Preventive measures for hot work

Working Together for Safety Recommendation 034E/2020

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Introduction

This recommendation discusses preventive measures for hot work on surface-treated materials, such as painted metal structures.

Challenges relating to fire and explosion hazards are not covered in this document, nor are health hazards relating to the metal being worked on or welding gas, welding wire, fluxes, etc.

The recommendation provides information about the health hazards associated with chemicals that may be formed upon the thermal decomposition of paints or other surface coatings, and provides advice about measures which can prevent this.

If the coating cannot be removed using other means, the additional exposure that hot work involves must be taken into account when implementing measures and selecting personal protective equipment. Surface coatings containing lead and asbestos are discussed in particular.

Purpose

This recommendation is intended for workers, management, HSE personnel, safety representatives, company health services and organisations which carry out or have a supervisory duty for hot work.

Changes from previous revision

All references in the previous revision has been reviewed and updated. Furthermore, some text has been added in the current revision:

- More information on chlorine and hormone mimics
- More information about exposure to radon
- More text about risk assessment and the precautionary principle
- SfS recommendation 009E «Breathing air and Respiratory Protective Equipment» has been included as a reference.

Background

Ensuring safety during hot work is a challenge, in terms of both safety relating to the risk of fire and explosion, and safety relating to health hazards. Useful information about this is provided on the Norwegian Labour Inspection Authority's web pages. Furthermore, The Norwegian Labour Inspection Authority's regulation regarding the execution of work (Regulations regarding the execution of work, use of equipment and accompanying technical requirements, FOR-2011-12-06-1357) sets requirements for the risk assessment of various aspects of the work, such as mapping, planning and implementation of measures that can limit health hazards posed by the work. The regulations state that an appropriate health check shall always be performed when employees may be exposed to hazardous chemicals.

The regulation regarding action and exposure limit values (Regulations regarding action values and exposure limit values in the working environment,) as well as groups at risk of infection by biological factors, FOR-2011-12-06-1358) is also important in this context. The challenges relating to hot work on surface-treated materials are not unique to the petroleum industry but are particularly relevant in the event of repairs to and the demolition of structures. Working Together for Safety has therefore found it appropriate to collate knowledge and experience from the industry in a dedicated recommendation.

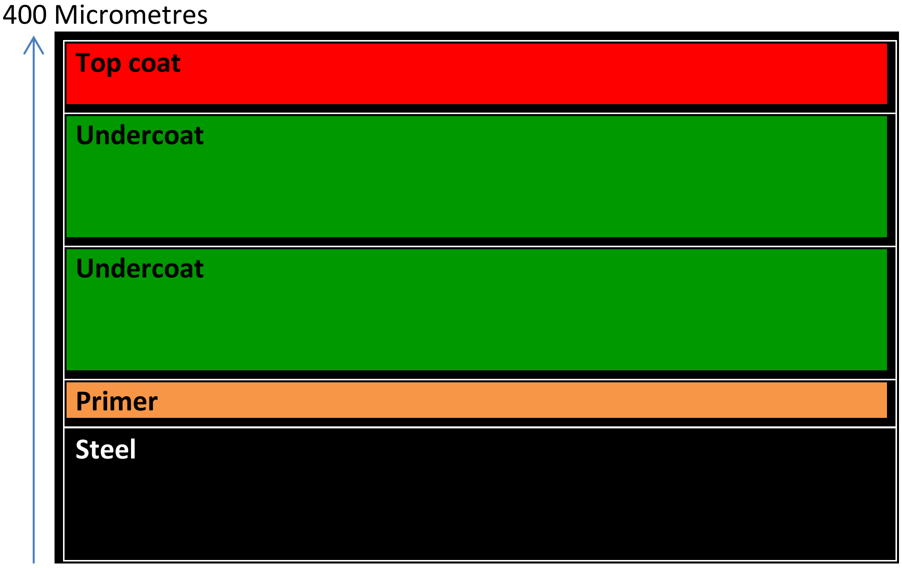
The recommendation focuses on hot work on surface-treated materials that results in temperatures which cause the thermal decomposition (breakdown) of coating films and sprayed-on fire insulation, and the consequent formation of hazardous substances.

