

Health & Safety Guidelines



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Introduction

In order to promote uniform standards regarding health, safety and environment, the adidas Group has developed two key guidelines, the Health & Safety (H&S) Guidelines and the Environmental Guidelines, for establishing, auditing and monitoring at factories doing business with us. The guidelines are based on existing standards used around the world and should be read and applied in conjunction with each other.

These guidelines detail the requirements which will allow suppliers to comply with the adidas Group Workplace Standards. The guidelines described do not necessarily reflect the national laws of all the countries where suppliers are based, and it is the responsibility of individual suppliers to ensure that they meet all legal requirements relating to health, safety and environmental matters. Suppliers should always follow the strictest standard available whether as stated in the law or in these guidelines.

The main purpose of the guidelines is to give practical ideas to suppliers to help them manage the process of continuous improvement in collaboration with people from our company.

The guidance offered in this document is presented in two parts. The first covers Basic Health and Safety and describes the minimum requirements for general manufacturing. In some cases suppliers may be required to achieve higher standards for their type of industry or as detailed in other technical guidance or practice notes issued by the adidas Group (e.g. *Fire Safety Guidance Note* and *Storage or the Handling of Materials Guidance Note*). Please consult with your local Social & Environmental Affairs (SEA) representative before making major investments in the construction or reengineering of systems to satisfy health and safety requirements.

The Technical Application Guidelines complement the Basic H&S Guidelines, by providing information on ways to strengthen the delivery of effective health and safety in the workplace. Practical guidance is given on common issues found in the workplace, such as material storage, the use of Personal Protective Equipment (PPE), ergonomics, hot working, electrical safety and ventilation design, as well as ways to assess occupational hazards and risks and to deliver effective H&S training for workers.

Local labour departments, government health and safety inspectorates and fire services departments should be consulted for local language guidelines and posters on health and safety. Whichever guidance sets the highest standards, those guidelines should be applied.

Health and Safety Guidelines – Basic H&S Guidelines

Section 1 – Management

Factory management has the ultimate responsibility to provide a safe and healthy work environment for its workers, and to manufacture a product that is safe for consumers and the environment. Therefore, it is essential that factory management fulfills these responsibilities by establishing the appropriate documentation in the form of relevant policies, procedures, plans and instructions.

Fire presents the greatest risk for loss of life and the destruction of property. The factory must have a fire safety and emergency preparedness plan in place, and all workers must be aware of their respective roles in the plan through training and drills.

Maintaining records of worker injuries and accidents is essential if future injuries and accidents are to be prevented and for legal liabilities to be managed. Accident investigation and the maintenance of an injury log (see Figure 1.1) are important elements of an effective H&S and environmental management system.

1.1 Documentation Guidelines for Factory Management

<ul style="list-style-type: none"> • Documentation of current local legal requirements for Health, Safety and Environment (e.g. building construction certificate, occupying licence, environmental impact assessment for a new factory or site, fire certificate, fire fighting system approval certificate). Reference shall also be made to the adidas Group Environmental Guidelines for further guidance. • Retain comprehensive records of: <ul style="list-style-type: none"> ○ Governmental permits or certificates (e.g. elevators, boilers, building structural loads, etc.). ○ Monitoring and test results (e.g. waste water treatment and discharge, air quality and worker exposure to chemicals, emergency lighting and alarm systems). ○ Internal training exercises and drills (in particular, evacuation drills in factory and dormitories). ○ Hazards and risk lists. 	<ul style="list-style-type: none"> • Written policies and personnel organisation on H&S subjects (including H&S and Environment coordinator(s), safety officer, H&S and Environment committee(s), etc.). • Accident/injury log (Figure 1.1). • Fire and Emergency Preparedness Plan (Figure 1.2). • Written training procedures and materials for workers on H&S and Environmental issues (e.g. general safety issues, chemical hazards and proper handling, pollution prevention, machine safety, first aid, etc.).
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Chemical management and environmental, safety and health certification programmes are one way the factory can improve its internal management of H&S and environmental issues. The Occupational Health and Safety Assessment Series standard (OHSAS 18001) from the British Standards Institute and the Environmental Management Standards from the International Organization of Standardization (ISO 14001) require written documentation to support the analysis and management of health, safety and environmental issues. Additional information on Environmental Management System (EMS) requirements can be found in the adidas Group Environmental Guidelines.

Factory management must also address product quality and stewardship issues. The adidas Group 'A-01: Policy for the Control and Monitoring of Hazardous Substances' provides the list of chemicals whose presence in our apparel and footwear products is restricted or prohibited. Factory compliance with this policy will better ensure the safety of consumers and the environment over the lifecycle of the products.

1.2 Accident/Injury Log

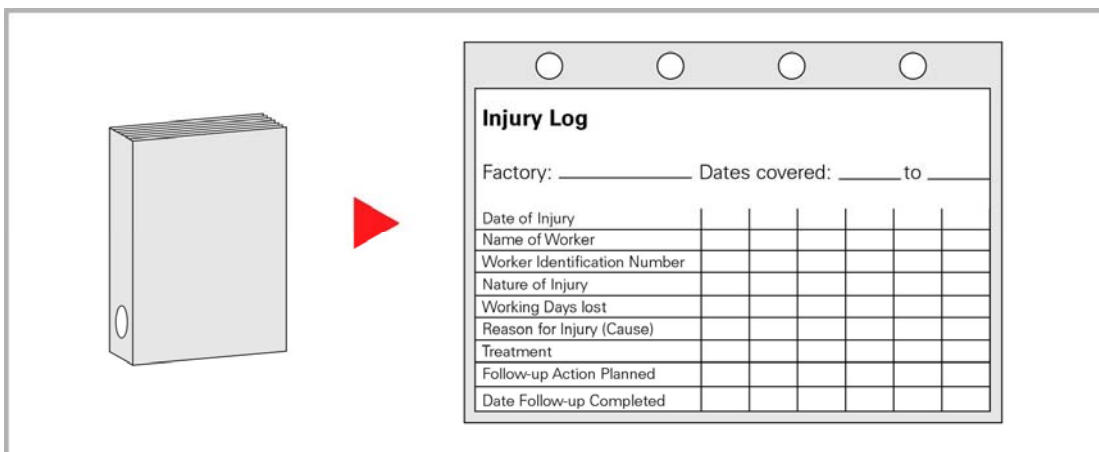


Figure 1.1 - Injury Log

1.3 Fire and Emergency Preparedness Plan

The following should be incorporated into the development of a fire and emergency preparedness plan:

