inspection methods, and compliance with international codes.

Qualification levels mostly depend on the requirements and demands of the manufacturers, specific projects, quality assessment and control requirements, but when International Welding Engineer (IWE), or "Advanced technical and managerial expertise" is achieved, all other levels are covered.

As per the IIW guideline, all this training routes are defined in the IIW GUIDELINE IAB-252R5-19/SV-02 [1] and as an example (Figure 1) we can refer to the one of the training programs and route which corresponds to the International Welding Engineer (IWE) training route that is comprehensive, having in mind other qualification levels and their required responsibilities.

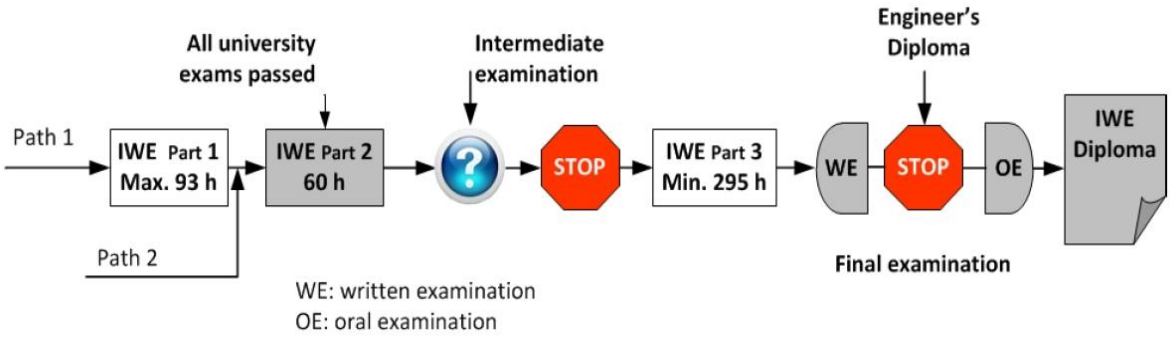

Figure 1 – IWE Route [1]

3. IMPORTANCE OF EDUCATION AND TRAINING FOR WELDING COORDINATORS

As the demands for quality and more practical solutions of the different project and tasks grow, training and education are foundational to the development of competent welding coordinators, with the knowledge and skills necessary to handle the challenges of modern welding operations. The IIW Guideline IAB-252r5-19/SV-02 emphasizes the critical role of a structured, multi-level educational framework. There are various topics on the importance of training and its multifaceted benefits.

3.1. Enhancing Technical Competence

Welding coordinators require in-depth technical knowledge of various welding processes, materials, and equipment. Training programs guided by the IIW standards ensure:

- Comprehensive Understanding: Participants gain a thorough knowledge of fusion welding processes, including manual, semi-automatic, and automated and robotized methods. The focus of the training is not only on welding process, but also to provide knowledge of brazing,

thermal cutting as well as other cutting and bonding techniques, metallurgical insight of different processes that are occurring during this processes of various bounding methods, design requirements, standard and different national regulations that are applied in the domestic market and industrial manufacturing.

- Advanced Problem-Solving: Coordinators learn to troubleshoot welding-related issues, such as distortion, cracking, and metallurgical defects, ensuring seamless production, reduce the cost with adaptation of specific tools, automatization and robotization of the production lines and process.
- Adaptation to New Technologies: Modern training incorporates advancements in automation and digital welding technologies, enabling coordinators to remain competitive in an evolving industry.

Without formal training, coordinators may lack the technical insight necessary to oversee complex operations or respond effectively to unforeseen challenges.

3.2. Ensuring Compliance with Standards

One of the primary responsibilities of welding coordinators is to ensure that welding operations comply with international codes, standards, and specifications. Training based on the IIW guidelines helps:

- Standard Interpretation: Coordinators become proficient in understanding and implementing standards like ISO 3834, etc.
- Regulatory Adherence: Coordinators are trained to identify and address gaps in documentation, procedures, and quality assurance systems, minimizing the risk of project rejections.
- Global Consistency: A standardized training framework ensures that welding coordinators worldwide possess comparable qualifications, fostering international collaboration and mobility.

