FSW-Tech

Friction Stir Welding European Qualifications

CU5 – Health & Safety

FSW Operator

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5. Health & Safety

5.1 – Safety Regulations

5.2 – Common Hazards derived from FSW

5.3 – Preventive Measures

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5.1 – Safety Regulations

There are no specific safety regulations regarding the friction stir welding process as it doesn't represent any particular hazard to the operator

Common cautions must be taken regarding:

- ✓ Ergonomics
- ✓ Machine-to-operator interaction.

BS EN ISO 13857:2008 – Safety of machinery. Safety distances to prevent hazard zones being reached by upper and lower limbs.

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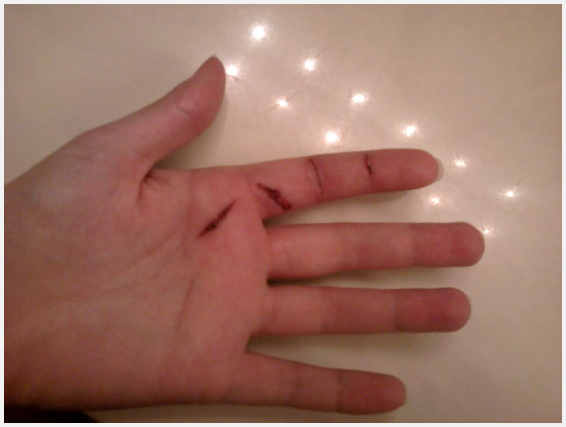
5.2 – Common Hazards derived from FSW

- Skin burns – by handling hot parts (tool, welded piece)
- Cuts from metal debris – scraping near sharp edges



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5.2 – Common Hazards derived from FSW

Electrical Risks

- The main risks related to electricity are: electrical shock and fire.
- Frayed cord and loose or broken connections can create a **short circuit.**

To minimize the risks operator should always:

- Check visually external wiring and equipment before use
- Verify normal function before making equipment before use
- Check that equipment used near sinks or other water sources is properly insulated and grounded
- Switch current off at the wall outlet or unplug immediately if coolant gets into the electrical components

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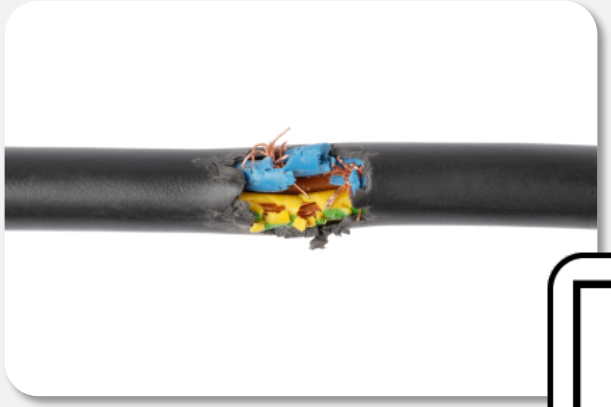
5.2 – Common Hazards derived from FSW



Frayed cord

Risk of Electric Shock Label

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5.2 – Common Hazards derived from FSW

Mechanical Risks

Machinery with rotating parts, like FSW machine, can catch loose clothing, hands or hair, potentially lead to serious injuries. There is also a possibility that uncovered parts may fly off and create additional risk, especially for eye injuries.

To minimize risks, operator should always:

- Carry out "daily machine check" before starting FSW machine to ensure that rotating shafts, belts and pulleys are covered by guards, lids or covers
- Always check devices, which are attached to a rotor before use, to ensure that they are tightly fastened
- During welding always wear eye protection, because the tool is an uncovered rotating part, which can fracture and violently ejected from the machine
- Do not touch sharp objects (e.g. sharp edges on workpiece) with bare hands, use protective gloves instead, but the gloves must not be worn when using the machine
- Check if there is a sufficient space around the machine, to avoid being pushed by machine, which can result in injury
- Secure long hair and loose clothing, remove any dangling jewellery
- Wear safety boots that have a protective reinforcement in the toe, to protect the foot from falling objects

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5.2 – Common Hazards derived from FSW

Safety boots
(reinforced toe)

Protective gloves

Eye protection and
eye protection label

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5.2 – Common Hazards derived from FSW

During operation of conventional machine tools or dedicated FSW machines, operator should:

- Be careful during closing movement of parts, which can result in finger trapping
- Be aware of heavy objects, which can fall from table

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5.2 – Common Hazards derived from FSW

Finger trap warning symbol

Example of risk

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5.2 – Common Hazards derived from FSW

During operation of robotic FSW machines, operator should remember:

- Unauthorized entry into a safeguarded area by someone who is unfamiliar with safety operation of robots can result in body crashing
- There is possibility of fault within the power system (hydraulic, electrical, pneumatic), control system, software, electromagnetic interference, and radio frequency interference, which can create erratic behaviour and increase in the hazardous energy potential of the machine

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5.2 – Common Hazards derived from FSW

The FSW process can emit **noise** at high levels, but main risk can come from sheet metal work before or after welding.

- Long exposure to sound in excess of 85 decibels (dB) contributes to cumulative damage to inner ear hair cells, which can further lead to permanent loss of hearing at the specific frequencies to which the lost hair cells were sensitive. If operator work in conditions above the upper level of 85dB, the employer must provide hearing protection and ensure that it is worn. In other cases, hearing protection should be available on request to employees.
- High-impact noise cause eardrum perforation. The eardrum perforations will heal, but every time this happens scar tissue build up on the eardrum and makes it less sensitive to sound waves.

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5.2 – Common Hazards derived from FSW

- During FSW the **heat is generated by friction** - the maximum temperature can reach of 0.8 of the melting temperature, so the workpiece and the tool can be hot. Heating can create fire and injury hazards. Directly after the weld is completed, the operator should wear heat-resistant gloves during manipulating with workpiece or tool.
- Operator should allow ample time for heated objects (workpiece and tool) before touching them. The temperature of the workpiece can be checked using pyrometer.

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5.3 – Preventive Measures

Pyrometer – for fast checking of the workpiece temperature

Heat-resistant gloves

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5.3 – Preventive Measures

- The health hazard related to welding can especially occur in hybrid methods, like laser and arc assisted FSW.
- Immediate and acute hazards include:
  - Burn to the skin
  - Slash burns to the eyes
  - Fire
  - Welding fume and gases
- As with any welding process, operator should follow proper guidelines to avoid injury. Personal protective equipment should be used only as a last resort, after all other control measures have been considered, or as a short term contingency during emergency / maintenance / repair or as an additional protective measure. PPE, used during FSW, can include basic equipment such as protective glasses, hearing protection, safety boots and heat-resistant gloves.

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5.3 – Preventive Measures

- ✓ Current friction stir welding **machines** provide <u>**safety features**</u> built-in to ensure operator safety
  - Reduce the risk of injury while the operator is interacting with the machine
  - Guard rails with e-stop triggers at access points, pressure pads and ladders
- ✓ Wear appropriate **clothing** – work overall and gloves suitable for this task.
- ✓ While in operation, workers should stay clear of the machine since the rotating pin "picks up" everything it touches (i.e. gloves, clothes, rags) and may cause an accident.

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