

TRAINING TOMORROW'S WELDING PERSONNEL

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Industry needs welding personnel who can, with adequate skills and technical knowledge, carry out their work efficiently and evaluate a problem and solve it effectively. Quality management systems like ISO 9000 have given high priority for training and education and mandatory standards for minimum training and education requirements of welding personnel from welder to welding engineer are expected in future.

Well balanced training and education programs, correctly chalked out for the appropriate functional duties and responsibilities, can alone meet our industry requirement. This paper discusses key elements which are essential for effective training and education of welding personnel at various levels.

The Changing Scenario

It is well known in the world of engineering that welding is an important manufacturing process in many industries. The reliability and safety of many products depends on the integrity of the welding joints. In manufacturing industry, the importance of welding is clearly seen throughout the engineering functions of the company e.g. Product Design, materials, Processes and Procedures and Quality Checks.

Since reliability, safety and cost-effectiveness in manufacture depend so much on correct application of welding technology, it follows that the necessary competencies in weld-

ing must be present in the engineering personnel and in the shop floor work force. This means that those having welding responsibilities must be adequately trained and qualified to undertake the tasks involved.

The employment of qualified welding personnel costs money and industry will do this only if it is essential for safety, technical, economic or legal reasons, or it is specified by standards or customers.

The Indian industry, waking up to the world of international quality and competitiveness will have to meet requirements of :-

- * Quality Management systems
- * Codes and Specifications
- * US and European Standards Organizations
- * Welding Societies and
- * National and Foreign Education and Training Directorates

The Welding job functions and Personnel Qualification Levels

Welding Management and Control

The range of welding co-ordination activities which may be needed to be addressed in the management and control of welding are listed below. The person/s responsible and authorised to control/share these activities could be called as WELDING CO-ORDINATOR/S

Range of Welding Co-ordination Activities

- | | |
|--|--|
| * Contract Review | * Equipment |
| * Design Review | * Fabrication procedures |
| * Materials of Construction | * Inspection and Testing |
| * Welding Consumables | * Non-destructive Testing |
| * Management and Control of welding operations | * Assessment of Inspection and testing results |
| * Working Environment | * Weld repairs |
| * Health and Safety | * Acceptance |
| * Welding Procedures | * Documentation |
| * Heat Treatment | |

WELDING CO-ORDINATOR should be able to demonstrate adequate knowledge to enable him/her to perform his/her job functions satisfactorily.

Depending upon the tasks and responsibilities of the job functions and the nature of the product, the technical knowledge level, required for the welding co-ordinator can be described as under :

Technical Knowledge Level for Welding Co-ordinators

- * Comprehensive Technical knowledge for those responsible for all the specified tasks in welding fabrication
- * Specific Technical Knowledge where the technical field is limited
- * Basic Technical Knowledge where technical field is limited and products are simple

The job designation may range from Manager, Sr.Engineer, Engineer, Sr. Supervisor, Supervisor, Sr.Inspector, Inspector, St. Technician, Instructor.

The European Council for Co-operation in Welding (ECCW) has identified four levels of knowledge qualification requirements of welding personnel in welding management and control functions as follows :

Knowledge Qualification Levels for Welding Co-ordinators

- * WELDING ENGINEER
Engineering Degree + Diploma in Welding Engineering
- * WELDING TECHNOLOGIST
Higher Level Engineering Certificate + Diploma in Welding Technology
- * WELDING SPECIALIST
Engineering Certificate or Diploma + Diploma in Welding

- * WELDING PRACTITIONER
Proven Practical Skill + Certificate in Welding Practice

Welding Craft

The WELDER has to possess adequate craft (skill and knowledge) to produce sound weld joint capable of meeting the acceptance requirements for a given or various Construction Types, Processes, Joints, Positions, Thickness, Shapes, Consumables, Materials etc.

The competence level of a WELDER could be grouped as below :

Competence levels for Welders and Welding Operators

Level 1

Competence in the performance of a range of work activities, most of which may be routine and predictable

Level 2

Competence in a significant range of varied work activities, performed in a variety of contexts. Some activities are complex or non routine, and there is some individual responsibility.