3.3. Promoting Safety and Quality

Safety and quality is overall goal in welding operations. Improper practices can lead to catastrophic failures, resulting in financial losses, reputational damage, and, in severe cases, loss of life. Education and training play a crucial role in:

- Hazard Identification: Coordinators are trained to recognize potential hazards, such as improper shielding gas selection, incorrect heat input, welding technology process, or equipment malfunction, and implement preventive measures.
- Risk assessment and preventive measures: Training emphasizes the importance of maintaining a safe work environment, including the proper use of personal protective equipment (PPE), ventilation systems, and fire prevention strategies.
- Quality Assurance: Coordinators learn techniques for weld inspection, including visual inspection, non-destructive testing (NDT), and destructive testing, ensuring that welds meet design and safety requirements.

3.4. Bridging the Gap Between Theory and Practice

We are aware that during the education of each student, there are medium or low specific trainings and practical work in academy type of scholarship, so the IIW guideline places significant emphasis on practical training, recognizing that theoretical knowledge alone is insufficient for real-world applications. This practical approach benefits welding coordinators by:

- Hands-On Experience: Coordinators gain direct exposure to welding equipment, processes, and joint designs under controlled conditions.
- Process Optimization: Practical training helps coordinators experiment with parameters such as welding speed, current, and voltage to optimize production efficiency.
- Defect Recognition: Coordinators develop the ability to identify defects during welding operations and understand their causes, allowing for timely corrective actions.

By combining theoretical understanding with practical expertise, coordinators are better equipped to manage and improve welding operations.

3.5. Facilitating Career Advancement

As there are different national routes of scholarship that may vary from each other more or less, International Welding Institute has provided with this guideline that internationally bonds this activity and give easier approach on certificate acceptance by various countries. Education and certification significantly enhance the professional prospects of welding coordinators. The structured training provided by the IIW guideline offers:

- Global Recognition: Certifications such as IWE, IWT, IWS, and IWP are internationally recognized, enabling coordinators to pursue opportunities in various industries and regions.
- Specialized Expertise: Coordinators can choose to specialize in areas like automation, NDT, or advanced materials, increasing their value to employers.
- Leadership Development: Training includes modules on project management, communication, and team leadership, preparing coordinators for supervisory roles.

Well-trained coordinators are not only more employable but also better positioned for promotions and long-term career growth.

3.6. Addressing Industry Challenges

Industries today face challenges such as skill shortages, rising quality expectations, and the rapid pace of technological change. Training programs aligned with the IIW guideline help address these challenges by:

- Meeting Skill Demands: Structured education ensures a steady supply of qualified personnel capable of meeting the growing demand for skilled welding coordinators.
- Driving Innovation: Educated coordinators are more likely to adopt and implement innovative technologies, such as robotic welding systems and real-time weld monitoring tools.
- Improving Efficiency: Training equips coordinators with the skills to optimize welding processes, reducing waste, rework, and project delays.

3.7. Fostering a Culture of Continuous Improvement

The IIW guideline advocates for lifelong learning, emphasizing that education is not a one-time process but a continuous journey. This philosophy fosters a culture of improvement by:

- Encouraging Skill Upgradation: Coordinators are motivated to stay updated on emerging trends, such as additive manufacturing and sustainable welding practices.
- Enabling Knowledge Sharing: Well-trained coordinators serve as mentors and trainers for junior staff, disseminating knowledge throughout the organization.
- Driving Industry Standards: Continuous education helps coordinators contribute to the development and refinement of industry standards and best practices.

Welding coordinators, during their professional carrier, are constantly learning, evolving and implementing new technologies and approaches on solving the problems and tasks, motivated by ever-growing welding as a process in modern industry.

3.8. Economic and Organizational Impact

Training and education also have a direct impact on organizational performance and profitability. With welding coordinators know-how, their employers also have benefits that are manifested during the production and manufacturing activities. Companies that invest in qualified welding coordinators experience:

- Reduced Defects and Rework: Properly trained coordinators ensure that welds are completed correctly the first time, minimizing costly rework.
- Improved Project Timelines: Efficient coordination and defect prevention lead to faster project completion.

- Enhanced Reputation: High-quality work enhances customer satisfaction and strengthens the company's reputation in the marketplace.