Paints, plastics and polyurethanes start to break down at approximately 150 °C. A number of work operations and the use of tools can result in a rise to such temperatures. The breakdown of components releases chemicals in the form of gases and results in the formation of dust. The dust may contain constituents from the paint that are not the result of decomposition. Dust (metals, quartz, asbestos) can also be released through other kinds of work. Grinding with rotary tools does not usually result in a temperature high enough to cause the paint to decompose but will result in the formation of dust. An important issue is sprayed-on fire insulation containing asbestos. Any mechanical work on such insulation (including cold work) demands compliance with the measures specified in the Regulation regarding the execution of work.

The surface coating may have been applied some time ago, and as shown below will usually consist of several layers, e.g. several types of paint. Work situations often vary and can be unpredictable. Because the content of the surface coating is often unknown, it is not practical to base risk assessments on measurements of pollutants in the work atmosphere or on a survey of the types of paint used.

There is significant potential for health hazards associated with hot work – see the chapter about these on page 6. **A reduced risk level for hot work on painted components on installations in the petroleum industry must therefore be based on exposure-reducing measures that consider all the critical components and effects described above (the precautionary principle).**

Example of paint system composition



Possible content:

Polyurethane
Fluorourethane
Epoxy
Polyester
Vinyl (PVC)
Acrylic
Alkyd
etc.

400 micrometres = 0.4 litres per $1m^2$

Exposure conditions

Survey of paint systems

On the initiative of Working Together for Safety, a preliminary survey of the paint systems that have been used in the industry has been carried out. The source for the survey is the oil industry's database of safety data sheets, which was found to contain 74 different safety data sheets for paints or paint systems.

The purpose of the survey is to obtain an overview of the types of paint systems that have been used, and on this basis prepare a qualitative overview of the possible hazardous exposures that may occur upon the thermal decomposition of these. The overview is therefore only qualitative – it does not provide information about combinations of paint systems, when they were used, the amount used or their location.

Paint systems

The survey showed that the following binding agents have been used:

- Epoxy (including tar epoxy)
- Alkyds
- Polyurethane
- Amino resins
- Primers with organic binding agents and metal compounds (e.g. iron epoxy or zinc alkyd primers)

- Primers with inorganic binding agents (e.g. zinc silicate paint)
- Vinyl paint
- Chlorine-caoutchouc paints

Products of thermal decomposition

Paint system	Examples of decomposition products
All	Carbon monoxide (CO), Carbon dioxide (CO_2), Nitrogen oxides (NO_x)
Polyurethane and amino resins	Isocyanates (diisocyanates, isocyanic acid, methyl isocyanate), aldehydes, amines, cyanides
Alkyd	Aldehydes, anhydrides (for example phthalic anhydride, maleic anhydride, trimaleic anhydryde.
Epoxy	Aliphatic amines, phenol, Bisphenol A, aldehydes, cyanides
Polyester	Styrene

Additives that can present a health hazard upon heating and eventual thermal decomposition:

- Tar/PAH
- Metals (Lead, Zinc, Copper, Chrome)
- Quartz
- Methylenedianiline
- Silicon
- Chlorinated paraffins (found as additives)
- Organotin compounds (to prevent fouling)
- Chlorine-caoutchouc
- Nanomaterials in newer paint types
- Hormone mimics

About lead/lead compounds

In the event of hot work, particularly on older installations and facilities, one must consider the possibility that paint containing lead may be present (e.g. zinc ethyl silicate with lead pigment, often intense yellow colours).

Zinc primers may contain lead pollutants, which can be released during hot work and sand blasting. The person responsible for the operation must undertake a survey of and provide information about any lead-containing paint when preparing for demolition work or other activities.

About asbestos used as a surface coating

Prior to the introduction of the asbestos ban in 1984, asbestos was also used in spray-on fire protection. Such asbestos-containing coatings represent a health hazard in the event of any work that produces dust, not only during hot work. The person responsible for the operation must undertake a survey of and provide information about any asbestos when preparing for demolition work or other activities.