<ul style="list-style-type: none"> • Provide maps/floor plans for each floor of the factory buildings, offices and dormitories, and post them at easily seen locations that show: <ul style="list-style-type: none"> ○ Actual location ("You are here"). ○ Locations of fire extinguishers. ○ Locations of audio and visual alarms. ○ Locations of First Aid kits. ○ Locations of alarm system pull boxes, activation buttons, or call points. ○ Exit routes, Exits and Assembly areas. 	<ul style="list-style-type: none"> • Identify major fire risk hazards and ensure that evacuation routes do not pass through these locations. • Provide telephone numbers and other contact information for: <ul style="list-style-type: none"> ○ Local fire department. ○ Ambulance service and local hospital. • Place maps prominently at entrances or egress to stairs, with height 1.6m, and at least A3 in size.
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Figure 1.2 – Emergency Escape Route

Section 2 – Architectural Considerations

The quality of factory buildings has a major impact on the safety and productivity of workers in the work environment. As these buildings are planned, constructed or renovated, physical stability, structural load capacity, fire prevention and general safety issues must be taken into consideration and should comply with applicable health and safety requirements. The principal concern in assessing the architecture of a factory is the risk of structural overload and collapse. However, more common safety hazards such as obstructed or insufficient exits, corridors, aisles and emergency egress routes may also increase the likelihood of loss of life during an emergency.

2.1 Guidelines on Structural Components of Factory Buildings

<ul style="list-style-type: none"> • The complete building should be maintained in good condition. • Roofs, ceilings and mezzanines: <ul style="list-style-type: none"> ○ The load capacity for upper floors must be sufficient for any machinery or equipment that will be installed. ○ Load-bearing walls, pillars and ceilings should be inspected regularly. • Storage racks should have adequate strength to support the anticipated loads. • Stairways: <ul style="list-style-type: none"> ○ Handrails are required if there are more than 4 steps (>1 metre rise). ○ The vertical distance between steps should be ≤ 0.19 metre. ○ The surface of steps should be even and slip-resistant. • Exposed overhead working surfaces should be protected by adequate guard rails and toeboards. • Floor openings and holes should be protected by covers and/or suitable barriers. 	<ul style="list-style-type: none"> • Elevators <ul style="list-style-type: none"> ○ The load capacity should be posted in the elevator. ○ Elevators should have doors, and the doors should be equipped with interlock devices that prevent the door from opening unless the elevator is present. ○ Elevators should be wired to be inoperable when the doors are open. ○ Each elevator should have a sign indicating if it is intended for passenger or freight use. ○ Warning signs regarding the use of elevators during emergencies should be posted just outside the elevator door at each level.
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2.2 Fire and Safety Issues Related to Building Construction

It is essential that all workers can quickly and easily evacuate their work areas and exit the building in the event of an emergency. Building construction, and the arrangement of equipment, utilities, furniture, etc. within the building spaces, must be strictly in accordance with fire codes and meet health and safety regulations and guidelines. The number and size of stairways and exits must be adequate for the occupancy load of the various sections of a factory building.

2.3 General Fire Safety

<ul style="list-style-type: none"> • The number and the width of stairways that are used for emergency egress must be adequate (see Table 2.1). • At least 2 stairways are required from each upper story of a building if the story has >30 occupants, unless legal requirements are more stringent. • Aisles and corridors that serve as means of emergency egress: <ul style="list-style-type: none"> ○ Width should be >1.1 metres. ○ Head room should be >2 metres. ○ The floor surface should be slip-resistant. ○ They must have no obstructions (e.g. not used for storage). ○ There must be adequate clearance (>0.4 metres) between work stations and clear passage for workers. ○ Dead-end corridors should be <15 metres long, and marked "No Exit" (see Table 2. 4). ○ No means of egress should pass through high hazard areas, such as chemical storage rooms, boiler rooms, etc. 	<p>Exits Exit doors must be unlocked during regular hours of factory occupancy and:</p> <ul style="list-style-type: none"> • Exit doors must open outwards. • Any doors not serving as exits or means of egress should be marked 'No Exit'. • The walking surface at exits should be at the same height on both sides of the exit door or passage. • There must be an adequate number of exits of appropriate widths (see Table 2.2). • No worker should be positioned more than 60 metres from the nearest exits. <p>Travel Distance</p> <ul style="list-style-type: none"> • Maximum travel distance must be determined to ensure safe and rapid evacuation in the event of emergency (see Tables 2. 3 & 2.4).
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2.4 Aisles and Emergency Egress Routes

