

## WELDING ERGONOMICS - ELEMENTS

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**Abstract:** Elements of ergonomics presented with focus on ergonomics in welding, are treated in their interdisciplinary context. Priority items are addressed as general: minimizing risks and occupational diseases by the concept of secure products, processes and systems welder operator adaptation, risk assessment and possible risk factors, the concerns of international professional bodies in the field.

**Key words:** ergonomics, welding, Work Related Musculoskeletal Disorders

### 1. INTRODUCTION

Ergonomics studies the behaviour of the human body in the working process, having as its end the optimisation of the respective activities. Therefore, when it was established more interdisciplinary sciences and disciplines concurred (Figure 1).

The main study object of ergonomics, in the man - machine system, from the work physiology point of view, imposes the analyses and as a consequence, considers the biomechanical conditions when performing the work and implicitly physical repercussions, but also the intellectual ones on the human body functions.



Fig. 1. Interdisciplinary synthesis ergonomics

On the other hand occupational medicine, is what is involved in tracking people adapt to their jobs, depending on the specific demands of work, early detection of morpho - multifunctional changes of the body under the influence of environmental factors, analysis of factors of adaptability and causes morbidity, diagnosis of deficiencies occurring conditions offered by certain jobs, psychology and especially work psychology is concerned with human mental attributes in relation to all of the objective conditions of work. Following the study of behaviour of mental mechanisms work and the impact of various factors on these mechanisms, psychology, through its functions, is the one that provides items such as: rational and balanced involvement of human psychological function in work tasks, psychological mechanisms of its actions determine the degree of mental application, study and psychological limits of human determination.

Sociology provides information on social factors needed to consider how to adapt human at work, of work to the man, respectively.

Technical sciences occur when the relationship between ergonomics and technical sciences manifest two-way. If on one hand data and knowledge are used in designing ergonomic

machinery and technology, on the other hand, depending on technical issues which require being resolved, are established the new trends of research in the field of ergonomics

Ergonomics stands out as a two-way relation with ergonomics. If on the one hand, ergonomic research allows an optimum organization of work, under the conditions of modern production, on the other hand, organizational economic studies have to answer to the efficiency concept.

### 2. PRINCIPLES OF ERGONOMICS IN WELDING TECHNIQUE

Welding itself is a demanding profession which requires safe operation, the total concentration on the subject of labour, routine work, reflected in much skill. Ergonomic principles, applied in welding, lead to performance, economic efficiency and productivity, in a developed activity, under quality assurance conditions.

WELDING, in turn, has a strong interdisciplinary impact on the study and its application intervene in many sciences, technologies and disciplines (metallurgy physics, heat treatment, physics of welding processes and allied ones, electro technique and electronics, automation, robots, elements of artificial intelligence, design and achievement in integrated manufacturing welded structures, certification, reliability, destructive and non-destructive inspection, quality assurance etc.).

Research developed in the field of welding ergonomics knows a remarkable dynamic. Two concepts are more and more used, which are specific to the ergonomics environment: the ergonomics of the process and that of the products, with reference to activities in the field of welding and allied techniques. It tends to follow the implementation of measures to avoid physical constraints of welding operators (position - effort) and cognitive constraints (complexity-regularity).

If in the field of welding processes the target is the correct placement of equipment, corresponding lightning, correct working position, correct ventilation etc., as regards products, the issue is different.

Ergonomics is focussing on changing things:

- *Issues due to no corresponding welding ergonomics*
  - Musculoskeletal disorders (MSD)
  - Injury due to repetitive movements
  - Lower productivity
  - No corresponding quality
  - Worker's lack of satisfaction
  - High absenteeism at work
  - Increased medical costs
- *Symptoms of musculoskeletal disorders*
  - Less resistance to welding duties
  - Limited movement
  - Partial or complete loss of muscle function
  - Joints and painful joints accompanied by swelling or inflammation
  - Sensations of pain or numbness, burning