Fumes and ultrafine particles

Some work operations result in the formation of fumes/ultrafine particles, which represent a significant health hazard because:

- They are carriers of chemicals, and these are therefore transported into the airways.
- Ultrafine particles are associated with the development of chronic obstructive pulmonary disease (COPD). It is also suspected that ultrafine particles may contribute to the development of cardiovascular diseases.

Health hazards associated with pollutants released by hot work on previously surface-treated materials

Based on the survey of the pollutants that may be released during hot work on surface-treated materials, there are a number of types of health hazards, both acute and chronic, which are relevant:

Respiratory allergies

Allergic asthma can be caused by isocyanates or phthalic anhydride. A diagnosis can be verified by the presence of antibodies. Symptoms may be delayed in relation to the exposure, a so-called “late asthmatic response”. The allergy can be caused by low levels of exposure.

Serious irritation of the airways – pulmonary oedema

This life-threatening condition can occur following overexposure to highly irritant (caustic) substances that affect the lungs. These substances often have low water solubility, which weakens the warning irritation (and smell) in the nose and throat that one otherwise associates with irritant substances. Typical substances that have such an effect are nitrous gases and phosgene.
Pulmonary oedema may occur several hours after exposure. Exposure far in excess of the occupational exposure limit is necessary for such a risk to occur.

Chronic irritation of the airways / bronchitis / COPD

Repeated exposure to irritating substances, particularly in connection with exposure to dust, is a risk factor for the development of chronic bronchitis and COPD. The predominant exposure will probably come from the material being worked with, but pollutants from the surface coating may also contribute. This particularly applies in the event of prolonged, repeated exposure and in combination with smoking.

Poisoning hazards

Certain types of coatings may produce toxic substances during thermal decomposition.
A typical example is hydrogen cyanide, which can be formed upon the decomposition of nitrogen-containing materials, such as polyurethane. In practice, the poisoning hazard is only likely to occur in extreme situations, such as during work in enclosed spaces without sufficient ventilation. Risks are also posed by mixed exposures.

The thermal decomposition (combustion) of organic substances can, under certain conditions, give rise to carbon monoxide (CO), which is a toxic substance. Again, in practice it is extreme conditions and mixed exposures that present a risk here. Gases (such as carbon monoxide) may collect in enclosed and poorly ventilated spaces, and displace oxygen from the air. During hot work, substances from the surface coating may contribute to this.

Exposure to lead can cause chronic poisoning, and is discussed in detail in the Chemical Regulations. Poisoning presents as brain damage and nerve damage with paralysis, damage to the bone marrow with a low haemoglobin percentage (anaemia), and damage to the kidneys. During pregnancy there is a risk of damage to the foetus. Exposed workers must be monitored using biological tests.

Metal fume fever

The inhalation of fumes from certain metals can cause metal fume fever, a temporary flu-like condition with symptoms of fever and muscle aches. It is generally the metal being worked with that gives rise to the pollutant, but the surface coating may also contain metals that can cause this. A typical example is work on galvanised products.

“Reactive airways dysfunction syndrome” (RADS)

This is a condition that one must be aware of when monitoring employees who are exposed to high concentrations of irritant substances, such as in the event of accidents or high levels of exposure in enclosed spaces. RADS occurs following accidental overexposure and develops into a chronic over-sensitivity to irritant substances.

Risk of cancer and reproductive hazards

In particular, types of paints with the addition of tar/PAH may represent a risk of cancer upon the inhalation of dust and gas. Work on several paint types that contain quartz may produce respirable dust (classified as carcinogenic), which again represents a risk of cancer.

The isocyanate monomer TDI (toluene diisocyanate), which can be released upon the heat-treatment of polyurethane, is classified as posing a possible cancer risk. The isocyanate monomer MDI (methylene diphenyl diisocyanate) is also associated with a risk of cancer.

Asbestos fibres released during work represent a significant risk of lung cancer and pleural cancer (mesothelioma). Chlorinated paraffins are classified as possibly carcinogenic if the fibres are inhaled. Bisphenol A is classified as hazardous to reproduction (hormone mimic).