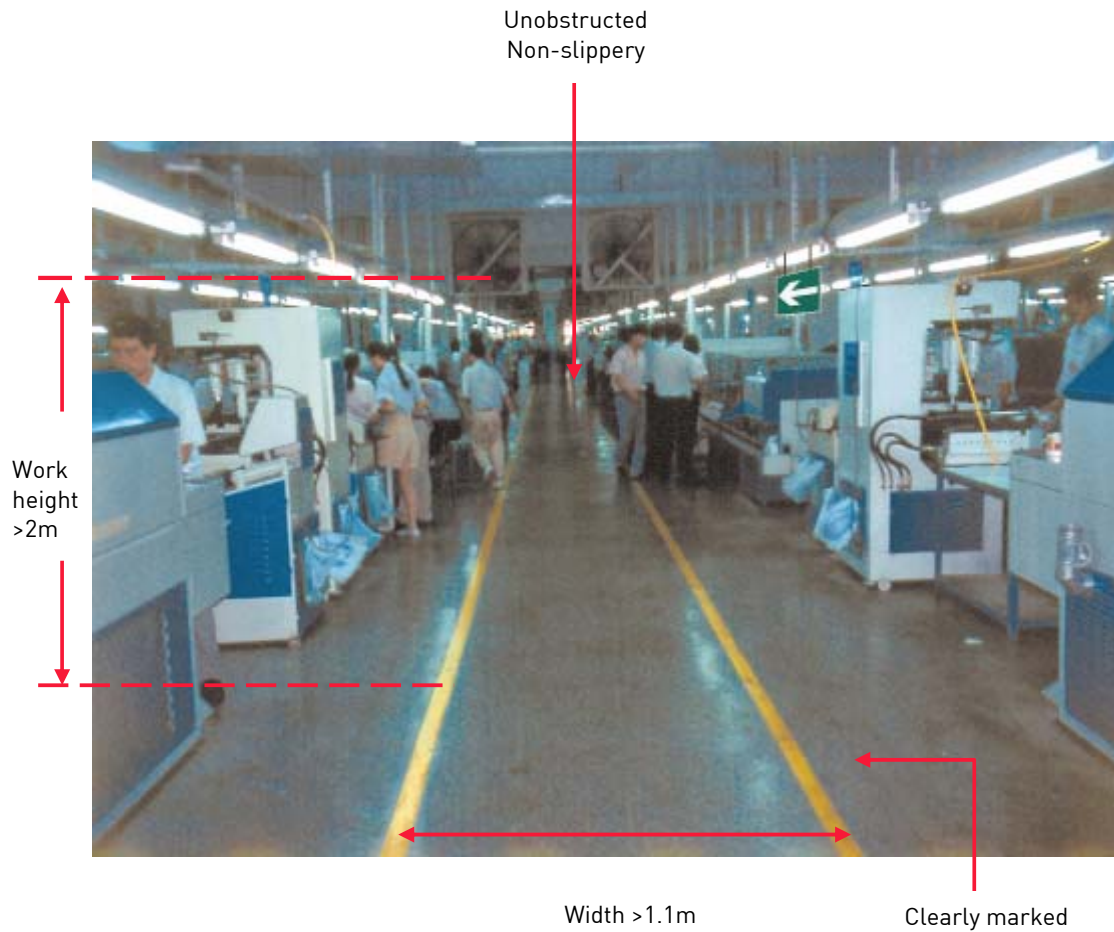


Figure 2.1 – Aisles and Emergency Egress Routes

2.5 Stairways

The width of stairways is a critical factor in ensuring that workers can evacuate from upper stories of a factory building in the event of a fire or other emergency. The recommended width of a stairway depends on:

- The total number of occupants in the building (the more people, the greater the required width); and
- The number of stories in the building (the more stories, the easier it is for a given number of occupants to evacuate via a given stairwell width).

The following table lists the number of people who can evacuate via a stairwell of stated width. It is assumed that there is approx. the same number of occupants on each story of the building. Further it is assumed that the width of the stairwell is constant on all levels of the building.

Number of People	Width of Stairways						
	1.00 m	1.50 m	2.00 m	2.50 m	3.00 m	3.50 m	4.00 m
1	200	300	400	500	600	700	800
2	240	360	480	600	720	840	960
3	280	420	560	700	840	980	1120
4	320	480	640	800	960	1120	1280
5	360	540	720	900	1080	1260	1440
6	400	600	800	1000	1200	1400	1600
Each Additional Storey	40	60	80	100	120	140	160

Table 2.1 – Requirements on the Width of Stairways

2.6 Exits

The width and number of exit doors for a room or other section of the factory depends upon the number of workers in the room and not on the floor area. Therefore, small rooms may require large exit doors if they hold many occupants. On the other hand, in large rooms or areas with few workers (e.g. warehouses), smaller exits may be acceptable. Table 2.2 lists the requirements for the number of exits and the total escape or exit width, given the number of persons in the building space. For example, an interior space or room with 450 workers should have at least 2 exit doors, which have a total width of at least 3 metres.

Requirements on Total Escape Width and Number of Exits									
Number of Persons in Room	< 30	< 200	< 300	< 500	< 750	< 1000	< 1250	< 1500	> 1500
Number of Exits	1	2	2	2	3	4	5	6	6 or more
Total Escape Width	>0.75m	1.75m	>2.50m	>3.00m	>4.50m	>6.00m	>7.50m	>9.00m	For each 250 persons add 1.5m

Table 2.2 – Requirements on Total Escape Width and Number of Exits

2.7 Travel Distance

The calculated travel distance provides safe and rapid evacuation during an emergency situation. Table 2.3 describes the travel distance required for different types of use, with or without fire protection. Table 2.4 describes the travel distance, exit capacity and maximum distance to a dead end.

