Fundamentals
M7
MAINTENANCE PRACTICES

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M7.1
Safety Precautions-Aircraft and Workshop

EASA Part-66
CAT B1

Training Manual

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M7 MAINTENANCE PRACTICES

M7.1 SAFETY PRECAUTIONS AIRCRAFT AND WORKSHOP

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SAFETY ASPECTS

Introduction

General

This sub module is concerned with fire and safety precautions in and around workshops and hangars.

It is up to all of us working in this environment to ensure the safety of people and equipment.

Bear in mind that most accidents are the result of overestimation of one's capacities result from the action of inexperienced people. Therefore, to avoid injury to expensive equipment or personnel, sensible and proper actions should be carried out

Fatigue of personnel represents a dangerous source of accidents, especially when working with instruments and devices.

Personal malpractices, such as alcohol and drug abuse, can render a person a hazard both to himself and to his co-workers.

Supervision and training (both in normal processes and in emergency procedures) is essential.

The following hazards may occur everywhere in our work environment:

- Unauthorized work with tools, equipment and machinery
- Badly maintained tools, equipment and machinery
- Slippery floors
- Poorly maintained stairways and stagings
- Crowded workplaces and obstructed passageways
- Bad lighting, inadequate ventilation and noise can result in headaches, fatigue and carelessness
- Dirty, unpleasant surroundings can lead to a decrease in work performance.

Health and Safety

There are several laws dealing with the health, safety and welfare of people at work.

Accident Prevention

- Eliminate the source of the hazard
- Remove the source of the hazard
- Guard equipment
- Wear protective work clothes
- Safety training

Employer's Responsibilities

The employer is responsible for providion of the following:

- a safe place to work
- safe plant and equipment
- safe work procedures
- a safe work environment
- safe handling, storing and transportation procedures for goods
- reporting accidents and incidents
- information, instruction, training and supervision must be ensured
- safety instructions

Failure to comply or maintain these conditions can result in an inspector from the Health and Safety Executive prosecuting the company.

Employee's Responsibilities

Under the Health and Safety at Work Act, an employee can also be prosecuted for breaking the safety laws. Therefore, the employee is legally bound to co-operate with the employer to comply with the requirements of the Act mentioned above.

Employees are responsible for

- the adherence to work safety and accident prevention procedures
- correct use of equipment.

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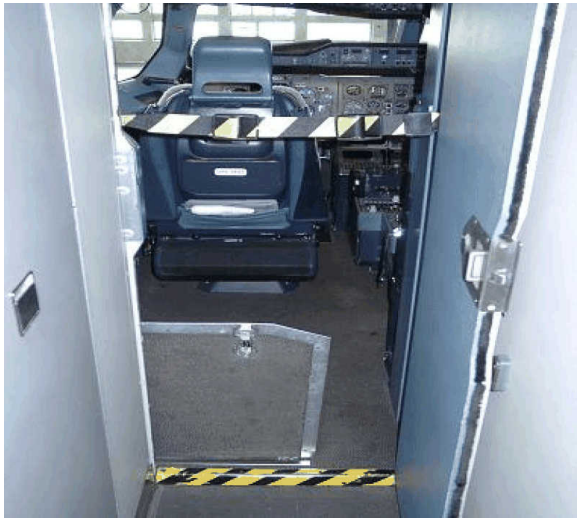






Figure 1 Safety Precautions

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Prohibition- and Order Signs

Prohibition Signs

They prohibit an action that could cause a hazard, e.g. smoking.

Mandatory Signs

They command a certain action, e.g. the use of ear protection.

Warning Signs

They warn against a danger or risk, e.g. toxic materials.

Emergency Signs

They show escape routes, emergency doors, first aid devices or the way to them, in our example the escape route.

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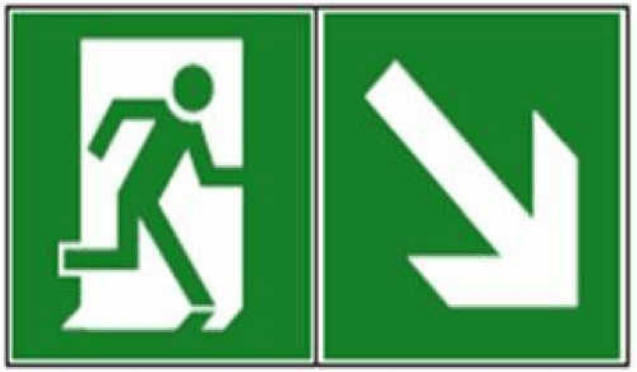
Prohibition Sign



Mandatory Sign



Warning Sign



Emergency Sign

Figure 2 Prohibition and Order Signs

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Manual Lifting and Carrying

Loads and Safety

In the engineering industry, heavy and bulky objects such as machines, large castings and forgings, heavy beams, and plates etc., which have to be loaded onto vehicles, unloaded from vehicles or moved around within the factory are defined as “loads“.

The movement of heavy loads involves careful planning and the anticipation of potential hazards before they arise. When moving such loads it is important that you use the correct handling techniques and observe the appropriate safety precautions and procedures at all times.

Lifting and Carrying performed by Individuals

In the engineering industry it is often necessary to lift fairly heavy loads. As a general rule, loads lifted manually should not exceed 20 kg. Mechanical lifting equipment should be used for loads in excess of 20 kg. However, even lifting loads less than 20 kg can cause injuries of the back.

The risk of personal injury and damage to equipment can be reduced by taking simple precautions before the lifting or handling operations begin. For example, if the load is obviously too heavy or bulky for one person, you should ask for assistance.

Even a light load can be dangerous if it obscures your vision. All moveable objects which form hazardous obstructions should be moved to a safe place before the movement of the load.

As has already been stated, it is important to use the correct lifting technique. High loads or incorrect methods of lifting can result a damage of the intervertebral discs causing considerable pain. This is often referred to as a ’slipped disc’ and the damage (and pain) can be permanent.

You should start the lift in a balanced squatting position with your legs at hip width apart and one foot slightly ahead of the other. The load to be lifted should be held close to your body. Make sure that you have a safe and secure grip on the load. Before taking the weight of the load, your back should be straightened and as near to the vertical body axis as possible. Keep your head up and your chin drawn in; this helps to keep your spine straight and rigid.

To raise the load, first straighten your legs. This ensures that the load is being raised by your powerful thigh muscles and bones, and not by your back. To complete the lift, raise the upper part of your body to a vertical position.

To carry the load, keep your body upright and hold the load close to your body. Wherever possible hold the load so that the bone structure of your body supports the load. If the load has jagged or sharp edges, wear protective gloves, and if hazardous liquids are being handled wear the appropriate protective clothing.

Team Lifting and Carrying

When a lifting party is formed in order to move a particularly large or heavy load, a team leader should be appointed who is responsible for the completion of the task.

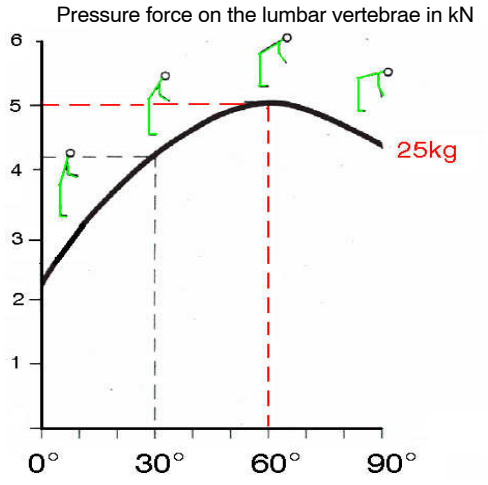
The team leader should not take part in the actual lifting but should ensure that:

- Everyone understands what the job involves and the method chosen for its completion.
- The area is clear of obstructions and that the floor is safe and will provide a good foothold.
- The members of the lifting party are of similar height and physique, and that they are wearing the necessary protective clothing.
- Each person should be positioned so that the weight is evenly distributed.
- The responsible person takes up a position which gives the best all–round view of the area and will permit the development of any hazardous situation to be seen so that the appropriate action can be taken in time to prevent an accident.
- Any equipment moved in order to carry out the operation is put back in its original position when the task has been completed.