Training and education are foundational to the development of competent welding coordinators, equipping them with the knowledge and skills necessary to handle the challenges of modern welding operations. The IIW Guideline IAB-252r5-19/SV-02 underscores the critical role of a structured, multi-level educational framework. Below is an expanded discussion on the importance of training and its multifaceted benefits.

4. CHALLENGES IN IMPLEMENTING TRAINING PROGRAMS

While the IIW guideline provides a robust framework, its implementation is not without challenges:

- Cost and Accessibility: Training and certification can be expensive, particularly in regions with limited access to accredited centers.
- Technological Gaps: Many training institutions lack modern tools such as virtual welding simulators, which are essential for preparing coordinators for contemporary industrial environments.
- Resistance to Change: Industries accustomed to traditional training methods may be reluctant to adopt the standardized approach outlined in the guideline.

These challenges highlight the need for increased investment in training infrastructure, as well as collaboration between industry stakeholders and educational institutions.

5. CASE STUDY: IMPROVING WELDING COORDINATION THROUGH STRUCTURED TRAINING

Companies that have implemented and trained their personnel in accordance with the IIW guideline and have proven to have benefits in their business. During the research time [9] for over a two-year period, the companies that agreed and presented their improvements, observed the following:

- An up to 25% reduction in welding defects, attributed to better understanding and application of welding standards.
- An up to 30% improvement in project timelines due to more efficient management of welding tasks.
- Enhanced safety performance, with a significant decrease in workplace accidents related to welding activities.

This case study underscores the tangible benefits of investing in structured training programs. This type of personnel training, has proven to provide benefits to the manufactures that has provided such training to their employees, and the improvements are mutual, as for this personnel are improving themselves all the time through the various of tasks that they have in front of them during the everyday work.

6. RECOMMENDATIONS

As the training has for more than a 3 decades of application, it could be concluded that in order to maximize the impact of training and education for welding coordinators, the following recommendations can be proposed [9]:

- Expand Access to Training Centers: Establish more accredited centers globally to make education accessible to all regions, particularly in developing countries.
- Integrate Advanced Technologies: Use virtual reality, augmented reality, and simulation tools to enhance the learning experience and better prepare trainees for real-world challenges.
- Promote Continuous Learning: Encourage welding coordinators to pursue lifelong education to stay updated on emerging trends and technologies.

- Develop Industry Partnerships: Foster collaboration between industries and training institutions to align educational programs with market needs.
- Financial Support for Trainees: Provide scholarships, subsidies, or employer-sponsored programs to reduce the financial burden on individuals pursuing certification.

In following years, we will most certainly witness more complex welding and allied processes applications and accordingly, the training of welding coordinators will adapt in the same manner. As the requirements and technology is growing and improving, the IIW Guideline IAB-252r5-19/SV-02 will also be improved and revised, so the upcoming welding coordination personnel can properly respond to the new requests.

7. CONCLUSION

The role of welding coordinators has grown in complexity due to advancements in welding technology, increased regulatory requirements, and the global nature of modern industries. Competent welding coordination personnel are pivotal to ensuring the quality, safety, and efficiency of welding operations.

Training and education, as outlined in the IIW Guideline IAB-252r5-19/SV-02, provide a structured framework to address these demands. By equipping coordinators with both theoretical knowledge and practical expertise, the guideline ensures that they are well-prepared to manage the intricacies of welding processes. Furthermore, the modular nature of the training ensures that coordinators at all levels, from practitioners to engineers, receive tailored education that aligns with their specific roles and responsibilities.

Investing in the training of welding coordinators yields numerous benefits. It not only enhances individual technical competence and career prospects but also contributes to organizational success by improving process efficiency, reducing defects, and ensuring compliance with international standards. On a broader scale, standardized training fosters global workforce mobility, enabling welding coordinators to adapt to diverse industrial environments and cross-border collaborations.

However, challenges such as limited access to training centers, high costs and resistance to adopting new technologies must be addressed to maximize the impact of these programs. Collaborative efforts among industry stakeholders, educational institutions, and regulatory bodies are essential to overcome these obstacles. Initiatives such as expanding access to accredited centers, integrating advanced technologies like virtual reality, and promoting lifelong learning can enhance the reach and effectiveness of welding coordinator training.

8. REFERNCES

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