Type of Occupancy	Max. Travel Distance (m) (One-way Escape)		Max. Travel Distance (m) (Two-way Escape)	
	Without Sprinkler	With Sprinkler	Without Sprinkler	With Sprinkler
Hazardous activity	10	20	20	35
Industrial buildings (factories, workshops, godowns/warehouse)	15	25	30	60
Dormitories, hostels	15	30	30	60
Shops	15	25	45	60
Offices	15	25	45	75
Clinics/hospitals	15	25	30	45

Table 2.3 – Requirements for Safe Travel Distances and Exit Capacity by Building Use

Type of Occupancy	Egress Capacity No. of persons per unit of escape width (X) refer to table 2.2				Max Dead End (m)
	Door openings		Staircases	Ramps, corridors, exits, passageways	Distance travelled to corridors
	To outdoors at ground level	Other exit & corridor doors			
Hazardous activity	50	40	30	50	<15
Industrial buildings (factories, workshops, godowns/warehouse)	100	80	60	100	<15
Dormitories, hostels	50	40	30	50	<15
Shops	100	80	60	100	<15
Offices	100	80	60	100	<15
Clinics/hospitals	30	30	15	30	<15

Table 2.4 – Requirements for Safe Egress Capacity and Safe Travel Distance at Dead End Condition

Section 3 – Fire Safety

Each year industrial fires cause injuries and loss of life and property. These losses can be avoided with the proper implementation of fire prevention measures and emergency preparedness. Fire extinguishers are one of the less expensive aspects of fire safety, but their use in factories is often compromised by poor maintenance, inappropriate and/or obstructed placement, and lack of worker training. Automatic sprinkler systems, when adequately designed, installed and maintained, are up to 95%+ effective and offer the best protection for building occupants and property.

Every country has fire safety legislation and fire safety and building codes. Suppliers should understand and comply with these codes and regulations. General guidance on fire safety is given below and further details can be found in the adidas Group’s Fire Safety Guidance Note. Whenever there is a conflict between national codes and the adidas Group guidance, ***the most stringent standard should apply.***

3.1 Fire Safety Guidelines

<ul style="list-style-type: none"> • Fire alarm systems (sound and light) should be installed which are distinct from other alarms and notification systems: <ul style="list-style-type: none"> ○ Full testing of alarm systems every three months. ○ All records of tests, maintenance, repair or replacement of alarm systems should be retained. • Emergency lighting should be installed along egress routes, at exits, in stairwells, and at other appropriate locations (see Figure 3.5): <ul style="list-style-type: none"> ○ Lighting should be >1 lux. ○ Inspection and testing with documentation every month. ○ Illuminated “EXIT” signs with back-up power supply are required at exits and along egress routes. • Sufficient directional and exit signs to ensure that all egress routes from all areas of the building to exits are clearly indicated. • Exit signs should be clearly legible with pictogram and wording in English and the local language. • Assembly areas outside the building should be designated, and should not interfere with emergency service. 	<ul style="list-style-type: none"> • “No Smoking” signs should be displayed prominently throughout the premises. • Fire hydrants and fire hoses should be inspected and tested at least twice yearly and have control tags as documentation. • Automatic sprinkler system operation: <ul style="list-style-type: none"> ○ An independent water supply for the sprinkler system is required. ○ Pressure checks of the water storage container should be conducted every 5 years and documented. ○ Water level and pressure, water pumps and the general condition of related equipment should be inspected monthly. ○ Sprinkler heads should be kept clean. ○ Water flow through the sprinkler system should activate the building fire alarm. ○ Sprinkler piping should not be used to support unrelated equipment or materials. ○ There should be at least 0.45 metre clearance between sprinkler heads and stored materials.
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3.2 Fire Evacuation Drills

Suppliers should conduct *at least three evacuation drills* in their factory buildings and dormitories each year. At least one of these drills in each location (i.e. one in the factory and one in the dormitory) should be accompanied by a power shutdown to test the emergency lighting and alarm systems. Records should be kept of each drill, and any problems that were encountered should be noted as well as any subsequent corrective actions.

Drill records should include fire drill plan and arrangements, the fire procedure, fire emergency plan, the process of the drill, existing problems, and improvements.



Figure 3.1 – Fire Drill Activities

3.3 Background Information on the Development and Propagation of Fires

Fire can result from the right combination of fuel, heat and oxygen. When a material is heated to its **ignition** temperature, it will ignite and continue to burn as long as there is more fuel, an adequate supply of oxygen and the proper temperature. Likewise, when a flammable or combustible liquid is heated to temperatures greater than its **flash point**, there is adequate vapour in the air to support combustion if an ignition source and oxygen are present. Possible ignition sources are listed in the table below:

Flames	From such sources as fixed water boilers, gas welding and cutting, engine backfire or exhaust gases, heating and kitchen appliances, cigarette smoking.
Hot Surfaces	Including welding slag, hot spots on the opposite side of work pieces during welding, hot fumes and exhausts, hot process piping and equipment, lighting and other electrical equipment, frictional heat from slipping belt drives, unlubricated bearings, heating and cooking appliances.
Sparks or Electric Arcs	From hand tools, electric motors or generators, switches and relays, wiring, electric arc welding, storage batteries, boiler ignition devices, lighting systems, torches.
Sparks from Static Electricity Discharge	Can be generated from many sources, including high fluid velocities (fueling, filling vessels, steam cleaning, grit blasting, spray painting), normal frictional body movements when wearing synthetic clothes, radiofrequency transmission, and lighting.
Chemical Reactions	Which evolve heat, including substances that may ignite spontaneously on exposure to air such as white phosphorus, or water-reactive chemicals.
Heat of Compression	When hydrocarbon gases are mixed with air, e.g. by admission of VOCs into air compressors, or from the incomplete purging of pressure vessels.