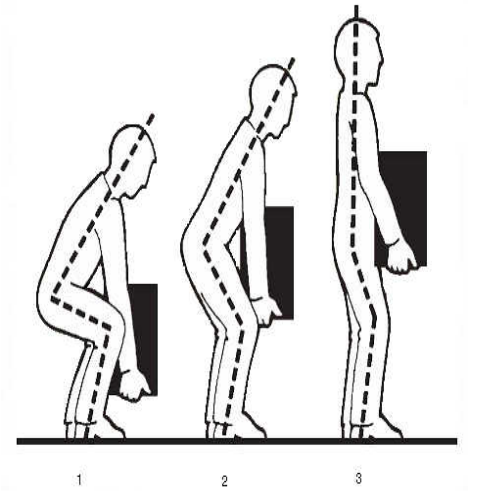
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Art	Geschlecht	Alter (Jahre)	selten < 5% der Schicht (kg)	wiederholt 5-10% der Schicht (kg)	häufig >10-35% der Schicht (kg)
Heben	Männer	- 16 17 - 19 20 - 45 > 45	20 35 55 50	13 25 30 25	- 20 25 20
Heben	Frauen	- 16 17 - 19 20 - 45 > 45	13 13 15 13	9 9 10 9	- 8 9 8
Tragen	Männer	- 16 17 -19 20 - 45 > 45	20 30 50 40	13 20 30 25	- 15 20 15
Tragen	Frauen	- 16 17 - 19 20 - 45 > 45	13 13 15 13	9 9 10 9	- 8 9 8



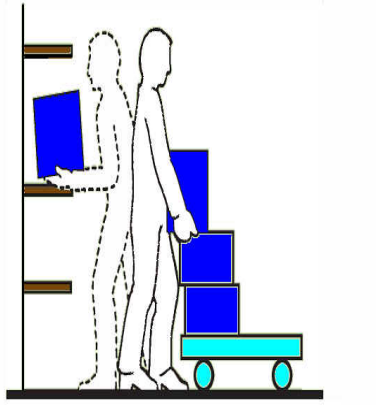
Angle of inclination



Properly raising from a crouch with your back straight



Incorrectly: transport with twisting of the upper body



Better: transport without twisting of the upper body (by change of position)

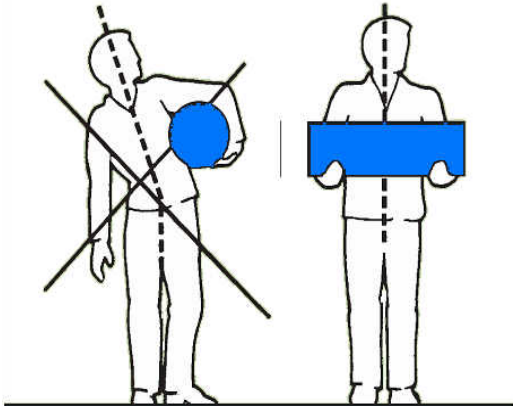


Figure 3 Manual Lifting and Carrying

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Safety Protection at Work

Over the past 30 years or so, health and safety at work has become a major issue for both employers and employees. Gone are the days when workers had few rights and were exploited to the detriment of their health and well-being.

It is the employer's responsibility to provide suitable, and adequate personal protective equipment and it is the employee's responsibility to use it. If an injury occurs and suitable protection was available but not used, the injured party takes responsibility and cannot claim any compensation.

Never...

- wear watches, rings and other items of jewelry that can catch in machinery, scratch metal etc.. or cause a short circuit.
- employ a "Hit or Miss" attitude. Take your , be careful and ensure completeness of the task.

Always...

- Minimize the chances of developing dermatitis by application of barrier cream, to the hands (and arms if necessary) before starting work. After washing your hands, don't forget to pply the cream again.
- Use suitable protective gloves.
- Wear correctly-fitting overalls which are fastened comletely at the cuffs and front, and are not just covering the lower part of the body. The zipper should always be closed.
- Protect your ears by wearing ear-protection or plugs.
- Wear a safety helmet or hard hat.
- Protect the feet from falling objects, as well as chemical spills, by wearing safety boots.
- Prevent injury to the eyes by wearing safety spectacles or goggles.
- Wear a suitable safety mask and/or respirator when dust and fumes are present.
- Handle tools and equipment with care - otherwise injuries could result.
- Minimize the possibility of accidents by covering cables, hoses, lines etc. wherever possible.

First Aid

Due to legal requirements everyone has to assist in case of accidents and emergency situations.

Accident Book

In the event of an injury that occurred at work, it is the employee's responsibility to ensure that a record of the injury (and subsequent treatment) is recorded in the Accident Book.

Failure to do this (however small the injury may be) means that, should complications arise at a later date, the injured person will not be entitled to a legal title.

Danger caused by Noise

EG Directive "Noise" defines two essential limits:

a) If sound levels reach or exceed the limit of 80 decibels (A) at workplace, the respective workplace is regarded as noise sector.
The respective employer must provide ear protection.

b) If sound levels reach or exceed the limit of 85 decibels (A), the workplace is classified as identifiable noise sector.According to BG regulation "Safety and Health Protection Signage at the Place of Work" the noise sector must be identified by the mandatory sign "Wear Ear Protection".

The affected employees must wear ear protection at such a place of work.

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Breathing Protection



Eye / Face Protection



Foot Protection



Ear Protection



Hand Protection



Skin Protection





Body Protection



Falling Protection



Head Protection

Figure 4 Working Clothes/Working Environment

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Electrical Equipment

General

When using electrical equipment, the following instructions have to be followed:

- The device must be fitted with a three-pin plug, incorporating an earth wire.
- Stand on a dry surface. If not possible, stand on a wooden platform or move to a dry position.
- Wear safety shoes with an insulated sole.
- The electrical cable should not get into contact with moisture.
- Ensure the cable is in proper condition before using the equipment.

Electric Shock – First Aid

If personnel are subjected to an electric shock you should proceed as follows:

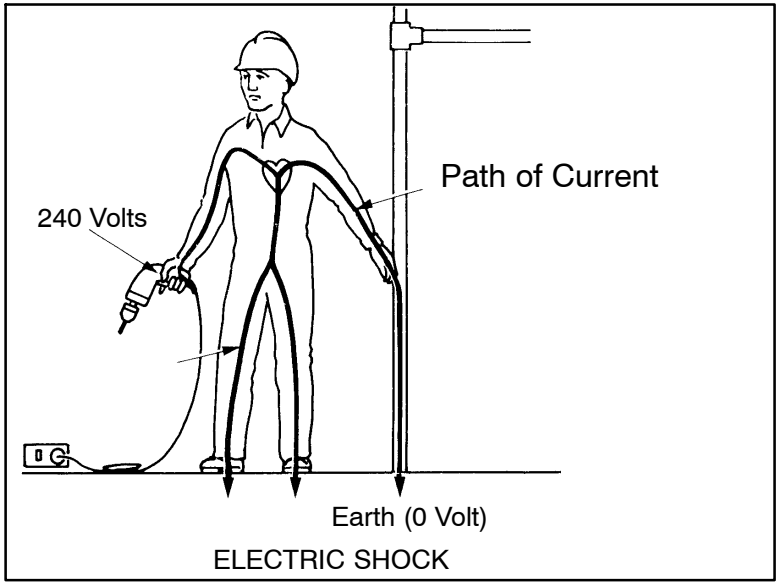
- Switch off current and remove the victim from the electrical circuit. Make sure that insulation is provided, e.g. rubber gloves or a broom.
- Perform shock treatment. Keep the victim warm.
- Get medical assistance immediately.

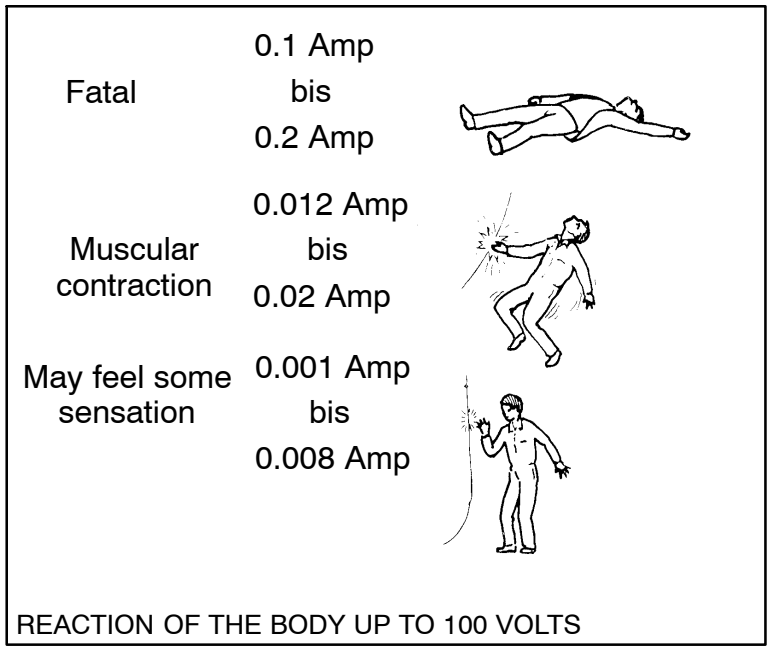
Prevention of Electrical Fires

Never overload extension cables or wall sockets. Heat generated by excessive current flow can result in a fire.