Increased risk of severe pneumonia, interaction of exposures?

Several cases of severe pneumonia have been observed in welders, some with a fatal outcome. It is not clear which exposures are directly pathogenic, but an interaction of several types of pollutants that can be released during hot work is suspected, including metal fumes and pollutants released from the surface coating. The described cases of severe pneumonia appeared 1-2 days after exposure. It can also be assumed that several cases have not been linked to the occupational exposure and have therefore not been registered.

Skin diseases

The pollutants that are formed may come into contact with the skin, both via direct contact and via contaminated work tools. In the event of prolonged contact with this mixture of various chemicals, particularly with simultaneous moisture on the skin, the worker is at risk of developing allergic or irritant contact eczema. For example, some metals (nickel, chromium) and chemicals (isocyanates, acid anhydrides) can be extremely allergenic.

Chemicals and acoustic trauma

The relevant work operations often result in noise, and possible ototoxic chemicals that can increase the risk of acoustic trauma must therefore also be taken into consideration. Solvents, carbon monoxide, and metals such as lead, mercury and manganese are examples of ototoxic chemicals.

Risk assessment

Risk assessment of the relevant work operations

In accordance with regulations, the employer must undertake a specific risk assessment prior to all work operations that may pose a health hazard. Risk assessments of specific work operations must take prior knowledge of the risk factors that are present into account. Preventive measures must be prioritised based on existing opportunities, primarily if there are alternatives to hot work or the hazardous components can be removed using another method. Opportunities for specific exposure control must also be evaluated. This must be documented in a risk assessment.

General risk assessment

In practice, situations will often arise where critical hazardous components or critical effects cannot be identified. It will not usually be possible to identify the paint type of the relevant component or undertake measurements of possible pollutants during the work. One must take into account the fact that hot work on painted components on the installation can form hazardous compounds in concentrations that are hazardous to health, with the consequences described above. It is therefore not possible to take an approach that is specifically targeted towards individual chemicals due to the many possibilities for mixed exposures and combined effects as described above.

The exposure conditions will vary, and even though the exposure can be monitored using dust meters, relevant occupational exposure limits will not exist for mixed exposures. Dust meters may be used to survey exposures and the effect of measures but will not document the absence of health hazards.

Hot work is a well-known risk factor for the development of respiratory disorders such as asthma, chronic bronchitis, COPD and an increased risk of lung cancer. The products that are released from surface coatings constitute a significant additional risk, not only with regard to the chronic diseases described above, but also as a possible cause of acute and other poisonings. In Norwegian workplaces, it has also been observed that hot work on surface-treated materials can result in acute, life-threatening damage to the lungs.

A reduced level of risk during hot work on painted components on installations in the petroleum industry must therefore be based on exposure-reducing measures that take all the critical components and effects described above into account. This can be achieved by removing the surface coating using another method, or by utilising technical solutions and protective equipment. Personnel on the periphery of the work area must also be covered by the risk assessment. This particularly applies to work indoors and where ventilation is poor.

When evaluating the health risk of paints based on safety data sheets, one must ensure that the data sheet for the relevant colour is used. This is because different colours may contain different additives, e.g. lead chromates.

Lead and asbestos

The person responsible for the operation shall carry out a survey to establish whether parts of the installation/facility may contain lead-containing paints or asbestos-containing materials. If the presence of lead and asbestos cannot be ruled out, the provisions regarding lead and lead compounds in the “Regulations regarding the execution of work” (§ 3) apply.

Exposure-reducing measures:

Tasks are being prepared in workshops to an ever-increasing extent so that almost finished parts can be sent to the installation, reducing the need for hot work. However, there is still a need for hot work on installations.

Alternatives to hot work on surface-treated metals

Note that alternative methods for removing surface coatings may result in other kinds of environmental challenges. The usual precautions must be taken regardless of the chosen method – good personal hygiene, safe disposal of waste, and the safe handling of workwear and equipment.