Table 3.1 – Potential Ignition Sources

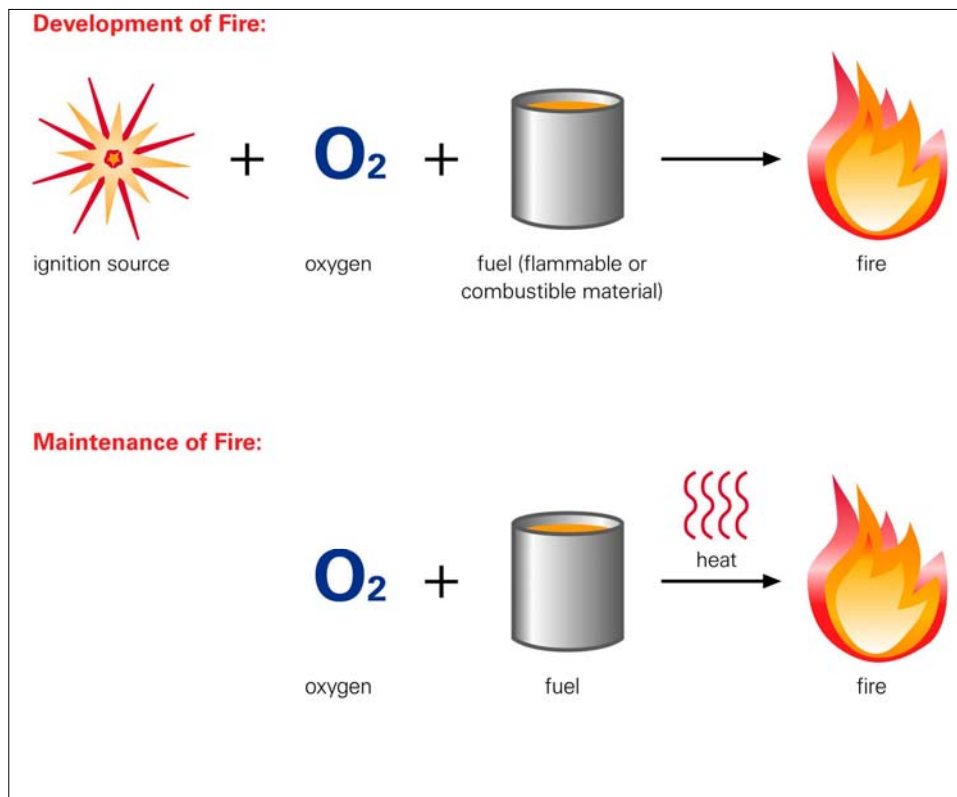


Figure 3.2 – Development and Propagation of a Fire

3.4 Fire Prevention Strategy

Oxygen is normally present in the air around us in a sufficient quantity to support fire (approximately 21%). Every factory uses combustible/flammable material. Thus, fire prevention has to focus on prevention of ignition sources in fire sensitive areas.

3.5 Fire Extinguishing Strategy

To extinguish a fire once it has begun, one of the three required elements must be eliminated or removed: the combustible/flammable material (i.e. fuel), the oxygen, or the heat. Most fire extinguishing methods focus on the removal of oxygen (e.g. carbon dioxide extinguishers) or the removal of heat (water extinguishers or automatic sprinklers).

3.6 Fire Fighting Strategy

To fight fire, the combustible/flammable material, the oxygen or the heat have to be removed. If there is no chance to remove the combustible/flammable material, fire fighting focuses on the removal of oxygen (e.g. with carbon dioxide extinguishers). Additionally, some extinguishers also work by cooling the material below its critical temperature.

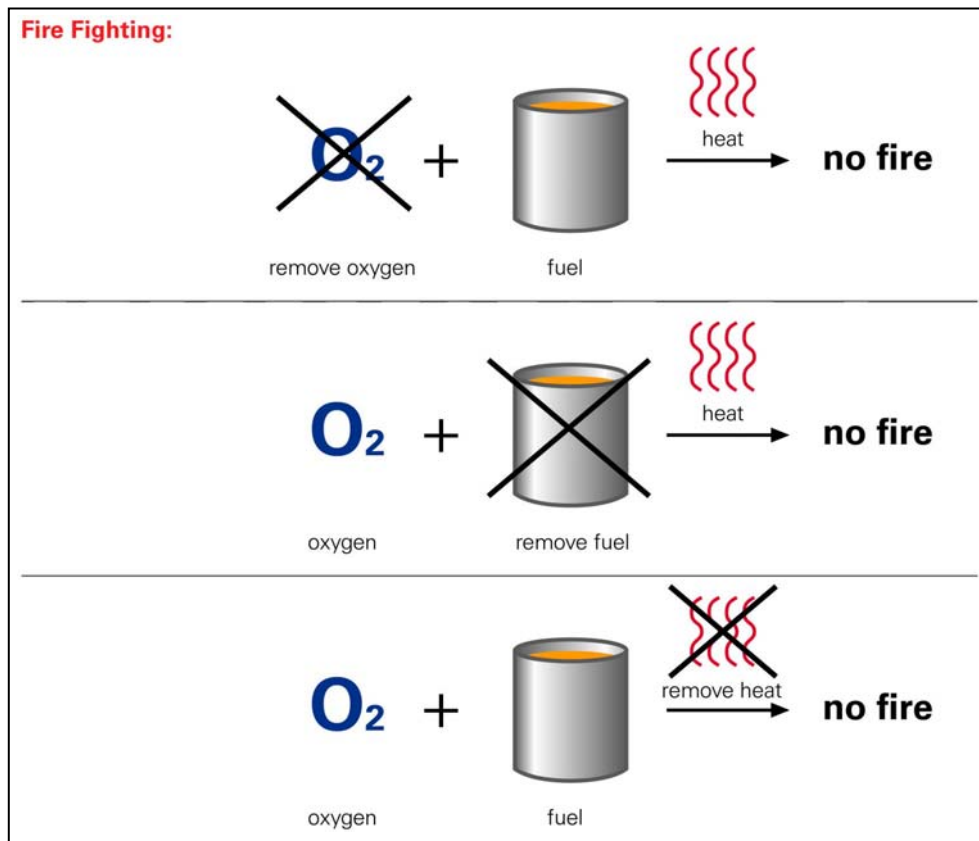


Figure 3.3 – Strategies to Fight Fire

To remove oxygen from the fire, it is important that the extinguisher is suitable for the kind of fire; otherwise the situation becomes worse. A typical bad example is the treatment of a diesel fire with water. Diesel and water cannot be mixed. As a consequence, the jet of water only spreads the burning diesel drops and worsens the fire instead of extinguishing it.