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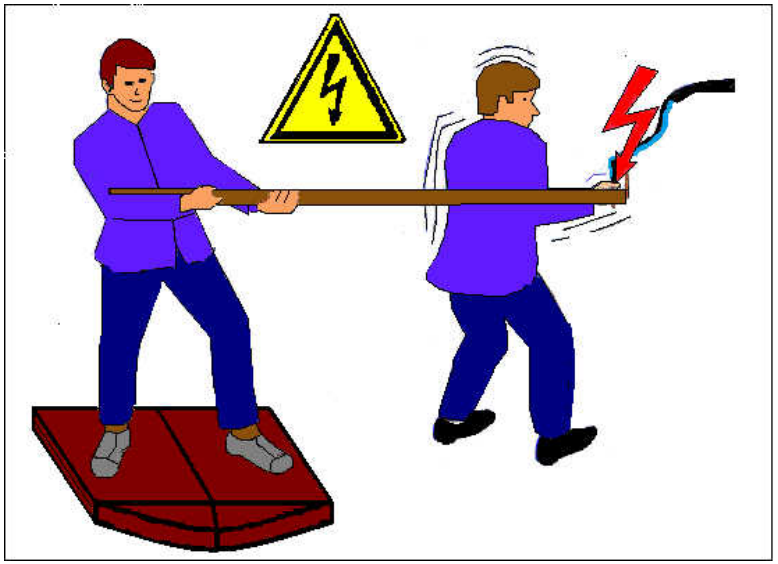


Figure 5 Working with Electricity

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Compressed Air or Gases

Work on aircraft includes work with compressed air and gases.

Compressed Air

Compressed air is used for all pneumatic tools like drills, rivet guns, paint spray-guns etc.

Compressed Nitrogen

Compressed nitrogen is used to inflate, tires and shock struts.

Storage and Distribution

Compressed air is normally created by a compressor, stored in a tank and distributed via pressure lines. Other compressed gasses, such as nitrogen and oxygen, are stored in steel cylinders, usually on racks or trolleys. When full, they are normally pressurized to 2,900 PSI (pounds per square inch) (200 bar).

Safety

Compressed gasses entering the bloodstream can result in severe injury or death.

Personal injury can be avoided by:

- not indulging in horseplay.
- disconnecting air supply from devices when not in use and when
  - fitting/replacing drill bits
  - fitting/replacing riveting dollies etc..
- using eye protection.
- preventing hose damage by maintaining them in good condition.
- obey all safety precautions when carrying out initial inflation of a tire.
- always using calibrated gauges for tire pressure checks.
- Ensuring that protective caps are fitted to cylinders when not in use.

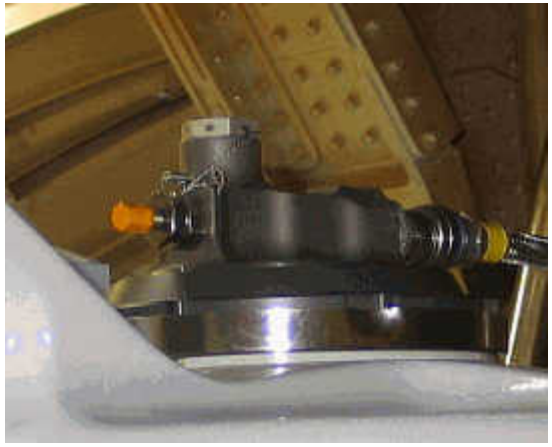
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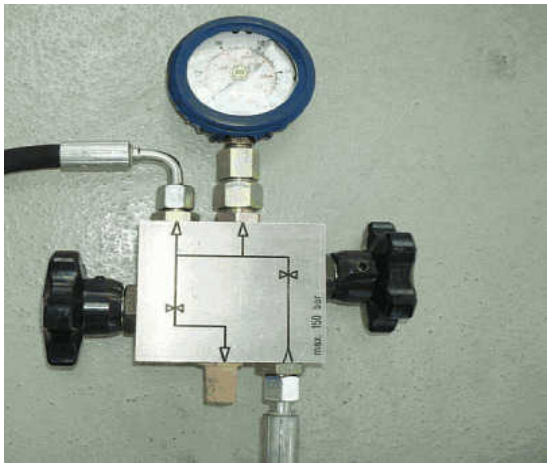


Figure 6 Compressed Gases

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Oxygen

Pressurized oxygen is carried on aircraft for emergencies to support breathing at high altitudes in the event of a cabin pressure loss.

Oxygen causes spontaneous combustion when in contact with oils or greases. The presence of heat is not necessary for this reaction. Oxygen itself does not burn, but supports and intensifies a fire with any combustible material. A build-up of static electricity can result in a spark being generated, which could then cause a fire in an environment with high oxygen content.

A small, leak in an oxygen system can cause ignition of the material through which it is leaking by friction-generated heat.

Trained Personnel

Only especially trained and assigned personnel, which can assess the dangers when working with oxygen, is allowed to work with oxygen systems. This personnel must be capable of reducing the occurrence of dangerous situations by appropriate actions.

Cleanness

The maintenance staff for oxygen components has to take care that hands, cloths, tools, components and connectors are clean and free from grease. Cloths must not be saturated with oxygen. When working with oxygen systems smoking is generally prohibited.

Fire– and Explosion Hazard

When working with oxygen systems, highest accuracy and attention is needed. Fires and explosions can be caused by damaged devices. Due to this reason only the staff that is needed for the work should be in the plane. This should especially be adhered to, when filling oxygen bottles and performing other work with pressurized oxygen. **Oils and Greases** are easily combustible due to the carbon in their molecular structure and their low flash and ignition point. Hands and cloths have to be kept clean. In the working area smoking and eating is prohibited.

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Oxygen in the Aircraft

Green





Oxygen on a cart



Figure 7 Oxygen

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Prevention of Accidents when working with Oxygen

To prevent accidents when working with oxygen systems or components:

- Minimize the possibility of static electricity build-up by ensuring that the aircraft is suitably connected to ground.
- Display warning signs outside the aircraft while an oxygen system is being serviced.
- Tools and torque wrenches must be spark–free. Spark–free tools are not required if oxygen system and its components respectively have not been oxygen supplied.
- Tools and equipment must be absolutely free of oils greases, dust or lints. Protective caps must be installed to open ends of pipes/components immediately after disconnection.
- Only use materials approved for the use with oxygen.
- Do NOT use PTFE (polytetraflourethylene) tape or sealant (with the exception of Teflon tape with specification MIL-T-27730), as these may contain certain oils.
- Use only approved solutions for leak tests(MIL-L-25567 'B' and MIL-L-25567 'C' Type 1**),** and suds based on non oily soap.
- Obey safety distance between oxygen cylinders and hydraulic or refuelling equipment.
- Turn off oxygen valve prior to disconnection of couplings.
- Prevent build-up of heat by opening valves slowly.
- Have appropriate fire-fighting equipment ready.
- Prevent high oxygen concentration by adequate ventilation.
- Clothing may become saturated with oxygen when working in an atmosphere with high oxygen content for a longer time. Air your clothing for at least 15 minutes and keep it away from flames or other sources of heat.
- Oxygen maintenance personnel must wear white, preferably clean protective clothes. Hands must be clean and free from grease. Personnel must make sure that all connections and equipment/devices are clean and free from oil and/or grease.