Methods for removing surface coatings:

- Grinding with rotary equipment/tools that do not result in a temperature above approx. 150°C: Operation time limit due to vibrations, noise and dust.
- Water jetting: Method with operation time limit due to noise and vibrations. Also poses challenges relating to steam, water/dust particles and ergonomics.
- Sandblasting: Operational limitations due to noise, vibrations and dust problems.
- Vacuum blasting: Sandblasting with a vacuum produces less dust and noise than traditional sandblasting.
- Sponge blasting: Small particles “wrapped” in epoxy or polyurethane “foam”, seldom used. Challenges with noise and dust.
- Induction removal: The surface is electrically heated to 100-110°C, then the paint is scraped off. This is a method which seems to become increasingly common but requires relatively cumbersome equipment with electrical cables and water pipes.
- Chemical removal: Seldom used. Effective on old paint coatings, such as vinyl paints. Can save on use of water jetting.
- Needle picking: Work time limit due to noise and vibrations.
- Wet blasting: Like sandblasting, but with added water to control dust. Effective for jobs in areas that are easy to keep clean.
- Dry ice blasting: Pellets of dry ice. Limited area of application. Can replace sandblasting and UHT on some surfaces, but poses problems relating to noise. New technology may make increased use possible.

Renovations/maintenance on installations/facilities

- The use of hot work is generally limited offshore. The operations often consist of removing old equipment or inserting new equipment packages.

Demolition (removal of installation)

- Preparation for separation.
- Lifting off offshore modules and bringing them to land.
- Hydraulic shears are used wherever possible, including offshore.
- Cutting: The Green Turtle consists of four diamond blades that rotate to cut conductors. The operation is monitored and executed via remote control. Can be used at depths of up to 200 metres and cuts 15 metres below mud level. Divers do not need to be present in the vicinity of the cutting site.

Exposure control during hot work

The Norwegian Labour Inspection Authority's regulations on the execution of work (FOR-2011-12-06-1357) specify that the employer shall ensure that health and safety risks posed by chemicals are removed or reduced to a satisfactory level. The regulations also provide details of how this shall be done.

Faults in ventilation and extraction systems shall be reported automatically. The ventilation system shall not provide the possibility to use recirculated air. Stationary process extraction shall direct the extracted air outdoors. Where it is not practical to use stationary extraction, mobile extraction with filters appropriate to the relevant pollutants shall be used. The air output from extractors using filters must not be released in tight spaces.

Even though in practice the presence of a mixed exposure with many chemical substances and dust must be taken into account (see general risk assessment), it can be relevant to undertake measurements, e.g. of respirable dust, to obtain knowledge of the actual exposure conditions and the effect of protective measures. This must be assessed at permanent workplaces with repeating work operations, so that a basis for exposure evaluations can also be acquired.

<u>Protection against exposure in peripheral areas:</u>
Personnel in peripheral areas may be exposed to gases/smoke produced during hot work, since they generally do not use respiratory protective equipment. Hot work on painted surfaces may result in the release of lead, chromium (VI), isocyanates and other hazardous gases, depending on the type of paint or coating that has been used. A significant amount of hot work takes place during work stoppages, and it should therefore be assumed that exposure to gases/smoke will be considerably higher during a shutdown than during normal operations.

The risk of exposure in peripheral areas must be assessed in the event of both outdoor and indoor work. Exposed areas must be cordoned off before the work starts. The purpose of cordoning off the area is to protect personnel against gases and particles/dust. When a restricted area is being established, the following factors should be assessed:

- Experience and competence of the personnel who will perform the work.
- Minimum restricted area is five metres in well-ventilated outdoor areas. Local conditions may necessitate an expansion of the restricted zone.
- Type of hot work (flame cutting, welding, etc. Different types of hot work have sources of varying strengths).
- Material on which hot work shall be performed (is the surface painted/coated? Or has this been removed prior to the hot work?). If hot work is performed on processing equipment this may result in the contents on the inside releasing mercury, LRA or arsenic.
- Wind speed and direction.
- Turbulence (walls and other obstructions may cause an increase in turbulence).

