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**Health and safety in welding —  
Guidelines for risk assessment of  
welding fabrication activities**

*Hygiène et sécurité en soudage - Lignes directrices pour l'évaluation  
des risques des activités de fabrication de soudage*

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Published in Switzerland

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## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is I1W, *International Institute of Welding*, Commission VIII.

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## Introduction

This Technical Report was prepared by the International Institute of Welding (IIW), Commission VIII: Health, Safety, and Environment.

It constitutes the concerns of this expert group on the possible hazards and risks to be considered during arc welding and allied processes in order to help welding fabricators to identify countermeasures in order to minimize exposures to risk. The experts have drawn on views expressed in previous IIW Commission VIII documents on this topic and information published in papers in the scientific literature. The latter are listed in the Bibliography.

This Technical Report provides tables of possible risks associated with welding and allied activities, focusing on possible consequent harm and damages. The lists contain the most common health and safety aspects related to welding, but do not purport to be exhaustive.

In addition, [Annex A](#) reports information on possible actions to be implemented to reduce the risk, and [Annex B](#) suggests relations among processes typically allied activities. [Annex C](#) gives information about the use of this risk assessment procedure as part of a health and safety management system for welding fabrication.

This Technical Report is not intended to replace or supersede national, regional, or local legislation.

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# Health and safety in welding — Guidelines for risk assessment of welding fabrication activities

## 1 Scope

This Technical Report provides guidance for the assessment of the health and safety aspects of welding fabrication of metallic materials, including on-site and repair work. This Technical Report applies to welding and allied processes which are covered by the following processes in accordance with ISO 4063:

- arc welding (process number 1);
- gas welding (process number 3);
- cutting and gouging [process number 8 (excluding 84 laser cutting)].

For the purpose of this Technical Report, allied processes includes joint preparation and grinding.

Other processes, such as the following, might have similar health and safety aspects but are not directly addressed by this Technical Report:

- soldering and brazing;
- thermal spraying;
- pre-heating and post weld heat treatments;
- flame straightening and mechanical straightening.

This Technical Report includes a list of hazards, harms, and damages with reference to assessment procedures and a guide for possible preventive actions.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4063, *Welding and allied processes — Nomenclature of processes and reference numbers*

ISO 14731, *Welding coordination — Tasks and responsibilities*

ISO 31000, *Risk management — Principles and guidelines*

ISO/TR 25901, *Welding and related processes — Vocabulary*

ISO/IEC Guide 2, *Standardization and related activities — General vocabulary*

ISO/IEC Guide 51, *Safety aspects — Guidelines for their inclusion in standards*

ISO/IEC Guide 73, *Risk management — Vocabulary — Guidelines for use in standards*

IEC 31010, *Risk management — Risk assessment techniques*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/TR 25901, ISO/IEC Guide 2, ISO/IEC Guide 51, ISO/IEC Guide 73, and the following apply.

#### 3.1 hazard

source or situation with a potential for harm, which in this Technical Report comprises injury, occupational disease, death, material damage, and/or other loss

#### 3.2 risk

combination of the likelihood and consequence(s) of a specified hazardous event, typically quantified by means of a risk assessment

### 4 Use of this document

This Technical Report provides lists for the assessment of health and safety aspects of welding fabrication of metallic materials, including on-site and repair work. In order to perform such assessments, an understanding of the following topics is required:

- occupational health and safety;
- welding fabrication;
- management systems.

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For the intended use of this Technical Report, the support of welding coordination personnel is needed. Tasks and responsibilities of welding coordination personnel are defined in ISO 14731.

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### 5 Procedures

It is in the employer's interest that personnel are able to work in a healthy and safe environment as this has a direct influence on productivity and motivation. Common sense should dictate measures to maintain the health and safety of operators in manufacturing environments. Beyond this, other requirements that ensure the health and safety of welding personnel during welding and allied activities can originate from a number of sources such as

- legal requirements, often at the national and/or regional level,
- customer requirements,
- insurance requirements, and
- certification requirements.

NOTE This Technical Report does not replace or supersede legal requirements.

### 6 Risk assessment principles

Accidents and occupational diseases can ruin lives and affect business if output is lost, machinery or property is damaged, and can lead to an increase in insurance costs. Risk assessments and risk assessment techniques are described in various national and international guidelines and International Standards (e.g. ISO 31000 and IEC 31010), which generally follow the same principal sequence.

A risk assessment is a systematic examination of hazards in a specific activity, in order to consider precautions to prevent harm as depicted in [Figure 1](#).



This Technical Report can help in identifying possible hazards related to, and harm arising from, welding and allied activities (steps 2 and 3 in [Figure 1](#)) as well as in reducing or even preventing the associated risks (step 6 in [Figure 1](#)).

Occupational Exposure Limits (OEL) or other reference levels may apply, but protection of the health and safety conditions is, as a general rule, a continuous process for which gradual improvements are targeted (see [Annex C](#)).