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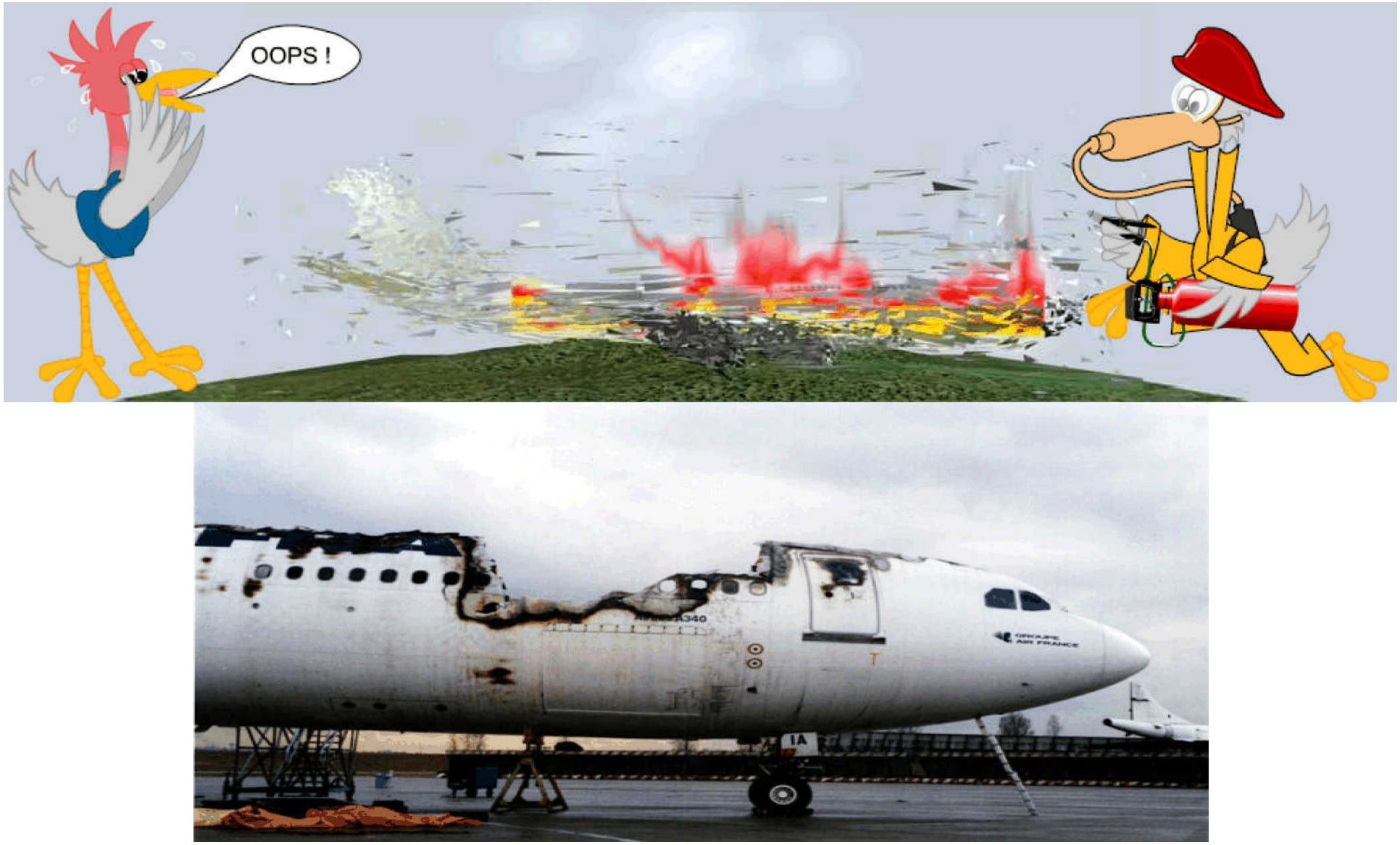


Figure 8 Fire Protection

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Oils and Chemicals

Oils and chemicals present a pozential safety risk. They can:

- be inflammable
- produce harmful vapors
- make the ground slippery
- cause skin diseases (dermatitis).

Safety Precautions

Safety of personnel can be improved by the following precautions:

- The staff must be familiar with the properties of the materials used at the workplace and the related safety instructions. It is the employer's responsibility to provide all COSHH (Control of Substances Hazardous to Health) sheets, which provide important information for the user.
- Two simple precautions can minimize the fire hazard:
  - do not use footwear with metal in tips or soles.
  - do not carry matches or lighters.
- Minimize the effects of fumes or gases by:
  - wearing a suitable mask or respirator
  - using a fume extractor
- Clean up or contain and cordon off spillages promptly(prevent entry into adjacent areas.
- Prevent dermatitis by:
  - applying barrier cream prior to work
  - washing thoroughly after contact with oils and chemicals
  - using suitable protective gloves.

Before eating, drinking or smoking it is absolutely necessary to clean hands and face. When handling carcinogen (cancer-causing) or fertility damaging material, no eating, drinking, smoking or taking snuff (tabacco) is allowed in the working area.

Technical Precautions (examples):

- Automatically operated closed facilities,
- Effective fume extracting cabinets,
- Explosions proof electrical installations.

Organizational Precautions (examples):

- marking of workplaces and containers,
- operating instructions for every dangerous substance,
- storage of dangerous substances according to instructions.

Working when toxic Gases, Fumes or Aerosols may develop

Work tasks during which toxic, unhealthy, caustic or irritant gases, fumes or aerosols can develop, must only be performed, if hazards for the employees can definitely be excluded.

The above mentioned operational precautions, like closed systems or fume extraction cabinets, have absolute priority.

Bottling of hazardous Fluids

When this fluids are bottled from balloons, bottles barrels or similar reservoirs suitable devices like funnels, safety lifters, balloon canters or pumps have to be used.

Storage of hazardous Substances:

Particularly hazardous and easily flammable substances, like pyrotechnic materials have to be kept in special storage rooms.

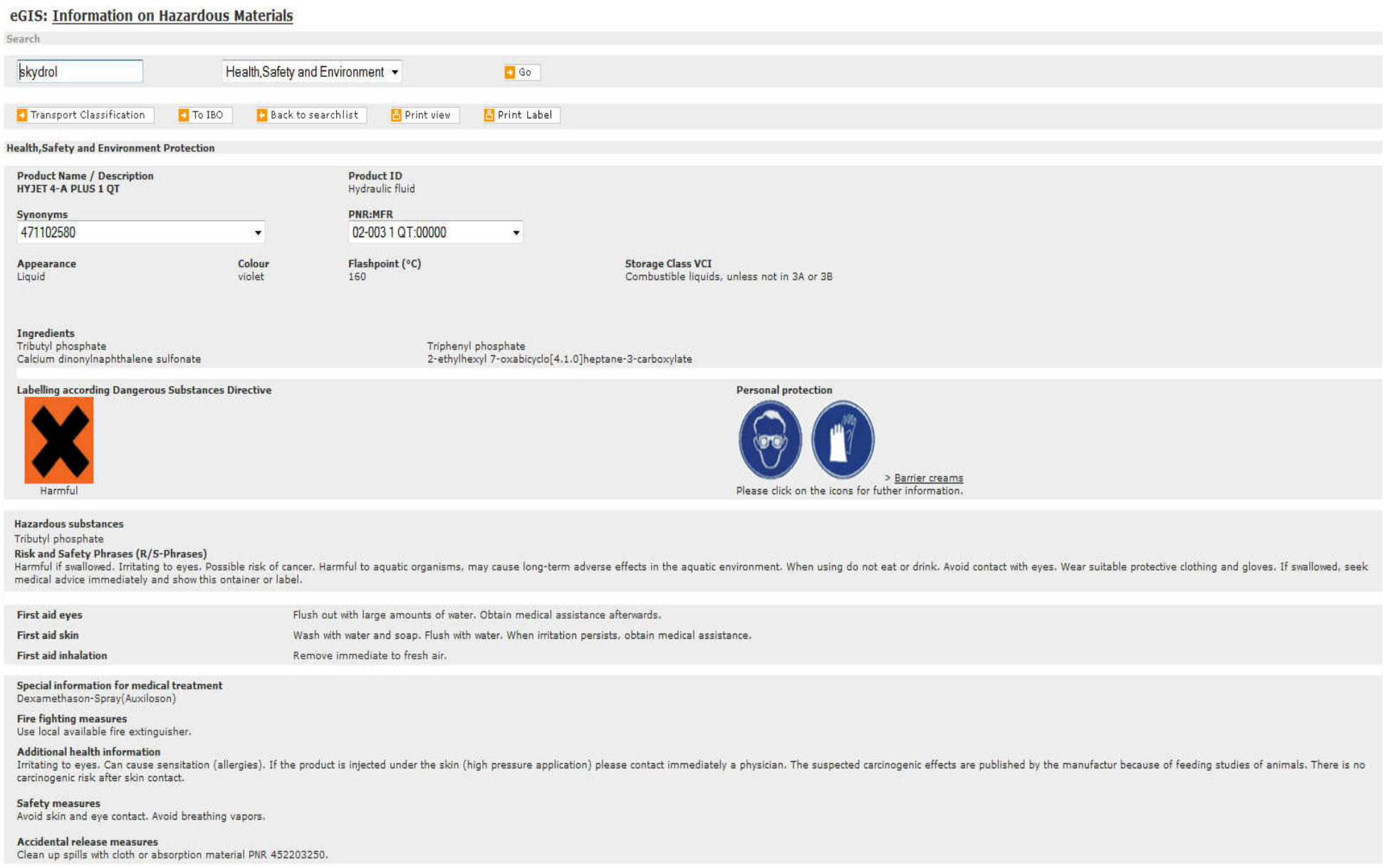
Solvents:

Solvents are mainly organic substances, which are used to dissolve, dilute or suspend other materials in order to enable their processing or removal.

- When inhaling these vapors, narcotic effects can occur.
- Solvents cause a very fast degreasing of the skin thus create the precondition for dermatitis.
- Intoxication by absorbing solvents through the skin is possible if a large skin area is affected.

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eGIS: Information on Hazardous Materials

Search

skydrol | Health,Safety and Environment | Go

Transport Classification | To IBO | Back to searchlist | Print view | Print Label

Health,Safety and Environment Protection

Product Name / Description
HYJET 4-A PLUS 1 QT

Product ID
Hydraulic fluid

Synonyms
471102580

PNR:MFR
02-003 1 QT:00000

Appearance
Liquid

Colour
violet

Flashpoint (°C)
160

Storage Class VCI
Combustible liquids, unless not in 3A or 3B

Ingredients
Tributyl phosphate
Calcium dinonylnaphthalene sulfonate
Triphenyl phosphate
2-ethylhexyl 7-oxabicyclo[4.1.0]heptane-3-carboxylate

Labelling according Dangerous Substances Directive

Harmful

Personal protection

> Barrier creams

Please click on the icons for futher information.

