FSW-Tech

Friction Stir Welding European Qualifications

CU5 – Health & Safety

FSW Specialist & Engineer

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5. Health & Safety

5.1 – Health & Safety Plan

5.2 – General Health and Safety measures

5.3 – Specific Health and Safety measures for FSW

5.4 – Causes of Risks & Accidents

5.5 – Measures to prevent or minimize risks

5.6 – Extended list of risks

5.7 – Risks associated to FSW and associated accidents

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5.1 – Health and Safety Plan (Safety regulations)

- Company Health and Safety rules and goals
  - ✓ Context
  - ✓ Purpose
  - ✓ Organisation
  - ✓ Policy

- Management Plan
  - ✓ Legal Requirements
  - ✓ Administrative Requirements
  - ✓ Accident Reporting and Investigation
  - ✓ Roles and Responsibilities

- Risk and Hazards Identification and Assessment
- Appointments
- Basic Emergency Procedures
- Industrial Regulation

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 – General Health and Safety measures

- Employer duties
- Workplace
- Personnel Protective Equipment (PPE)
- Manual Handling Operations
- Use and provision of work equipment
- Reporting injuries or illness
- Reportable occupational diseases
- Working Time

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5.3 – Specific Health and Safety measures for FSW

- ✓ Operator friendly process
- ✓ Risk associated to it is very low
- ✓ Nil production of fumes and gases
- ✓ No radiations like ultraviolet, infrared and visible light

FSW Safety Measures

Built in Machine Safety Features

General Operator's Cautions

- ✓ Guard rails with e-stop triggers at access points
- ✓ Pressure pads and ladders
- ✓ Multiple sensors to collect different information

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5.4 – Causes of Risks & Accidents

- Bad assessment of workers capabilities
- Operator poorly informed of risks for operating the machine
- Inadequate machinery training
- Operator does not comply with health and safety measures
- Workplace is not in conformity with Health and Safety requirements
- Operator behaves carelessly when operating with the equipment
- Operator exceeds safety recommended work hours
- Operator violates procedure
- Lack of monitoring and supervision
- Management pressure on operator to meet production targets
- Communication issues (e.g. between shifts, between personnel and management)

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5.4 – Causes of Risks & Accidents

- Tests and inspections not carried out properly
- Inappropriate factory layout, without considering risk assessment
- Inadequate maintenance of machinery
- Programmed maintenance skipped
- Defects on safety system
- Inappropriate conduction of safety test
- Inadequate control and monitoring of the machinery
- Defects on machinery not identified on quality measurements procedures
- Inadequate risk assessment plan
- Failure to learn lessons from past incidents

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5.5 – Measures to prevent or minimize risks

- ✓ Risk assessment
- ✓ Risk mitigation
- ✓ Risk contingency

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5.6 – Risks associated to FSW and associated accidents

- ✓ Common electrical or mechanical hazards
- ✓ Skin burns
- ✓ Cuts from metal debris

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5.6 – Risks associated to FSW and associated accidents

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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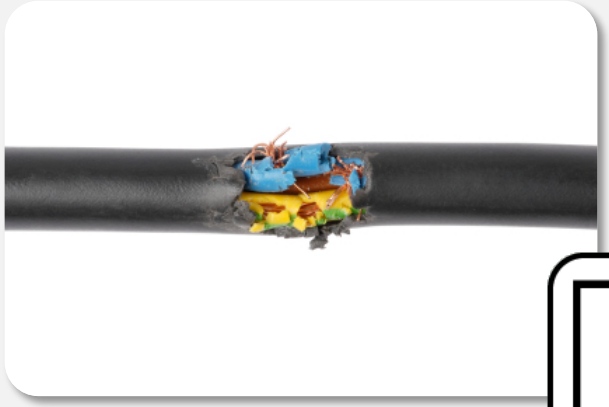
5.6 – Risks associated to FSW and associated accidents



Frayed cord

Risk of Electric Shock Label

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5.6 – Risks associated to FSW and associated accidents

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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5.6 – Risks associated to FSW and associated accidents

Safety boots
(reinforced toe)

Protective gloves

Eye protection and
eye protection label

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5.6 – Risks associated to FSW and associated accidents

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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5.6 – Risks associated to FSW and associated accidents

Finger trap warning symbol

Example of risk

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5.6 – Risks associated to FSW and associated accidents

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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5.6 – Risks associated to FSW and associated accidents

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5.6 – Risks associated to FSW and associated accidents

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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5.6 – Risks associated to FSW and associated accidents

- 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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Friction Stir Welding European Qualifications

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