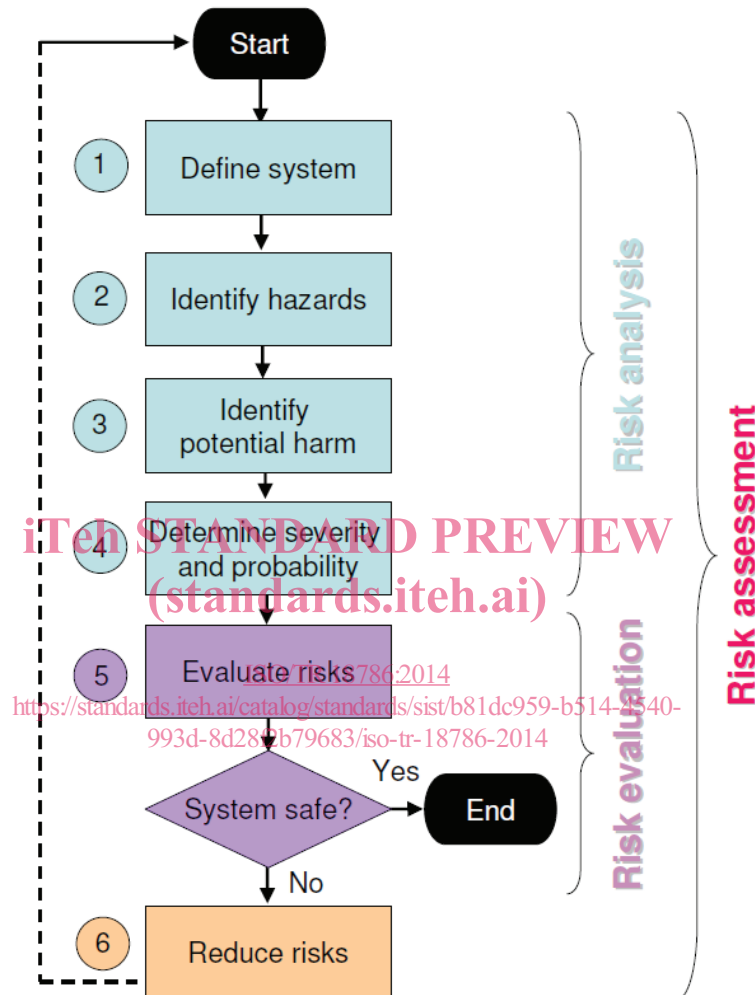


Figure 1 — Principle of risk assessment

## 7 Risk assessment for welding and allied activities

The lists in this Technical Report can be used as a tool for health and safety analysis and for the identification of possible problem areas. In general, this applies to the following situations:

- when planning a fabrication, the implementation of new fabrication methods or equipment;
- the identification of procedures that might require specific monitoring or checks of health and safety aspects;
- the specification of safety procedures for welding and for handling, storing, and disposing of welding-related substances that might be hazardous to health and safety.

This assessment is based on the following steps:

- a) Identify the hazards arising from the activity (as referred to in [Table 1](#)).
- b) Identify the potential harm arising from the hazard (as referred to in [Table 2](#)).
- c) Based on that, preventive measures (substitute with a safer process, reduce, or protect) can be implemented in order to minimize the probability and/or the severity of the harm. [Annex A](#) lists possible preventive and corrective measures which can be typically applied.

## 8 List for welding and allied activities

**Table 1 — Hazard identification**

A-No.	Activity	Hazard	H-No.
<b>Welding processes (W)</b>			
W1	Fusion welding in general	Ergonomic aspects (body work, body posture, climate etc.)	H1
		Fumes, gases, vapours, and/or dust (explosive, inflammable, toxic, suffocating etc.)	H2.2
W2	Arc welding, cutting, and joint preparation using an electrical arc	Optical radiation	H3
		Hot (incl. liquid) metal, spatter, and/or slag	H4
		Hot surfaces	H5
		Electrical currents	H6
W3	Gas welding, cutting and joint preparation using a gas flame	Electromagnetic fields	H6.1
		Optical radiation	H3
		Hot (incl. liquid) metal, spatter, and/or slag	H4
		Hot surfaces	H5
		Flame	H7
<b>General activities (G)</b>			
G1	Grinding/mechanical cutting and joint preparation	Projectiles	H8
		Sparks	H9
		Noise	H10
		Dust and fumes	H2.1
		Sharp edges	H11
		Vibration	H12
		Hot surfaces	H5
G2	Cleaning	Hazardous materials (acids, solvents, gases, etc.)	H14
		Sharp edges	H11
G3	Operating electrical tools	Electrical currents	H6
G4	Using compressed air	Projectiles	H8
G5	Cutting in general	Released parts or stresses	H15

Table 1 (continued)

A-No.	Activity	Hazard	H-No.
G6	Mechanized, semi-automated and fully automated processes	Moving machinery	H16
<b>Activities associated with specific welding processes (A)</b>			
A1	Slag removal	Hot (incl. liquid) metal, spatter, and/or slag	H4
		Projectiles	H8
		Noise	H10
A2	Gas handling	Hazardous materials (acids, solvents, gases etc.)	H14
		Pressurized gas	H17
A3	Drying of electrodes and flux/powder	Hot surfaces	H5
A4	Flux/powder handling	Dust	H2
		Ergonomic aspects (body work, body posture, climate, etc.)	H1
A5	Disposal of electrode stubs	Hot surfaces	H5
		Slipping	H18
A6	Regrinding of thoriated tungsten electrodes	Radioactive dust	H19
<b>Surroundings/welding environment (S)</b>			
S1	Welding in dangerous or sensitive environments	Explosive atmosphere	H20
		Combustible materials	H21
S2	Welding in confined spaces	Ergonomic aspects (body work, body posture, climate, etc.)	H1
		Fumes, gases, vapours, and/or dust (explosive, inflammable, toxic, suffocating, etc.)	H2.2
		Exposure	H22
S3	Welding in electrically conducting surroundings	Electrical currents, elevated hazard	H6.2
S4	Welding under water	Ergonomic aspects (body work, body posture, climate, etc.)	H1
		Electrical currents	H6
		Diving related hazards	H23