Tables 3.2 and 3.3 provide examples of the types of extinguishers that are suitable for various types of fires.





Suitability of Extinguishers		
Fire Class	Kind of Flammable / Combustible Material	Suitable Portable Fire Extinguisher
	solid material (e.g. wood, coal, paper, textiles, polymers, rubber etc.)	<ul style="list-style-type: none"> ■ dry powder extinguisher (ABC-powder) ■ foam extinguisher ■ water extinguisher
	liquid material non water mixable (e.g. fuel, solvents, oil, etc.)	<ul style="list-style-type: none"> ■ carbon dioxide extinguisher ■ dry powder extinguisher (ABC or BC-powder) ■ foam extinguisher ■ (water extinguisher with additives)
	gaseous material (acetylene, butane, propane, methane, hydrogen)	<ul style="list-style-type: none"> ■ powder extinguisher (ABC or BC-powder)
	metals (e.g. aluminium or magnesium alloys, titanium, zirconium, sodium and potassium)	<ul style="list-style-type: none"> ■ powder extinguisher (with special metal fire powder)

Table 3.2 – Suitability of Fire Extinguishers

Fire Class	Types of Materials Involved	Appropriate Type of Fire Extinguisher
<p>Class A</p> 	<p>Ordinary combustible materials such as wood, paper, cloth, rubber and many plastics.</p>	<p>Type A extinguishers</p> <ul style="list-style-type: none"> • Water extinguishers • Foam extinguishers • Dry chemical (ABC)
<p>Class B</p> 	<p>Liquids that are not water-miscible, such as flammable and combustible solvents, greases, tars, oils and fuels.</p>	<p>Type B extinguishers</p> <ul style="list-style-type: none"> • Dry chemical (BC or ABC) • Carbon Dioxide extinguisher • Foam extinguisher • Water + Additives extinguisher
<p>Class B</p> 	<p>Pressurised flammable gases and liquids (e.g. hydrogen, acetylene, propane).</p>	<ul style="list-style-type: none"> • Dry chemical extinguisher (BC or ABC)
<p>Class C</p> 	<p>Class A or B materials involved with energised electrical equipment.</p>	<p>Type C extinguishers</p> <ul style="list-style-type: none"> • Dry chemical (BC or ABC) • Certain halon agent-type extinguishers

Table 3.3 – Suitability of Fire Extinguishers



Fire Class	Types of Materials Involved	Appropriate Type of Fire Extinguisher
<p>Class D</p> 	<p>Metals such as aluminum, lithium, magnesium, titanium, sodium, zirconium and potassium.</p>	<p>Type D extinguishers</p> <ul style="list-style-type: none"> • Dry powder (D)
<p>Class F/K</p> 	<p>Combustible cooking media (animal and vegetable oils and fats).</p>	<p>Type K extinguishers</p> <ul style="list-style-type: none"> • Dry chemical (K) • Wet chemical (F/K)

Table 3.3 – Suitability of Fire Extinguishers, contd.

Halon 1211 fire extinguishers are still found in some factories. Since Halon 1211 is a chemical with a high ozone-depleting potential, this type of fire extinguisher should be replaced as soon as practically possible.

3.7 Guidelines on Distribution and Use of Portable Fire Extinguishers

<ul style="list-style-type: none"> • Distribution across factory locations should be determined by the class of fire hazard at the various locations (see Table 3.1). • At least one extinguisher (6 kg size) per 100 square metres of floor area. • Distance from any worker to a fire extinguisher should be <22.5 metres (~75 feet). • Fire extinguishers should be easily accessible and their locations clearly marked. • An extinguisher should be located just outside of rooms used for storage of combustible materials. • An extinguisher should be located near storage areas for empty flammable liquid containers. • Type B extinguishers within 3 metres of the door to indoor flammable liquid storage areas, and within 25 metres of outdoor flammable liquid storage areas. 	<ul style="list-style-type: none"> • Portable extinguishers should be identifiable with a unique number (for purposes of inspection and maintenance). • Extinguishers should be fully charged at all times, and should be recharged after each use. • Visual inspections should be conducted monthly, and documented on a control tag. • All portable fire extinguishers should be serviced at least annually by qualified personnel from a licensed company. • Operating instructions should be in English and in the local language of the workers.
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3.8 Colour Coding Fire Extinguishers

Prior to 1997, the code of practice for fire extinguishers in the UK was BS 5423, which advised the colour coding of fire extinguishers as follows:

Water	- Red
Foam	- Cream
Dry Powder	- Blue
Carbon Dioxide (CO2)	- Black
Wet Chemical	- Yellow
Halon	- Green (now 'illegal' with some exceptions such as the Police, Armed Services and aircraft)