Hazardous substances
Tributyl phosphate

Risk and Safety Phrases (R/S-Phrases)
Harmful if swallowed. Irritating to eyes. Possible risk of cancer. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. When using do not eat or drink. Avoid contact with eyes. Wear suitable protective clothing and gloves. If swallowed, seek medical advice immediately and show this ontainer or label.

First aid eyes	Flush out with large amounts of water. Obtain medical assistance afterwards.
First aid skin	Wash with water and soap. Flush with water. When irritation persists, obtain medical assistance.
First aid inhalation	Remove immediate to fresh air.

Special information for medical treatment
Dexamethason-Spray(Auxiloson)

Fire fighting measures
Use local available fire extinguisher.

Additional health information
Irritating to eyes. Can cause sensitation (allergies). If the product is injected under the skin (high pressure application) please contact immediately a physician. The suspected carcinogenic effects are published by the manufactur because of feeding studies of animals. There is no carcinogenic risk after skin contact.

Safety measures
Avoid skin and eye contact. Avoid breathing vapors.

Accidental release measures
Clean up spills with cloth or absorption material PNR 452203250.

Figure 9 Handling Chemicals

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Protection and Identification of Aircraft Devices

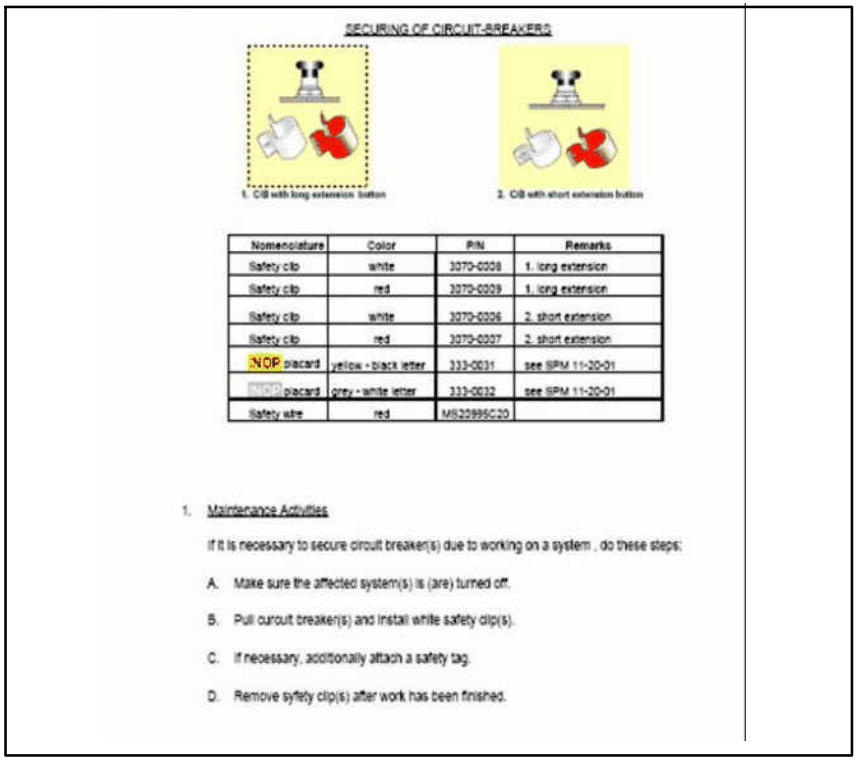
Devices which must not be operatedn for safety reasons have to be protected by suitable methods (to be documented in the Log Book).

- Attach red warning signs which are clearly filled out.
- Open and secure circuit breakers with safety clips.
- Insert safety devices at hydraulic components (actuators),
- Remove connectors for the electrical control (document this and connect them again after finishing of the work).

Before operation make sure that all areas of the applicable devices are clear and that there is no danger for employees and the aircraft.

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SECURING OF CIRCUIT-BREAKERS

1. CB with long extension button

2. CB with short extension button

Nomenclature	Color	PIN	Remarks
Safety clip	white	3070-0008	1. long extension
Safety clip	red	3070-0009	1. long extension
Safety clip	white	3070-0006	2. short extension
Safety clip	red	3070-0007	2. short extension
NOP placard	yellow - black letter	333-0031	see SPM 11-20-01
placard	grey - white letter	333-0032	see SPM 11-20-01
Safety wire	red	MS20995C20	

1. Maintenance Activities

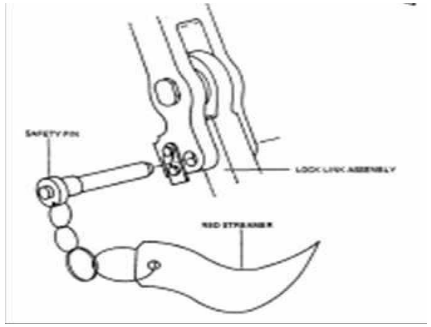
If it is necessary to secure circuit breaker(s) due to working on a system , do these steps:

A. Make sure the affected system(s) is (are) turned off.

B. Pull circuit breaker(s) and install white safety clip(s).

C. If necessary, additionally attach a safety tag.

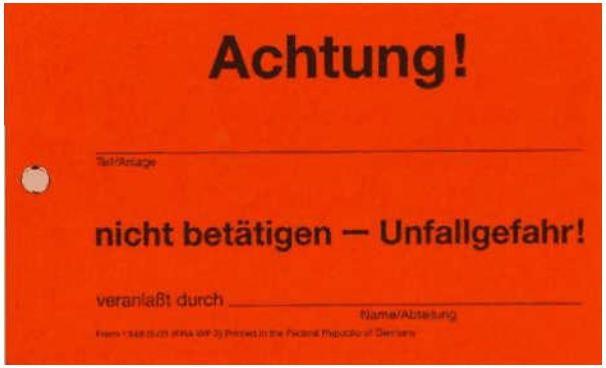
D. Remove safety clip(s) after work has been finished.



Safety Pin

Aircraft deenergized and protected against resetting.





Warning Sign for the Protection of Aircraft Systems

Figure 10 Protect Aircraft Devices

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Working on high platforms or other high places

When > 1m above ground, you are working on a high attitude work place. The highest possible work area is the upper end of the vertical stabilizer.

There is a hazard of falling down and suitable protections must exist (e.g. balustrade with knee and foot rail, side protection).

When the balustrade is used as an access ladder, always install both balustrades.

Forbidden actions are:

- The positioning of stairs and ladders **on** working platforms and staircases is forbidden.
- Platform planking and steps have to be free from oils and greases because of the slip hazard.
- Icy or snowy ladders have to be cleaned from ice and snow before climbing on them.
- Working platforms, stairs and ladders have to be arrested to prevent inadvertent rolling.
- Do not use defective devices, but initiate their repair.
- When working high above ground, locate tools and equipment in a place where they are prevented from falling.
- Always keep stairs in docks free of any obstacles.
- Install ladders safely and in the right angle.
- Secure ladders from, falling, sliding, etc.

When performing tasks that involve the danger of falling and no protective installations are at the location or the installed devices do not ensure suitable protection, you have to use full belt safety harnesses.

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Correct Procedure!





Wrong Procedure!



Figure 11 Ladders und Stairs

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Behavior on the Apron

Many potential hazards have to be observed on the apron:

- rolling- and towing movements,
- driving of apron vehicles,
- special weather conditions,
- starting of engines,
- noise pollution caused by running machines,
- deadline pressure,
- many different persons around the A/C.

To prevent injury and damage resulting from the above mentioned dangers, a briefing is carried out by a group of people who have been instructed by the divisional manager. Without having attended this briefing it is prohibited to stay on the apron.

General rules:

- rolling or towed A/Cs have the right of way.
- when the red light under the aircraft fuselage is on, the engines will be started soon.
- don’t drive below any part of the airplane, but circumnavigate the aircraft in a safe distance.
- you must react to light or radio signals from the tower in an appropriate manner.

