Fachbereich AKTUELL

FBHM-043

DGUV
Fachbereich Holz und Metall
Berufsgenossenschaft
Holz und Metall

Sachgebiet Maschinen, Robotik und Fertigungsautomation

Fire on machine tools

What has to be considered?

Issue as of: 26.06.2020

Translation of the German version.

Approximately 40,000 tonnes of non water-miscible metalworking fluids are produced for the metalworking industries in Germany per year. Particularly, hard-to-machine broaching processes, deep hole drilling operations and deep grinding processes are almost exclusively carried out with non water miscible metalworking fluids and considered to be an „oil“ domain.

The flammable metalworking fluids represent an important factor to implement an efficient and economic production, mainly in the series production.

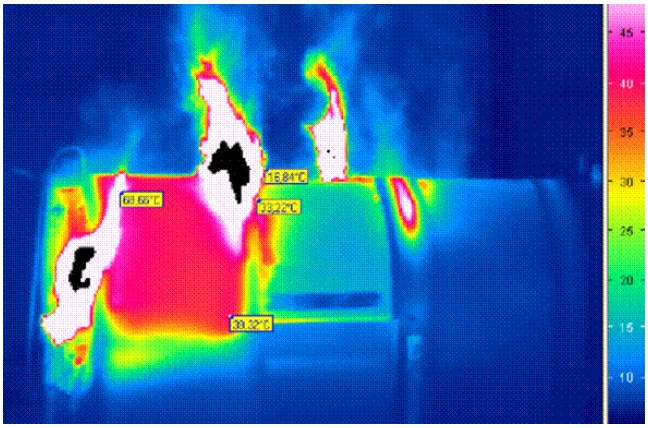

Figure 1: Flame ejections in case of a deflagration

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1 What are the reasons for fire incidents on machine tools?

In the course of metal cutting machining, low-pressure explosions (deflagrations) with subsequent fire may occur due to the ignition of the oil-air mixture in the interior of the machine tool. Such violent reactions are mainly caused by tool breakage, incorrect control or dry running of tools. Incandescent chips and hot surfaces act as ignition sources.

In most cases, it remains a local fire which can be quickly get under control.

Violent reactions, however, may lead to serious accidents with burn injuries and considerable material damage.

2 What has to be done in case of fire?

In such hazardous situations, a proper and circumspect behaviour is important. Decisions taken in panic can disimprove the situation considerably.

The awareness of possible hazards can save employees and the company from the occurrence of serious damage. A fire or a deflagration in the interior of the machine may lead to heavy flame ejections particularly in the door and operating area of the machine.

Reignitions can be very insidious when the door is opened with the intention of “saving” the machine. The sudden air supply in conjunction with hot surfaces may lead to violent flame reactions and toxic smoke formation. The operator may suffer severe burns.

Generally, attention has to be drawn to the complete personal protective equipment, (e. g. safety googles, safety shoes etc.).

Furthermore, fire tests have shown that a flame propagation into the extraction system has to be expected if no adequate measures are taken.

Figure 2: Fire fighting after machine fire

Figure 3: Blocking of the fire suppression system

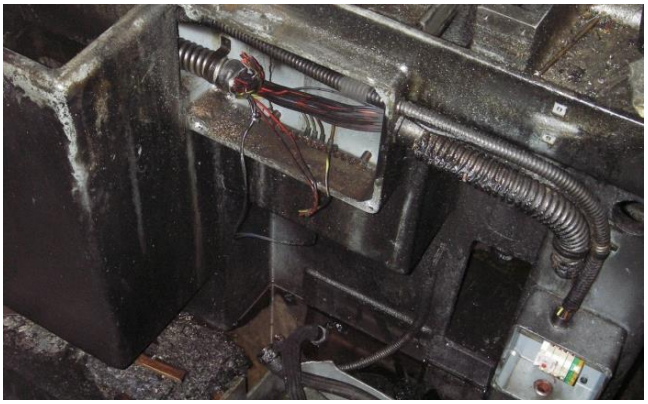

Figure 4: Scorched exposed cables

3 Seven „hot“ mistakes

Never open the machine door in case of fire (or immediately after).