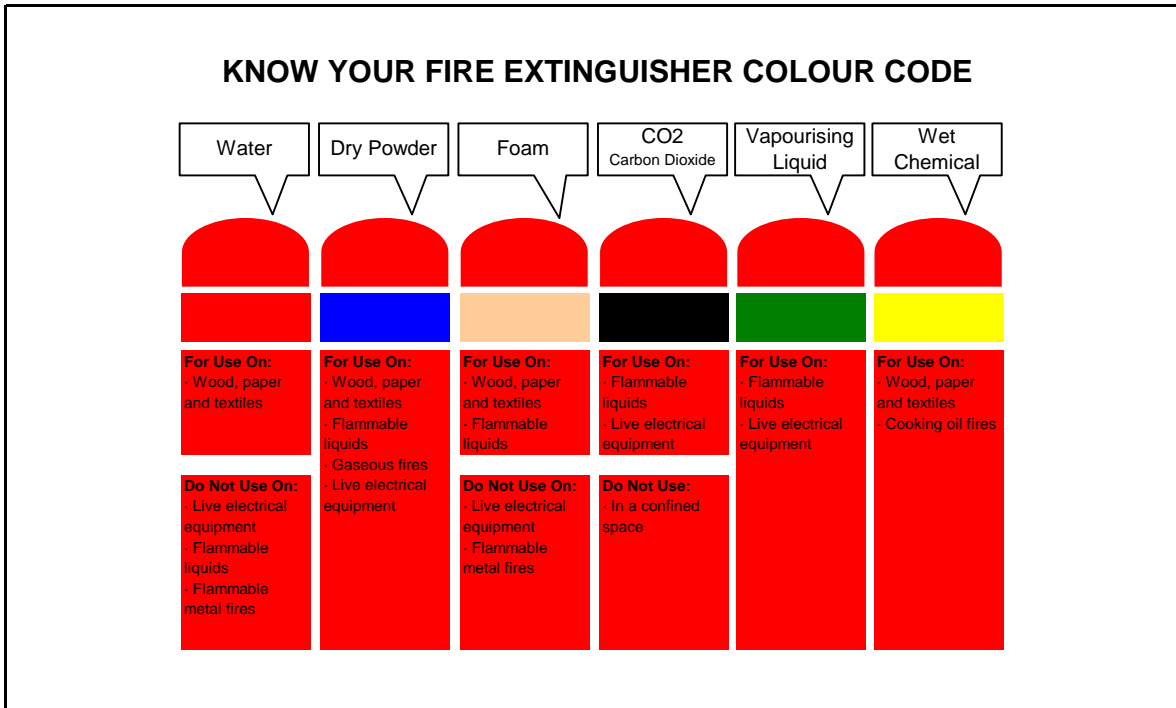


Figure 3.4 – Fire Extinguisher Colour Code

New extinguishers should conform to BS EN 3, which requires that the entire body of the extinguisher be coloured red. A zone of colour of up to 5% of the external area can be used to identify the contents using the old colour coding shown in Figure 3.4 above.

3.9 Worker Training on Aspects of Fire Safety

All workers should receive fire safety training as it applies to their work location and their dormitory (if applicable). Instructions on emergency evacuation procedures should be given as part of the workers' initial orientation and regularly thereafter. Workers should also receive instruction on the location and use of alarm pull boxes or other alarm activation methods.

If any workers are expected to use portable fire extinguishers in the effort to extinguish small, newly started fires, then they should receive training. This training should include the actual use of such equipment. The factory should also communicate their expectation of these trained workers: that in the event of an actual fire, they should only respond to relatively small, early stage fires, and if they have any doubt, then they should evacuate.

3.10 Exit Signs/Emergency Illumination



Battery-powered emergency illumination charged permanently (number and spacing sufficient to provide at least 1 lux)

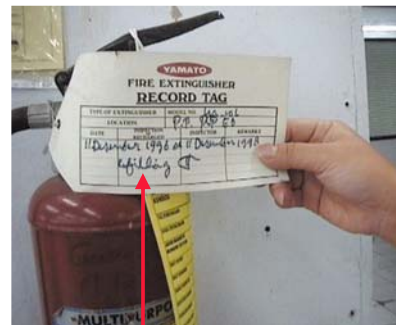
Switch in 'On' position



'EXIT' light box over exit door in English and local language

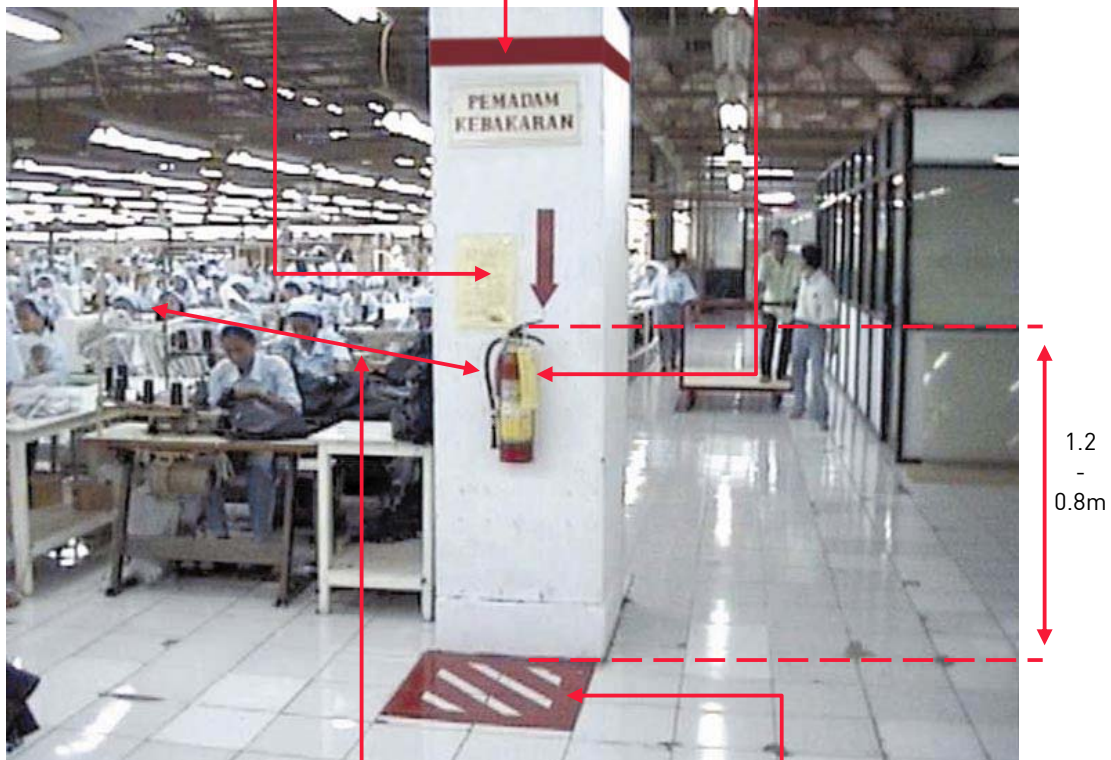
Figure 3.5 – Emergency Illumination Requirements