Level 3

Competence in a broad range of varied work activities performed in a wide variety of contexts, most of which are complex and non routine. There is a considerable responsibility and autonomy, and control or guiding of others is often required.

The job designation may range from Tacker, Welder Trainee, Welder, Sr. Welder, Master Welder, etc.

The qualification of the welding craft competency at various levels can be obtained through several routes mentioned below :

Qualification routes for welding craft competency

- * Directly into employment and learning on the job
- * Passing out of Technical Institute and learning on the job
- * Completion of requirements of Vocational Education Scheme
- * Trained and Certified by Private Welder Training Schools
- * Trained and Certified by Welding Institutes
- * Trained and Certified in-house by the manufacturer

The acceptance criteria vary with level of competence and include :

- * safe and true understanding of the process and its potential
- * completion of plate welds to specified standards
- * completion of pipe welds to specified standards

Development of Welding Education and Training Programs/Courses

Technical Programs

Welding Training and Education Institutes play a significant role in development of application oriented technical programs for the personnel involved in management and control of welding. These programs must supplement what is taught in colleges and universities and must empower the personnel to solve the real problems effectively and efficiently.

The critical factors to be taken into account for development and presentation of successful programs are :-

- * course content should be appropriate to the job functions
- * the course presentation should be correct mix of lectures, demonstrations, discussions and problem solving
- * the evaluation should assess the ability to make use of knowledge gained, to solve problems of application of implementation
- * the course duration should be appropriate to the ease of drawing out the personnel from their normal activities

For example a short list is presented in **Table - 1** below showing various programs for Managers, Engineers, Supervisors and Inspectors.

Skills Courses

Welding Training and Education Institutes also play a significant role in development of Skills courses for the would be welders or practising Welders. These courses must be deliber-

ately biased towards practical welding rather than welding theory. The trained personnel must be able to gain the practical excellence, understand the welding process operation, equipment care, safety standards, and welding procedures.

The critical factors to be taken into account for development and execution of successful courses :

- * the course structuring should be based on a trainee entering with no welding experience and leaving at the end of a defined period with the necessary skill required by the employer or that needed to gain employment as a skilled craftsman in a defined area of welding skill
- * the course should consist of a series of practical welding exercises in which specific material types, thickness, shapes, (plate work or pipe) welding positions, joint geometry etc. are encountered.

- * the course modules should be prepared on the basis of elementary through to advanced, for a particular fusion process and the exercises within a course should be arranged to take into account of the increased skill requirements for successful completion
- * the course evaluation should indicate the ability of the trainee to complete the exercises on Distinction, Merit or pass grade
- * the course duration should be appropriate for a trainee of average ability whose dexterity and skill allows achievement of the practical exercise to minimum standards

For example a short list is presented in **Table - 2** below showing various courses for Welder trainees, Welders, Sr. Welders

Table - 1

Job Function	Course Title	Duration
QA/Planning	- Development of QA & QC for Welding	3 days
	- Welding Codes & their Applications	3 days
	- Welding Procedures & Qualifications	3 days
Production	- Refresher Course in Welding Technology	6 days
	- Foundation Course for Welders, Foremen and Supervisors	6 days
QC	- Certification Course for Welding Inspectors	6 days

Table - 2

Process	Level	Title	Duration
SMAW	Basic	Shielded Metal Arc Welding	8 weeks
	Advanced	Pipe Welding	4 weeks
		Pipe Welder Certification	2 weeks
GTAW	Basic	Gas Shielded Tungsten Arc Welding	1 week
	Advanced	Pipe and Tube Welding	2 weeks
GMAW	Basic	Gas Shielded Metal Arc Welding (CO ₂)	1 week

Key Elements for Effective Education & Training

Well designed education and training programs/courses can turn out to be effective both for the participants and their employers only when :

the choice of the program/course is made properly by the participant/employer, after going through the course contents and

the chosen program/course can meet the following criteria

Facilities	are	spacious, well equipped
Course ware	is	focussed, structured, comprehensive
Faculty	is	trained, experienced, special-ised
Instruction method	is	multilevel with lectures, videos, slides, films demonstration, participation, practice
Evaluation	is	as per well defined standards, specs., guidelines
Feedback	is	collected for corrective action.

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