BRITISH STANDARD

BS EN
14717:2005

Welding and allied processes — Environmental check list

The European Standard EN 14717:2005 has the status of a British Standard

ICS 13.020.01; 25.160.01

National foreword

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The UK participation in its preparation was entrusted to Technical Committee WEE/-/1, Briefing committee for welding, which has the responsibility to:

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 28 April 2005

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 15 and a back cover.

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Amendments issued since publication

Amd. No.	Date	Comments

ISBN 0 580 45981 0

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14717

April 2005

ICS 13.020.01; 25.160.01

English version

Welding and allied processes - Environmental check list

Soudage et techniques connexes - Liste de vérification relative à l'environnement

Schweißen und verwandte Prozesse - Umweltcheckliste

This European Standard was approved by CEN on 15 March 2005.

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Ref. No. EN 14717:2005: E

Contents

Foreword

This document (EN 14717:2005) has been prepared by Technical Committee CEN/TC 121 “Welding”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2005, and conflicting national standards shall be withdrawn at the latest by October 2005.

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Introduction

Protection of the environment is a key political issue in Europe and elsewhere. Protection of the environment is taken in a very broad sense. What is meant is the total life cycle aspects of, e.g. a product on the environment, including expenditure of energy and during all phases from mining of raw materials, fabrication, packaging, distribution, use, scrapping, recycling of materials, etc. However, assessment of all aspects of the welded product or structure during its entire lifetime cycle is beyond the scope of the present document. The document is limited to aspects directly related to welding fabrication.

The design of the fabricated structures puts a lower limit on the expenditure of energy during joint preparation and welding, on the consumption of consumables and consequently on emissions of fumes and gases during welding, etc. but the design phase is not covered by the document.

Welding fabrication has many environmental aspects. This document provides for a checklist, which may be used for identification of environmental aspects during welding fabrication.

Provisions have to be restricted to a general guidance. Limit values are specified in national laws.

Some of the environmental aspects also have an implication for occupational health and safety, but the check list in this document is incomplete for this use.

1 Scope

This document provides check lists for the assessment of the environmental aspects of welding fabrication of metallic materials including site and repair work. Informative annexes indicate recommended actions for avoiding and reducing the possible environmental impacts outside the workshop.

2 Normative references

Not applicable.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
welding fabrication
welding fabrication includes (for the purpose of this document) the following activities and associated processes:

- joint preparation including thermal cutting and grinding;
- surface preparation including sand blasting, shot blasting, shot peening, chemical pickling and cleaning;
- welding, including grinding and back gouging;
- soldering and brazing;
- thermal spraying;
- preheating and heat treatments;
- flame straightening and mechanical straightening;
- inspection and testing of welds and thermal sprayed surfaces.

3.2
disposal
collection, sorting, transport and treatment of waste as well as its storage and tipping above or under ground, the transformation operations necessary for its re-use, recovery or recycling [Directive 75/442/EEC]

3.3
environment
surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation [EN ISO 14001:2004]

3.4
environmental aspect
element of an organization's activities or products or services that can interact with the environment
[EN ISO 14001:2004]

3.5
environmental impact
any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects [EN ISO 14001:2004]

4 Procedures

Requirements for the protection of the environment during welding fabrication can originate from a number of sources such as:

– legal requirements, often at the national level;

– commercial requirements (customer requirements);

– economical requirements, e.g. related to insurance.

Annex B provides further comments on the possible requirements.

Absolute limits, e.g. emissions, can apply but protection of the environment is, as a general rule, a continuous process for which gradual improvements are aimed.

The check lists in the document can be used as a tool for determination of possible problem areas. In general this applies to the following situations:

– when planning a fabrication, the application of new methods of fabrication or new equipment;

– for identification of procedures for monitoring or checks of actual environmental aspects;

– for specification of procedures for handling, storage and disposal of environmentally harmful substances.

All check lists state possible environmental aspects. Many aspects can be identified during the planning stage as having no environmental impact. Others can be shown to be of no significance by monitoring or checking the production processes. A few can result in further action to comply with the requirements. Annex A provides some general guidance for assessment and possible actions.