When the door is opened, a violent reignition and ejecting flames may occur due to the sudden air supply.

Never work on the machine with oil soaked clothing.

Oil soaked clothing can easily ignite in case of ejecting flames. Due to the large surface, even fire resistant oil soiled textiles can easily catch fire (wicking effect).

Never restart the machine immediately after a fire.

Hot surfaces are very effective ignition sources and may cause violent reignitions when the metal-working fluid is injected.

Never touch the machine immediately after a fire.

In case of fire, the machine enclosure may heat very strongly and form hot surfaces. Scorched electrical cables and hydraulic lines may cause an additional hazard.

Never empty cleaning agent into the metalworking fluid container.

Even the introduction of low quantities of volatile flammable liquids (cleaning agent, benzine etc.) may lead to an increased fire and explosion hazard.

Never enter the interior of the machine without prior blocking of the fire suppression system.

Attention: Danger to life if CO_2 suppression system is activated. Therefore, prior to entering the interior of the machine (e.g. for cleaning, repairs) it is essential to block the fire suppression system (e. g. by a mechanical blocking device).

Never work with machine door open.

In case of a deflagration, ejecting flames may lead to serious injuries. (see figure 5, figure 6). Generally, attention has to be drawn to the complete personal protective equipment, e. g. wearing of safety googles, safety shoes etc.

Figure 5: Flame ejection from open door gap (6 cm) during a deflagration (Dummy)

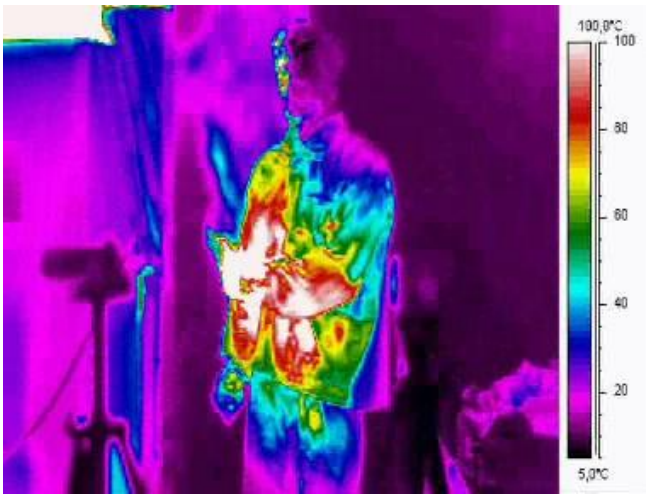

Figure 6: Dummy from figure 5, temperature distribution after a deflagration

4 Avoid ignition sources

Smouldering cigarette ends are very effective ignition sources and should not be thrown into chip containers.

Figure 7: Ignition sources cigarette ends, fire in chip container

Generally, the observance of a general ban on smoking is indispensable in areas with a high fire risk.

5 Summary and limits of application

This “Fachbereich AKTUELL” is based on expert knowledge gathered by the expert committee woodworking and metalworking (FBHM), subcommittee machinery, robotics and automation (SG MRF) of Deutsche Gesetzliche Unfallversicherung (DGUV).

This leaflet is especially intended to provide orientation to designers and manufacturers and to safety specialists and operating engineers of users of metalworking machinery on how the concretising requirements of the European standards in relation to the provisions of the Machinery Directive are implemented in practice.

This „Fachbereich AKTUELL“ describes hazards the machine operators are exposed to as a result of fire incidents occurring in the interior of a machine. Furthermore, it describes „cardinal errors“ that occurred in the past as well as adequate counter measures in order to protect employees from serious burn injuries. A list of fire hazards and preventive measures facilitates instruction to the employees.

The provisions according to individual laws and regulations remain unaffected by this “Fachbereich AKTUELL”. The requirements of the legal regulations apply in full.

In order to get complete information, it is necessary to read the relevant regulation contents.