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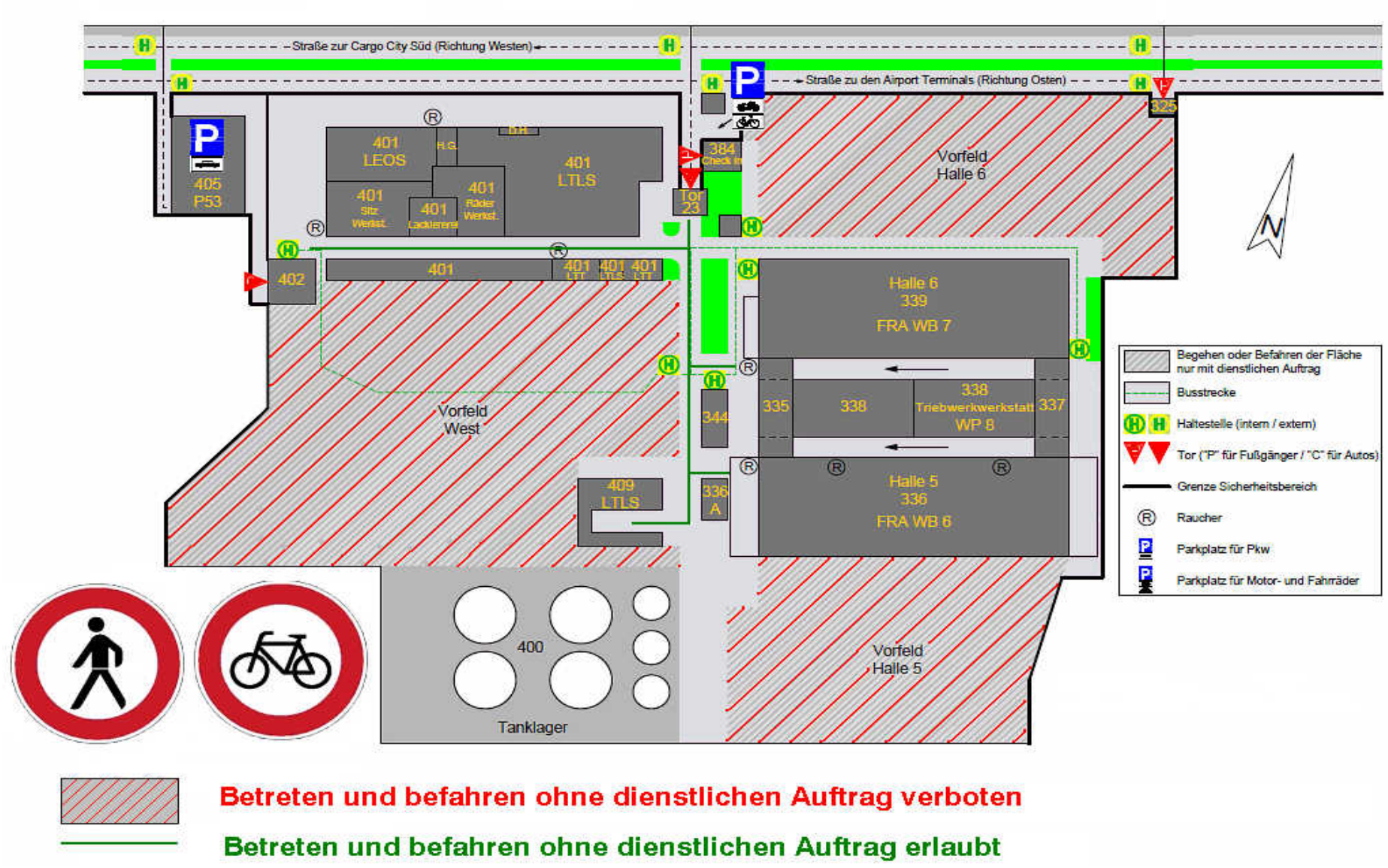


Figure 12 Behavior on the Apron

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Foreign Object Damage

FOD (such as propeller nicks, tyre damage and fabric tears) has been a part of accidents and unscheduled maintenance reports since the earliest days of aviation.

Anything that can find its way into an engine, or to flight controls and structural items represents a potential cause for foreign object damage.

This damage can result in anything from minor repairs to catastrophic events.

Foreign objects can be found anywhere in the aviation environment.

It is vital to always act carefully. The employees are responsible for their tools and the maintenance of tools. At the end of the shift, the complete work area has to be clean and free of foreign objects.

When you adhere to these rules, FOD can be prevented.

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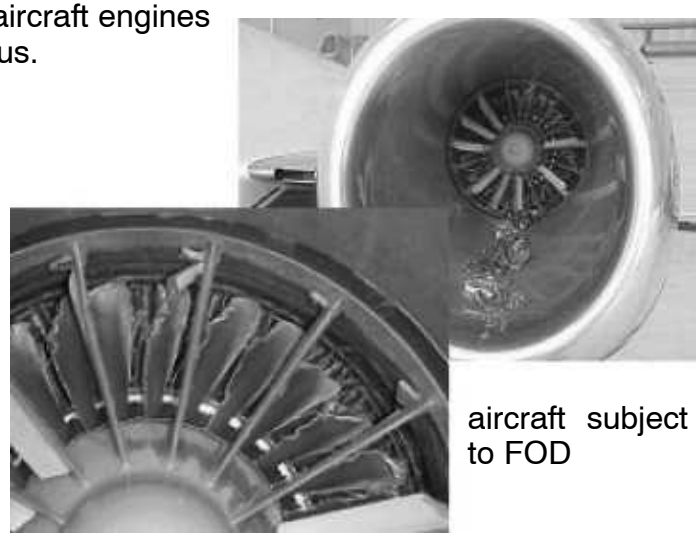


Ensure all loose articles are removed ...





The suction power of aircraft engines is enormous.



aircraft subject to FOD

Figure 13 FOD Examples

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Handling of Fire Extinguisher Cartridges

For handling and transporting fire extinguisher cartridges in Germany a qualification certificate according to §20 SprengG (law dealing with explosives) is necessary. Therefore these cartridges must only be handed to responsible persons (§20 SprengG – owners) or, after consulting the appropriate national authority, the cartridges may be handed to qualified persons for transport in the area of a locally coherent plant.

The qualified persons are people, who are instructed periodically according to the regulations of the SprengG (German law dealing with explosives) and deal with pyrotechnical cartridges and signal devices under supervision of the responsible persons.

At line and maintenance areas the installation, the maintenance, the supervision and the removal of pyrotechnical cartridges and signal devices is performed by responsible or qualified persons.

Corresponding information is recorded in the safety precautions of the respective passages of the AMM (Aircraft Maintenance Manual).

This is for example:

- only qualified persons are allowed to handle cartridges.
- Cartridges must only be handed over from one employee to another employee.
- Cartridges must only be transported with a short-circuit protection.
- No unsupervised intermediate storage is allowed.

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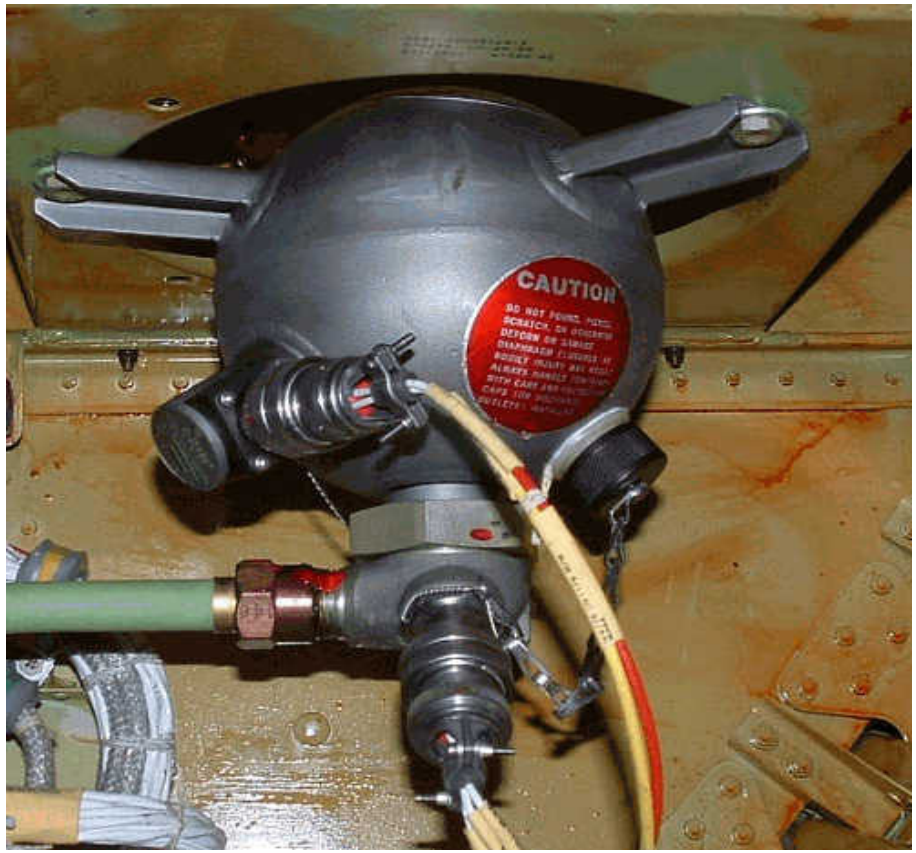


Figure 14 Fire Extinguisher Cartridge

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FIRE PRECAUTION AND FIRE FIGHTING

Introduction

You must always be aware of fire hazards due to easily flammable fluids. a wide range of these fluids is present in an aircraft and in the maintenance areas.