- Stiffness or back injuries - the pain, the spine twists and degradation
- Bursitis - a bag of liquid that appears to elbow, shoulder, knee, etc.
- Carpal tunnel syndrome - numbness, tingling of the limbs generally
- Tendonitis and tenosynovitis
- Chest syndrome - which affects the nerves passing from the neck in her arms

- *Practical solution in welding ergonomics*

- Keeping elbows close to body, within the personal comfort
- Avoid short and long positions, avoid repetitive extreme movements avoiding low, uncomfortable position on a longer duration without breaks
- Finding solutions to avoid pressure points or compression occurring in the spine of welders operators;
- Use hand tools and lighter design with a holder adapted
- Use suspended tools when suitable and fastening devices
- Ensure sufficient rest to those who welds

- *Designing factors of working post in the field of welding*

- Location of work adapted for operators
- Organizing work process
- Tool weight design of devices and household
- Biomechanics body operator in operations and activities
- The type and quality of protective equipment used
- Workstation environment
- Workplace physical requirements
- Mental requirements (motivation, alertness, concentration)
- Strength and size operators

Many injuries can be developed when there is a mismatch between the capabilities of the working force and the requirements of welding operator's tasks.

### 3. RISK FACTORS WHEN WELDING

Risk assessment in the field of welding is very important as it represents the way to working places with a healthy and secure climate. It is a dynamic process that allows employers and occupational organizations to implement a proactive risk management policy at work. Risk assessment approach to welding, is done in stages:

1. Identification of hazards and of the operators exposed during the welding process.
2. Assessment of welding risks and their classification in order of their importance.
3. Deciding on preventive action to be taken to.
4. Adoption of concrete measures according to the case
5. Their monitoring and periodic review

### 4. WELDING ERGONOMICS CRITERIA APPROACH

Relevant requirements are those which are to be addressed as ergonomics according to several criteria:

- Generated by the intended purpose
- Required by state or implementation phase
- Dependent on the subject concerns
- Depending on content

Related criterion "to watching" refers to adapting work to human ergonomics, human adaptation to that work. On the other hand "stage" and "implementation phase" refers to the concept. "The purpose of concerns" refers either to production or the product.

Regarding the "content" is made to ergonomics survey information cognitively involved, based on perception and reasoning and decision topoeergonomics, which deals with research and dimensional design of machines, control bodies of working places according to human anthropometric data, and

bio ergonomics referring to the phenomenon of fatigue of human body in relation to elements of work organization.

### 5. APPROACH SPECIALIZED BODIES

Welding ergonomics is approached by specialized bodies in the field such as the International Institute of Welding (IIS/IIW), that by its Commissions has preoccupations directed (it is the concrete case of Commission VIII), international standardizations forums and the European Welding Federation (EWF) (Figure 2). Depending on the results of their concerns there come the actions for implementation.

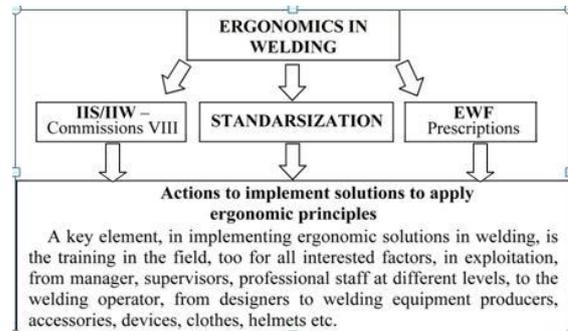


Fig. 2. Implications of international organizations

### 6. PROFESSIONAL TRAINING IN THE FIELD

A key element, in implementing ergonomic solutions in welding, is the training in the field, too for all interested factors. So, training is made from manager, supervisors, professional staff at different levels, to the welding operator, from designers to welding equipment producers, accessories, devices, clothes, helmets etc. Their training and the continuous watching of changes in legislation and professional directives is compulsory.

### 7. CONCLUSIONS

It insists on the importance of ergonomics in approaching processes and products with particularization on welding technique.

The approaching criteria of welding ergonomics, risk factors and steps in their assessment, as well as the focalization on symptoms MSD, practical solutions and designing factors of working posts in the field of welding complete the data presented.

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