5 Check lists of possible environmental aspects

Table 1 — Common to welding fabrication

Common to welding fabrication	
Consumables	Check for: - Disposal of containers, packaging material, etc.; - Disposal of used consumables and waste materials.
Equipment	Check for: - Energy and fuel efficiency; - Generation of physical aspects, e.g. noise, heat and radiation; - Requirements for spare parts and consumables for maintenance; - Procedures for disposal of the equipment.
Work operation	Check for: - Disposal of scrap; - Emission of fumes, gases and aerosols; - Energy and fuel consumption; - Fire hazards and explosion risks whenever there is a risk of ignition; - Generation of physical aspects, e.g. heat, light, noise, radiation.
NOTE Several of the aspects listed above have a limited range of influence. It depends on the circumstances whether they represent an environmental aspect or not. Noise may e.g. not represent an environmental aspect when working in a large workshop but may be a serious problem when working on site or performing repair work in residential areas.	

Table 2 — Joint and surface preparation, weld dressing, surface treatment and cleaning

Joint and surface preparation, weld dressing, surface treatment and cleaning	
Cleaning, pickling and other chemical treatment	Check for: - Disposal of cleaning agents and other chemicals; – Vapours; – Leakage of consumables, cleaning agents, etc. from storage vessels representing a risk of contamination of soil, drains, watercourses or groundwater; – Emission of hazardous substances in the air.
Grinding and gouging	Check for: – Disposal of dust, used grinding wheels and other tools for grinding; – Dust explosions; – Emission of dust; [a] – Noise.
Sandblasting, shot blasting, shot peening, etc.	Check for: – Disposal of dust and used sand/shot; – Emission of dust; [a] – Noise.
Thermal cutting	Check for: – Disposal of scrap, slag or mud; – Emission of UV-/IR-radiation; – Emission of dust; [a] – Noise; – Use of coolants; – Emission of hazardous gases, e.g. nitrogen oxide (if relevant).
[a] Un-controlled emission of dust (not least when working on site) may represent a risk of contamination of soil, drains, watercourses or groundwater, e.g. by heavy metals.	

Table 3 — Welding, brazing and soldering

Welding, brazing and soldering	
Welding, brazing and soldering	Check for: – Disposal of non-permanent backing; – Disposal of slag, fluxes and powders; – Emission of UV-/IR-radiation; – Emission of fume, dust and gases; [a] – Noise; – Use of coolants.
[a] Un-controlled emission of dust (not least when working on site) may represent a risk of contamination of soil, drains, watercourses or groundwater, e.g. by heavy metals.	

Table 4 — Thermal spraying

Thermal spraying	
Thermal spraying	Check for: – Emission of fume and dust; – Disposal of dust; – Noise; – Pollution of water curtain; – Radiation (arc processes).

Table 5 — Pre- and post heating and post weld heat treatment

Pre- and post heating and post weld heat treatment	
Pre- and post heating and post weld heat treatment	Check for: – Disposal of insulating materials and other materials (in particular for temporary ovens); – Use of coolants. – Energy consumption (e.g. efficiency of insulation).

Table 6 — Inspection and testing

Inspection and testing	
Inspection and testing	Check for: – Disposal of chemicals used for development of radiographs; – Disposal of radiographs after use; – Ionising radiation; – Use and disposal of fluids and powders used for magnetic particle testing; – Use and disposal of penetrant and cleaning materials; – Cleaning/disposal of UT couplants.

Table 7 — Destructive testing

Destructive testing	
Destructive testing	Check for: – Use and disposal of chemicals used for preparation of test pieces; – Disposal of scrap and test pieces after use; – Environmental aspects related to sampling and preparation of test pieces. Table 2 may be used as a check list.

Annex A
(informative)

Assessment and recommended actions

The table below gives some indications of the assessment of the environmental aspects and some suggestions for actions in case any adverse environmental impact has been identified.