The following precautions must be observed, because fire is a permanent danger in our work environment:

- Smoking is only permitted in designated areas.
- Around the aircraft, smoking is generally strictly forbidden.
- Do not carry matches and do not wear steel tips on shoes, as they can create sparks.
- When working with equipment that is powered by petrol, make sure a foam fire extinguisher is available.
- Easily flammable liquids like paint and other finishes should be kept in an approved store outside the hangar or workshop.
- When welding or soldering, the flame should be directed towards fire bricks when not in immediate use.
- All staff must be informed about the location of fire extinguishers and other fire-fighting equipmentfire.

Employees in faciliies with fire-extinguisher systems must know the position of these systems and they must have been familiarized with the alarm and activation systems.

Although the activation of these systems often activates the alarm at the airport fire brigade as well, in an emergency case the next fire alarm box should be used or the fire brigade should be called by phone.

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blocked escape path

free escape path



Figure 15 Fighting Fires

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Fire Classes and Extinguishing Agents

Fire Classes

Depending on the combustible materials, fires are divided into the following classes:

- Class A - solid matter as: wood, fabric, paper
- Class B - liquid matter, or matter that will become liquid, oils and grease
- Class C - gaseous matteras hydrogen, propane, petroleum gas etc.
- Class D - flammable metals (magnesium, potassium, natrium).
- Class F - cooking oil and fat

Types of Fire Extinguishers

Water

Water extinguishers work by cooling the fire below the ignition temperature.

The water is pressurised in the extinguisher and ejected by air or carbon dioxide.

Water should only be used for Class A fires, when electricity and chemicals are not present. Using water on a Class D or Class F fire can *intensify* the fire and explosions can occur.

Carbon Dioxide

Carbon dioxide extinguishers work by eliminating oxygen from a fire, and by decreasing the temperature.

It is suitable to extinguish Class A and B fires.

Dry Powder

These extinguishers are most effective on Class A,B, and C fires. The two types of dry chemical extinguishers include one that contains ordinary sodium or potassium bicarbonate, urea potassium bicarbonate and potassium chloride base agents. The second multi–purpose type contains an ammonium phosphate base. The multi–purpose extinguisher can be used on class A, B, and C fires. Most dry chemical extinguishers use stored pressure to discharge the agent, and the fire is extinguished mainly by the interruption of the combustion chain reaction.

Halogenated Hydrocarbon

The most common fire extinguishing agent for aircraft cabin fires is Halon, a liquefied, compressed gas that stops the spread of fire by chemically disrupting combustion. It is most effective on Class B and C fires. It can be used on Class A and D fires, but it is not as effective.

Although the production of Halon was stoppen on January 1st, 1994 under the Environmental Protection Act (Clean Air Act), it is still legal to purchase and use recycled Halon and Halon fire extinguishers. In fact, the FAA requires all commercial aircraft to be equipped with halon fire extinguishers.

Halon or halon mixtures are liquefied compressed gases which stop the spread of fire by chemically interrupting combustion. Halons are odourless, colourless, electrically nonconductive, leave no residue after use and are not dangerous for human beings.

Foam

Foam fire extinguishers use an aqueous film forming foam (AFFF) agent that builds a layer of foam when it is discharged through the nozzle onto the surface of a burning liquid, starving a fire by removing the oxygen. Foam also has a cooling effect and extinguishes fires on solid combustible materials. Therfore foam is suitable for Classes A and B fires.

In cases of emergencies, fire fighters spray a foam 'blanket' onto runways to suppress sparks whenaircraft have to touch down with a retracted landing gear (pancake landing). This prevents sparks caused by friction.

The foam produces a film on the surface. This prevents the development of hydrocarbon vapors (for example Kerosin). The foam supresses the development of flames and surface fires (e.g. spilled fuel), but is not suited for fires inside the aircraft like for example in the fuel tanks.

Sand

For fires of classes D and F extinguishing agents such as, sand or fire blankets are used.

WARNING: NEVER USE WATER FOR THESE FIRE CLASSES! AN EXPLOSION COULD OCCUR!

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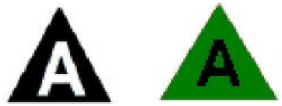
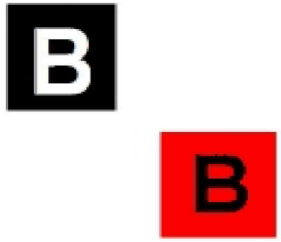
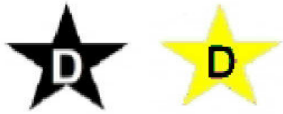
EUROPEAN	AMERICAN	US Symbol	Type of fire	Extinguishing agents	Comments
			ordinary combustibles: wood, paper, plastics, fabric, rubber	water, water-based solutions, foam, dry chemical powder (ABC = ammonium phosphat), gas, (CO_2 , nitrogen) fire blanket	
	 **Flammable liquid and gas**		flammable liquids: fuel, alcohol, ether, paint and finishes, thinner, paint	foam, dry chemical powder (ABC = ammonium phosphate; BC = sodium bicarbonate or potassium bicarbonate), gas (CO_2), halon, fire blanket	
			flammable gases: acetylen, hydrogen, metan, propan, butan	dry chemical powder (ABC, BC)	First **CLOSE** the main gas supply to minimize the risk of a built up or a new dangerous gas-air mixture
			combustible metals: aluminium, calium, magnesium, natrium, litium, titanium and their alloys	Use only special purpose fire extinguishers and get expert advise	**NEVER USE WATER** as extinguishing agent with metal fire
N/A			electrical equipment	CO_2 Dry chemical powder (ABC, BC)	Class E has been removed in EU since most extinguishers could be used in electical installations up to 1000V. Respect the minimum distance printed on the extinguisher
			oils and greases	fire blanket, dry chemical powder (BC) with restrictions	**NEVER USE WATER** as extinguishing agent with oil or grease fires

Figure 16 Fire Classes and Extinguishing Agents

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Fire Fighting Devices

For an effective accomplishment of emergency and fire fighting actions the right behavior of employees is critical.

Every employee has to know where in his working area fire alarm boxes and fire extinguishers are located and how to use them.

Fire Extinguishers

Before working in the hangars you have to learn how to use and handle the fire extinguishers.

Fire blanket

Use it for people when the clothes are on fire.

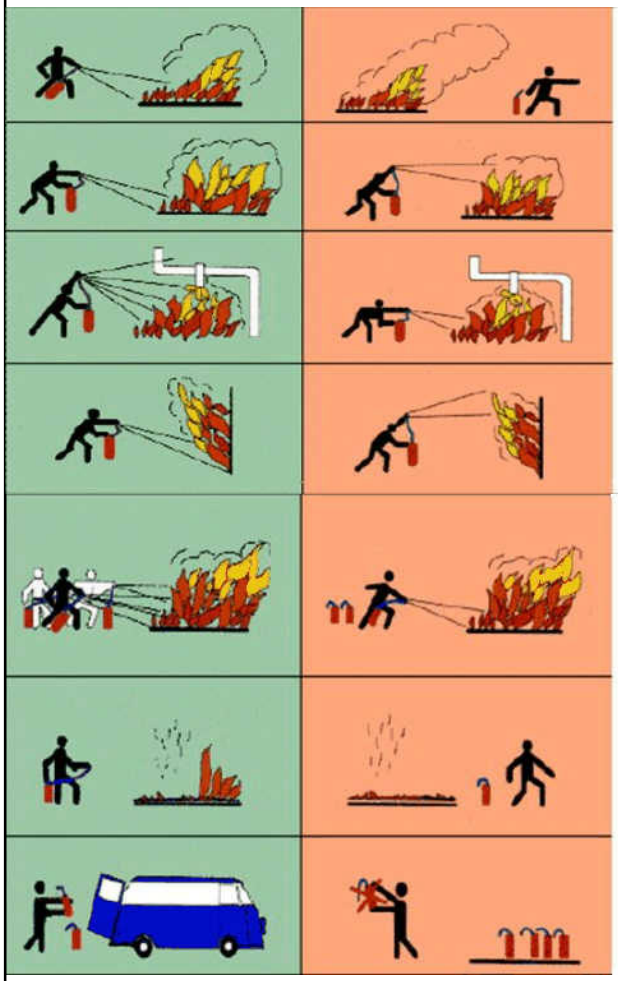
Wall Hydrant

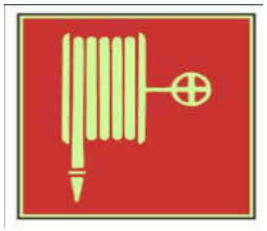
Due to a special use or higher fire risk some facilities are equipped with semi-stationary and stationary fire extinguishing devices in addition to other mentioned equipment.