This “Fachbereich AKTUELL” replaces the version of the same title, issued as Fachbereich information sheet no. 043, dated 04/2013. An updating has become necessary due to editorial amendments.

This information is the English translation of the German issue “FBHM-043” as of 29 May 2020.

The expert committee woodworking and metalworking is composed of representatives of the German Social Accident Insurance Institutions, federal authorities, social partners, manufacturers and users.

Further Fachbereich Aktuell or information leaflets of the expert committee woodworking and metalworking (Fachbereich Holz und Metall) are available for download on the internet [1].

German bibliography:

[1] Internet: www.dguv.de/fb-holzundmetall oder Publikationen oder www.bghm.de Webcode: <626>

[2] DGUV Information 205-001 „Arbeitssicherheit durch vorbeugenden Brandschutz“, Ausgabe November 2013, DGUV, Berlin

[3] DGUV Information 209-026 „Brand- und Explosionsschutz an Werkzeugmaschinen“, April 2009, DGUV, Berlin

[4] Brand- und Explosionsschutz an Werkzeugmaschinen – Forschungsprojekt „Prüfstand Flammensperre“. Film erstellt im Auftrag der Berufsgenossenschaft Holz und Metall, Mainz

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Figures 1, 2, 3, 4, 5, 6, 7: FBHM, SG MRF, Mainz

Annex Instruction List

Instruction of employees on fire hazards and countermeasures				
1.	**General**	**Yes**	**No**	**Remarks**
1.1.	Function and operation of the machine tool and fire suppression system in case of fire			
1.2.	Optical sensors：Avoid flashing light (lighters, welding)			
2.	**Special hazards Never do!**	**Yes**	**No**	**Remarks**
2.1.	Opening the machine door in the event of a fire in the interior Hazard of reignition!			
2.2.	Wearing oil soaked clothing Fire hazard (wicking effect) in case of reignition			
2.3.	Restarting the machine immediately after a fire Possible reignition			
2.4.	Touching machine parts after a fire: Possibly live (electric shock) and hot (burns)			
2.5.	Emptying cleaning agent, benzine etc. in the metalworking fluid Explosion hazard!			
2.6.	Entering the interior of machine with CO_2 fire suppression system active Danger to life!			
2.7.	Working with machine door open Flame ejection in case of deflagration			
3.	**In case of fire or explosion (DGUV Information 205-001 [2], DGUV Information 209-026 [3]):**	**Yes**	**No**	**Remarks**
3.1.	When the alarm activates: Leave the hazard zone immediately			
3.2.	Use escape and rescue routes			
3.3.	Call for help: telephone numbers of fire brigade, emergency			
4.	**Hazards due to ignition of metalworking fluid mixture:**	**Yes**	**No**	**Remarks**
4.1.	Violent flame ejections at pressure relief devices/ possible subsequent fires			
4.2.	Flame ejection at machine tool door gaps and openings			
4.3.	Extinguishing agent CO_2: Hazard of suffocation (from 5 % CO_2 volume in air)			
4.4.	During extinguishing process: Ejection of flames in the door area			
4.5.	Hazard of suffocation in confined spaces due to combustion gases and fumes			
5.	**Reduce fire hazard – Preventive measures:**	**Yes**	**No**	**Remarks**
5.1.	Regular emptying of chip container, avoid self-ignition			
5.2.	Regular emptying of machine tool oil pans (extract oil)			
5.3.	No combustible materials (cardboard/carton/oil-soaked rags) in the vicinity of the machine tool			
5.4.	General ban on smoking: No cigarette ends in chip containers/oil pans			

Publisher

Deutsche Gesetzliche
Unfallversicherung e.V. (DGUV)

Glinkastraße 40
10117 Berlin
Tel.: 030 13001-0 (Zentrale)
Fax: 030 13001-6132
E-Mail: info@dguv.de
Internet: www.dguv.de

Sachgebiet „Maschinen, Robotik und Fertigungsautomation“
im Fachbereich „Holz und Metall“
der DGUV > www.dguv.de Webcode: d544779