Table A.1 — Assessment and recommended actions

Environmental aspect	Suggested assessment	Recommended actions when adverse environmental impact has been identified
Chemicals used for development of radiographs	Development of radiographs includes the use of potentially harmful chemicals.	Used chemicals should be neutralised before disposal or special arrangements for disposal should be established. Used fixing baths hold silver, which can be recycled. Use digital radiography, whenever possible.
Cleaning agents	Cleaning fluids can include elements harmful to the environment. The environmental effects should be assessed for all cleaning agents, which evaporate significantly during use or storage. Water based cleaning fluids are usually less harmful than other cleaning agents.	Some fluids can be cleaned by filtration or distillation and re-used. Substitute other cleaning agents by water based cleaning fluids, if possible. Other fluids have to be disposed, e.g. by burning (organic fluids). Cleaning fluids should preferably be limited to non-cyclic hydrocarbon, aqueous cleaning agents or equivalent non-halogenated or halogen-free organic degreasing agents.
Coolants	Some welding power sources, laser beam sources and other equipment incorporate a cooling system. Some systems use direct water-cooling. Other systems include a refrigerating unit and use either water or the ambient air for secondary cooling. Check systems for leaks. Check for environmental consequences of emission of heat to surroundings. Check for use of cooling water.	Recycling of coolants and use of cooling towers may diminish waste. Use of waste heat for heating purposes e.g. room heating might also be a possibility. Check the efficiency of waste water treatment (if needed).

Table A.1 *(continued)*

Environmental aspect	Suggested assessment	Recommended actions when adverse environmental impact has been identified
Energy consumption	The total amount of joint preparation and welding and the corresponding expenditure of energy are determined largely by the design of the fabricated structures. However, ineffective work planning, repair work and ineffective process control can result in augmented energy consumption.	Efficient process control is important in order to avoid unnecessary expenditure of energy during repair and rework. Waste of consumables and raw materials is reduced at the same time. Check energy consumption of ventilation system. Check energy consumption of manipulators, fixtures and other auxiliary equipment.
Equipment	The disposal of equipment should be planned in order to minimize environmental effects.	Materials and parts of equipment should be recycled whenever possible. Special arrangements for disposal of remaining parts of equipment in garbage dumps can be required. Disposal of radioactive isotopes used for radiography represents a special problem, usually regulated by national law.
Explosions	Explosions are usually caused by one of the following: – Leakage of fuel gas or acetylene resulting in an explosive concentration especially in confined spaces. – Repair welding on storage vessels holding or having held an inflammable medium. – Dispersing of deposited dust. However, special techniques have been developed e.g. for hot tapping of gas pipelines. See also fire hazards.	Perform regular checks of hoses, gas installations, etc. Avoid cutting and repair welding on vessels holding remains of oil, gasoline, etc. Regular cleaning of the workplace and equipment. Enclosure of equipment to prevent dust deposit.
Fire hazards	Fire hazards can be caused by the heat from flames, sparks, hot spatter or hot materials. Fire hazards are, in particular, a problem when working on site, e.g. for repair work. Fire can develop very slowly and can sometimes be observed until several hours after ignition.	Combustible items close to the workplace should be removed whenever possible or at least shielded properly. Fire extinguishers should be readily at hand. Keep the welding site under regular surveillance during off-hours.

Table A.1 *(continued)*

Environmental aspect	Suggested assessment	Recommended actions when adverse environmental impact has been identified
Fire hazards due to oxygen enrichment	An unusual but potentially very dangerous fire hazard is due to oxygen enrichment. If a leak e.g. in an oxygen hose raises the oxygen concentration in a confined space, any fire can develop rapidly and violently.	Perform regular checks of hoses, oxygen installations, etc.
Fumes and gases	Fumes and gases can be removed by ventilation from the workplace into the environment unless effective filters are included in the flow. Check effectiveness of ventilation system and in particular of the filters. The nature of the emissions depends on the welding procedure. Control involves determination of the nature of possible emissions and subsequent determination of the amount of emission of each particular substance. Metallic oxides are a very common emission. Gases are usually not removed by filters. However, many protective gases are a normal constituent of the atmosphere and as such not harmful. This is the case for argon, nitrogen and oxygen. Helium is not harmful but is drawn from a limited resource. CO_2 is not directly harmful but can have an effect as a green house gas. The emission of other gases such as NO should be kept as low as possible. Ozone can also occur but is usually neutralised within a short distance from the welding workplace. Other possible gaseous decomposition products like xylene, ethanol, butanol, methanol, isopropylalcohol, formaldehyde, phenol etc. have to be analysed if they are supposed to be emitted in relevant quantity that might harm the environment.	Use more efficient filters. Fumes and gases emission can be reduced by choosing lower polluting processes and with appropriate process control. Check the function of filters, automatic switch-off/ alert in case limit values are exceeded, etc.
Insulating materials (in particular for temporary ovens)	Insulating materials often consist of mineral or glass wool. Older equipment may also include asbestos as an insulation. Materials used for insulation during preheating or for temporary ovens are often disposed after heat treatment or preheating. The materials are not biodegradable and can rarely be recycled.	Special arrangements for disposal in garbage dumps may be required. [a]