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Handling of Fire Extinguishers







Wall Hydrant





Fire Extinguisher



Fire Alarm Box





Fire Blanket

Figure 17 Fire Fighting Devices

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FEUERLÖSCHER BESITZEN FÜNF SCHRIFTFELDER

- 1. Schriftfeld enthält: das Wort Feuerlöscher, die Füllmenge, Art des Löschmittels und dessen Löschvermögen.
- 2. Schriftfeld enthält: die Bedienungsanleitung in Schriftform und als Piktogramm, ebenso die Brandklassen für die der Feuerlöscher geeignet ist.
- 3. Schriftfeld enthält: Warnhinweis für den Gebrauch bei elektrischen Anlagen
- 4. Schriftfeld enthält: Beschreibung des Löschmittels, des Treibmittels, des Funktionsbereiches, Nummer der Anerkennung und Typenbezeichnung.
- 5. Schriftfeld enthält: Angaben zum Hersteller

FIRE EXTINGUISHERS HAVE FIVE LABELLING FIELDS

- 1. In labelling field 1 you find the word fire extinguisher, quantity and type of extinguishing agent and extinguishing capacity
- 2. In labelling field 2 you find the directions of use in written form and as a pictogram and the fire classes for which the extinguisher is designated
- 3. Labelling field 3 provides the warning notices for fires in electrical installations.
- 4. Labelling field 4 contains a description of the extinguishing agent and the propellant, the operating scope, the number of approval and the type designation
- 5. Labelling field 5 gives details on the manufacturer

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Fire Extinguisher Types

Extinguisher		Type of Fire					
Colour	Type	Solids (wood, paper, cloth, etc)	Flammable Liquids	Flammable Gasses	Electrical Equipment	Cooking Oils & Fats	Special Notes
	Water	✓ Yes	✗ No	✗ No	✗ No	✗ No	Dangerous if used on 'liquid fires' or live electricity.
	Foam	✓ Yes	✓ Yes	✗ No	✗ No	✓ Yes	Not practical for home use.
	Dry Powder	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ No	Safe use up to 1000v.
	Carbon Dioxide (CO_2)	✗ No	✓ Yes	✗ No	✓ Yes	✓ Yes	Safe on high and low voltages.





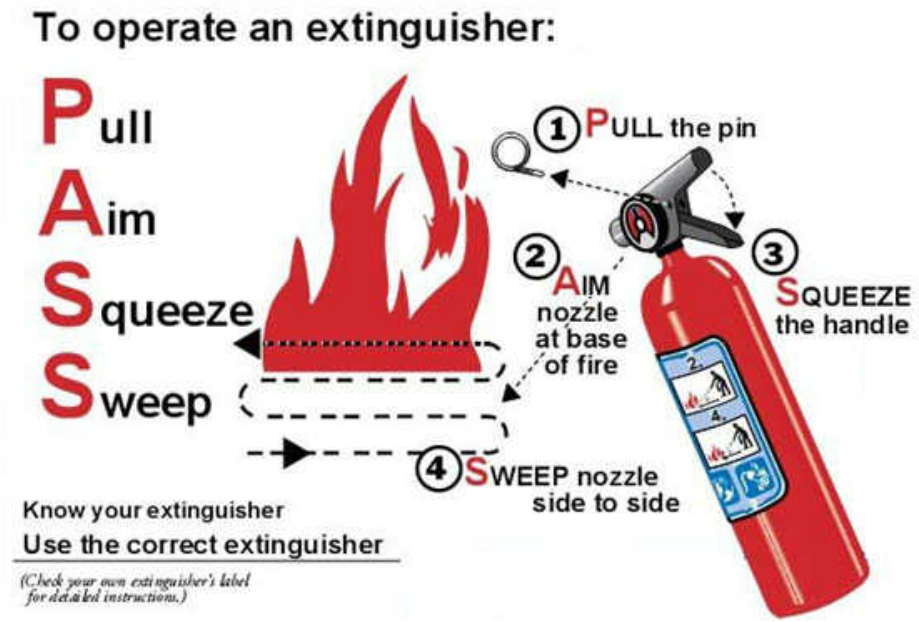


Figure 18 Fire Fighting Devices (1)

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Alarm Order (AO)

The AO is a covering law and serves the company's internal emergency and catastrophe protection and/or the limitation of damages in case of emergencies.

In the first chapters general preventive actions are mentioned.

They describe the necessary actions and responsibilities in an emergency situation. In the following chapters internal regulations and information for individual administrative sectors are dealt with.

The AO serves the protection of persons, company and environment. Tasks and responsibilities in an emergency situation are is described in the AO.

In the AO you will find a description of two alert phases for two groups of buildings. It must be made accessible by way of posters in every company area.

- Alert phase I is related to local accidents (fire and material damage, etc.)
- Alert phase II is related to crisis-type emergency situations, whose impact extents beyond the company area, and have consequences on e.g. air traffic. Centralized concerted actions are necessary.

Rules of Conduct to be prepared for, or prevent an Emergency

Never forget that carelessness and disregarding of the designated safety procedures and devices can endangers human life, material and environment.

Emergency exits, stairs, corridors and escape routes have to be kept free of obstacles at all times. Get information about the available safety devices and facilities and familiarise with their operation.

In case of alarm, provide clear information about the following:

- Location of emergency
- What happened?
- How many injured people?
- Who is responsible for the realization of the alarm?

Gathering Areas

When an evacuation is necessary go to the gathering areas.

The place and the assignment (who should go to which area) can be learned from alarm order.

Bomb Threat

In case of bomb or explosive alert for buildings or aircraft, an evacuation alarm will be caused and the building or aircraft must be evacuated.

The search is conducted by the plant protective force, the Federal Border Guard or similar forces.

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ALARMPLAN ALARM PLAN

NOTRUF-3333 EMERGENCY CALL # 3333

040-5070 3333



NOTRUFE EMERGENCY CALLS

Sprechen Sie deutlich! Please speak clearly!
Melden Sie: Please report:

- Was ist passiert? What has happened?
- Wo? Gebäude/Raum Location? Building/Room
- Ihren Namen Identify yourself

BEI FEUER/EXPLOSION IN CASE OF FIRE/EXPLOSION

- Betätigen Sie den nächstgelegenen Feuermelder! Please activate the next fire detector!

GEBÄUDEALARM BUILDING ALARM

- Alarmton mit anschließender Räumungsansage
  Alarm signal will sound and evacuation information will follow
- Räumen Sie das Gebäude sofort und begeben Sie sich zu Ihrem Sammelplatz !
  Evacuate the building immediately and proceed to the next gathering place!
- Benutzen Sie keine Aufzüge!
  Do not use any elevators!
- Achten Sie darauf, dass bei einem Räumungsalarm das Gebäude erst nach der offiziellen Freigabe wieder betreten wird!
  The building must have been declared safe before you are allowed to return to your facility!

ALLGEMEINE VERHALTENSREGELN GENERAL CODE OF BEHAVIOR

- Ruhe bewahren! Stay calm!
- Helfen Sie Menschen mit Behinderung!
  Assist handicapped persons!
- Elektrische Geräte bei Verlassen ausschalten! Turn off all electric devices!
- Türen nur zuziehen, nicht verschließen!
  Close all doors but do not lock up!
- Weisen Sie Feuerwehr oder Arzt zum Unfallort!
  Indicate the place of accident to the fire department and medical personnel!
- Informieren Sie sich über die Orte der Feuerlöscher und über Ihren Sammelplatz !
  Make yourself familiar where to find the next fire extinguisher and your gathering place!
- Achten Sie darauf, dass alle Flucht- und Zufahrtswege freigehalten werden!
  Make sure all escape- and access routes are not blocked!

Handlungsanleitung zur Unterweisung

Abwehr möglicher Gefahren am Arbeitsplatz und Schutzmaßnahmen

Die nächste Sammelstelle ist:

Alarmplan



112

Handy: **069 / 690 4 44 44**

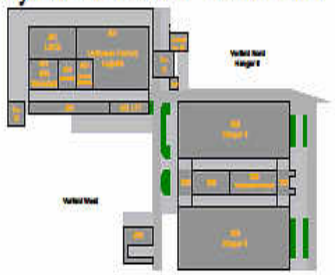
Wer? Name und Telefonnummer des Meldenden

Was? Art des Schadens

Wo? Gebäude, Etage, Bereich?

Wieviel Verletzte? Art der Verletzung?

Warten auf Rückfragen



Gebäudealarm: (Sirene/Hupe ertönt) Räumen Sie das Gebäude sofort und begeben sich zum zugewiesenen. _____ **Benutzen Sie keine Aufzüge!**

Hausherr: _____ Standort: _____ Sicherheitsingenieur: _____ Sicherheitsbeauftragte(r): _____ Ersthelfer: (Geb., Raum) _____

Figure 19 Alarm Plan

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