- Weather conditions may change during the operation, necessitating a new assessment of the need to restrict access.
- Use visible smoke as an indicator of whether the restrictions are adequate.
- Consider simultaneous operations. Smoke and particles from hot work may pollute adjacent work areas.
- Consider the use of ejectors to direct smoke to areas in which personnel will not be exposed.
- Respiratory protective equipment for personnel within the restricted area.
- Respiratory protective equipment must be kept on even after the hot work has been completed, since pollutants may still be present in the work area. Respiratory protective equipment shall be removed outside the restricted area.
- Direct-reading instruments (mercury meter, particle counter, VOC meter, etc.) can be used to assess the size of the area that should be cordoned off.

Welding fumes and other smoke from combustion contain both gases and particles. Usually, the particles constitute the visible part of the smoke, while gases can be both invisible and odour-free. Particles and gases may have extremely different properties in the air. In the event of hot work on black steel that has been in contact with hydrocarbons, high levels of mercury have been detected in the work atmosphere of peripheral zone personnel.

Respiratory protective equipment.

Personal protective equipment shall be used when adequate protection cannot be achieved by any other means. Hot work requires respiratory protective equipment with a high protection factor in practice. We recommend that respiratory protective equipment with a compressed air supply is used as standard.

For work in well-ventilated spaces (and outdoors), filter-based protection with fans (power-assisted respiratory protective equipment) can be a practical alternative. If such protection is used, knowledge of and procedures for the selection of the equipment and replacement of filters must be in place. See also Appendix 2.

See also SfS recommendation 009E «Breathing air and Respiratory Protective Equipment»" , Norwegian Labour Inspection Authority's Regulations regarding the use of personal protective equipment at the workplace (FOR-2018-06-22-1019) and the Norwegian Labour Inspection Authority's guidance on respiratory protective equipment; https://www.arbeidstilsynet.no/tema/personlig-verneutstyr/andedrettsvern/ .

Training

Working Together for Safety has produced a short film about the use of various types of protective equipment during hot work. This can be found on the Working Together for Safety website, www.samarbeidforsikkerhet.no.

Useful links and references

Several relevant guidelines and reports are available on the Norwegian Oil and Gas Association's website:

- Project reports from the chemicals project
- Recommended guidelines for health monitoring of employees exposed to chemicals (130)
- Recommended guidelines for fit testing of respiratory protective equipment (133)

On the Norwegian Labour Inspection Authority's website and lovdata.no, you will find:

- Regulations regarding the execution of work, use of equipment and accompanying technical requirements, FOR-2011-12-06-1357
- Regulations regarding action values and exposure limit values in the working environment, FOR-2011-12-06-1358
- The activity regulations § 36 Chemical health hazard
- The facilities regulations § 15 Chemicals and chemical exposure
- Nanomaterial and work environment: https://www.arbeidstilsynet.no/tema/kjemikalier/nanomaterialer-og-arbeidsmiljo/
- Hormone mimics : https://miljostatus.miljodirektoratet.no/tema/miljogifter/prioriterte-miljogifter/hormonforstyrrende-stoffer/

Appendix 1: Survey of paint types used on installations

A review of 74 safety data sheets for paint types in the "chemicals database" provided a basis for dividing the paint types into two groups. NB: This list is not complete.

Group 1 (approx. 20 paint types)

Paint types with "conventional binding agents", without additives with particular health hazards:
- Epoxy
- Polyurethane
- Amino resins

(It must however be noted that these binding agents form hazardous substances upon thermal decomposition, e.g. isocyanates, acid anhydrides, carbon monoxide and carbon dioxide)

Group 2

Examples of paint types with binding agents or additives with particular health hazards:

Hazardous component	Product	Comments
Tar/PAH	**Carbomastic 14** **Hempadur 15139** **Navitar AS comp A** **Jotaguard 85 comp A**	
Lead	**Sigmashield 460 (lead)**	
Copper	**Sigma Alphagen** **Sigma Ecofleet 530**	
Quartz	**Interline 910** **Interline 925** **Phenguard 930** **Sigmacover base 280** **Sigmacover 515** **Sigmacover 630** **Sigmashield 460 (lead free)**	
Zinc	**Carboline zinc dust** **Hempadur zinc** **Hempels zinc metal** **Interzinc powder** **Interguard 251** **Interzinc prime** **Barrier part A** **Sigma Ecofleet 530** **Sigmaweld 199 paste** **Resist GTI**	
Isocyanates	**Interplus 256** **Interthane 799** **Hardtop AS comp B**	
Amines	**Carboguard** **Hempels curing agent 95450** **Hempels curing agent 97400**	

	Interline 910 **Interline 925** **Interplus 256** **Interzone 954** **Interguards 251** **Interguard 400** **Primastic standard comp B** **Phenguard 930** **Sigmacover 515** **Sigmacover 630** **Sigmaguard 225** **Sigmaguard CFS** **Sigmashield 460 hardener** **Naviguard part B** **Jotamastic 87**	
Methylenedianiline	**Hempels curing agent 97400**	
Bisphenol A	**Carboguard** **Carbomastic 18** **Phenoline 187** **Thermaline 400** **Hempadur 35459** **Hempadur 45159** **Hempels curing agent 95140**	
Silicon	**Thermaline 4631** **Hempels silicone aluminium**	

Appendix 2: Protective equipment for use during hot work

(Source: HSE handbook for the engineering industry)

Working operation	*Hazardous elements*	*Recommended protective equipment*
Pin welding (welding with electrodes)	Carbon monoxide, nitrous gases. The smoke may contain of manganite dependant on type of aluminium.	Fresh air mask when poor ventilation and in narrow spaces.
Pin welding Stainless steel (SMO)	The smoke may develop a great amount of sixvalent chrome.	Fresh air mask.
TIG welding Aluminium	Ozone may occur. Nickel and trivalent chrome. Minor amount of smoke.	Fresh air mask.
MIG welding Aluminium	A great amount of ozone. Relatively unhazardous smoke.	Fresh air mask.
CO2 welding (MAG)	A great amount of carbon monoxide.	Fresh air mask when poor ventilation and in narrow spaces.
MIG welding Stainless	A great amount of ozone.	Fresh air maske.
Cutting torch Stainless steel Pointing carbon rod	A great amount of nitrous gases, smoke and dust.	Fresh air mask when poor ventilation and in narrow spaces.
Plasma torch Stainless (SMO)	A great amount of nitrous gases by air possibly by nitrogen as plasmagas.	Fresh air mask when poor or non-existent ventilation and in narrow spaces.
Titanium welding	A great amount of ozones.	Fresh air mask.
Pipe thread welding	A great amount of dust. Carbon monoxide, nitrous gases. May contain barium.	Fresh air mask.

Working operation	*Hazardous elements*	*Recommended protective equipment*
Welding/torching on galvanised steel and steel inflicted zinc pri-mer.	Development of great amounts of zinc that may give metal fever.	Fresh air mask.At operations where fresh air masks can-not be used, dust filter P2 and gas filter (brown) shall be combined.
Welding/torching on plastic painting/epoxy.	Toxic dust/gases. In some cases extremely hazar-dous substances. NB! Polyuretan painting. Teflon fur. Epoxy.	Fresh air mask. NB! Make sure of proper removal of the fur, preferably by sand blasting.
Spray painting.	Health hazardous gases and dust. Solvents and so-lid particles exist as aero-soles in the paint. Spraying pressure should be kept reasonably low. Existing OAR labelling (YL-mer-king) are not valid during spray painting.	Fresh air mask.
Painting (not paint spraying).	Health hazardous gases. Gas evolution from pain-ting and paint tins.	Gas mask - brown filter.
Metallizing.	Health hazardous dust and gases.	Fresh air mask. Eye pro-tection with coloured glasses.
Sand blasting.	Health hazardous dust.	Fresh air mask with replaceable glass.
Sweeping.	Health hazardous dust.	Dust mask class P2.
Work with chemicals.	May prove cauterizing es-pecially to eyes and mu-cous membrances. Be aware of fire hazard and oxydition hazard.	Protective equipment according to HSEdata leaflet.