Table A.1 *(concluded)*

Environmental aspect	Suggested assessment	Recommended actions when adverse environmental impact has been identified
Ionising radiation	The radiation from X-ray sources and radioactive isotopes is harmful to the environment. Distance is important and the problems are usually most pronounced when working on site in build-up areas.	Minimised the harmful effects by effective screening.
Light	Emission of non-ionising radiation usually has a minimal impact on the more distant environment. However, emission of light from arc welding can be a problem for welding on site and repair welding in build-up areas. Laser beams can present a more serious threat if going astray, e.g. due to reflections. High power focussed laser beams easily penetrate simple screens used for arc welding. However, the main danger is collimated but unfocussed beams, which can damage the eyes. The safe distance for powerful collimated, unfocussed YAG laser beams is of the order several kilometres.	Use effective light screen when welding on site and for repair welding. Safety devices should be installed which prevent collimated, unfocussed beams to be directed towards areas outside the laser beam cell.
Magnetic particle testing	Fluid and powders for magnetic particle testing can represent an environmental aspect due to hydrocarbons.	Use biodegradable and water soluble fluids, whenever possible. Use adequate procedures for disposal.
Noise	Noise may be difficult to attenuate. However, distance is essential for the environmental impact and problems are usually limited to work on site and to workplaces close to residential areas.	Check emission of noise from ventilation systems. Special arrangements may be needed when working in or close to residential areas.
Radiographs after use	Radiographs hold silver which may be re-cycled.	Silver can be recycled. Use digital radiography, whenever possible.
Scrap	Metal materials can hold alloy elements which can be harmful to the environment.	Scrap from different materials groups should be kept apart and free of contamination in order to facilitate re-cycling. Check layout of parts in plates, etc. in order to nest as close as possible and minimise the amount of scrap.
Slag and mud	Slag and mud can include chemical elements harmful to the environment such as heavy metals.	Re-cycling of slag and mud is not common. Special arrangements for disposal in garbage dumps can be required. Mud can occasionally be used for other purposes, depending on the chemical composition.

[a] Asbestos is harmful to health and disposal is in many countries regulated by national law.

Annex B
(informative)

Requirements

Requirements for the control of environmental impacts and the corresponding limit values for emissions depend on many factors and cannot be standardised. The following table provides comments on the various categories of requirements. The requirements can be legal in which case a limit value is specified or there can be a requirement for continual improvement as in EN ISO 14001.

Table B.1 — Category of requirements

Category of requirements	Comments
Regulations	Regulations are specified nationally and can depend on the location of the welding operations. The regulations usually specify limits for emissions and conditions for disposal of waste.
Commercial	Company management can have formulated an environmental policy, e.g. based on the requirements in EN ISO 14001.
	Customers may also require a formalised system (even certified) for environmental management, e.g. by reference to EN ISO 14001.
	Implementation of a strict environmental policy can make the company more attractive to new employees.
	Good relations with the local community can, in certain cases, require a reduction of one or more of the environmental impacts.
Economical	Efficient quality control is an efficient means for reduction of many environmental impacts - and also for reduction of costs.
	The costs related to disposal of waste, etc. might make it attractive to reduce the environmental impacts.
	Requirements for the control of the environmental impacts can be of importance for insurance conditions.
Occupational health and safety	Many environmental impacts also influence the occupational health and safety for the personnel involved in welding and vice versa. Legal or some other requirement can make it necessary to reduce one or more environmental impact in order to comply with the requirement to occupational health and safety. It should be noted, however, that the occupational health and safety is influenced by additional factors, which do not have any environmental impact. Some environmental impacts do not have any direct influence on the occupational health and safety. The check lists in this document can give some guidance but they are inadequate as check lists as regards impacts on the occupational health and safety

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