Recording tag on extinguisher



Extinguisher instruction in local language

Red ring around pillar



1.2
-
0.8m

Less than 22.5 m travel distance for each worker to extinguisher

Marking to prevent obstruction

Figure 3.6 – Requirements for Fire Extinguisher Points

Section 4 – First Aid

It is one of the most important duties of factory management to provide immediate and appropriate first aid to employees who are injured on the company's premises. A well-organised first aid system ensures quick medical attention for employees and can prevent the loss of many working days.

4.1 Guidelines for First Aid

<p>A First Aid room should be available in factories with more than 1,000 workers.</p> <ul style="list-style-type: none"> Clearly identified by signs (see Section 8 of these Guidelines). Clean and in an easily accessible location for workers. The First Aid room should be used only for that purpose. Adequately equipped for the type of injuries that may reasonably be expected in the factory. First aid supplies are available and within their expiration dates. At least one bed in the First Aid room per 1,000 workers at the factory. Screens/curtains available to provide appropriate privacy. First Aid instructions are available in both English and the local language. Contact information and a means to contact medical personnel and a hospital are available (e.g. a phone). A doctor or qualified medical personnel should be available to provide emergency medical services during working hours. Have a written procedure for worker access to such on-site medical services at times other than in an emergency. All medicines should be kept locked in the First Aid room and accessed by the doctor or qualified medical personnel only. <p>First Aid Personnel should be identified and trained</p> <ul style="list-style-type: none"> One first aid provider should be appointed for every 100 workers. 	<ul style="list-style-type: none"> First Aid providers should be adequately trained by professional personnel on an annual basis. The training should include a discussion of bloodborne pathogens. <p>First Aid kits should be available (see Figure 4.1)</p> <ul style="list-style-type: none"> A sufficient number of First Aid kits should be available (1 kit for ~100 workers, and the nature of the work and the distribution of the workforce should be considered also). First Aid kits should be kept in sealed containers that provide protection from dirt and water. The kits should be unlocked, or the keys should be easily accessible at all times. The kits should have sufficient first aid materials, all within their expiration dates. The kits should be inspected monthly and restocked after each use or as required over time. The kits should contain first aid instructions in both English and the local language. The kits should include a means of identifying current First Aid providers (either a list of names and/or photographs).
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Note: Consult your local SEA representative for additional guidance.



Figure 4.1 – Standards for First Aid Kits

Requirements/Contents of a First Aid Kit:

- Clearly marked
- Easily accessible for workers
- Protected against dust and water
- Inspection tag to document monthly checks
- Written first aid instructions in English and the local language
- A list of the required contents of the kit (for restocking), should include:
 - Scissors, tweezers and safety pins
 - Adhesive tape
 - Disposable latex gloves
 - Burn treatment applications (spray or cream)
 - Antiseptic applications
 - Sterile eye coverings (either two pads or a single cover for both eyes)
 - Large individually wrapped sterile triangular bandages
 - Individually wrapped sterile adhesive bandages (>20#) of assorted sizes
 - Small-sized individually wrapped sterile unmedicated wound dressings (absorbent compress) (>6#, ~12 cm x 12 cm in size)
 - Medium-sized individually wrapped sterile unmedicated wound dressings (adsorbent compress) (>2#, ~18 cm x 18 cm in size)
- In addition to the above, the following contents should be maintained in an emergency bag in the First Aid Room or stock room:
 - CPR barrier
 - Eye wash bottle (15 milliliter size)
 - Instant cold pack

Section 5 – Chemical Safety Management

5.1 Information on the Hazards Associated with Chemical Materials

Virtually all of the chemical materials that are used in production by factories are associated with one or more health or physical hazards. These hazards present potential adverse impacts on the workers, the work environment, the general public and the environment beyond the factory. The Environmental Guidelines outline further information on the environmental impacts due to chemical use, storage and disposal.

5.1.1 Health Hazards

A variety of health hazards are associated with chemicals in factories. The risk posed by any particular material is a function of:

- Severity of the Hazard – that is, the inherent toxicity of the chemical, or its “power” to cause adverse health effects.
- Exposure – the likelihood, duration and intensity of exposure (inhalation, dermal, ingestion) to the various forms of the chemical (gas or vapour, liquid, airborne dust or solid powders, etc.).
- Individual susceptibility or sensitisation – generally, there may be a range of individual susceptibilities to exposure to the various chemical agents. In addition, some individuals may become sensitised to certain chemicals after past exposures, and thereafter will exhibit adverse health effects at exposure levels that do not affect the majority of individuals.

The particular health hazards associated with different chemicals may vary. In general, there are two categories of adverse health effects: acute (those occurring during or soon after exposure) and chronic (those occurring after a long period of regular exposure, e.g. months or years). Within these two categories, chemicals may impact humans in a variety of ways:

- Carcinogenicity – exposure to some chemicals can lead to the development of cancer in one or more organs or body systems.
- Corrosivity – exposure can cause acute burns, ulceration and tissue damage in the eyes, skin and respiratory tract.
- Irritation – exposure can lead to skin, eye and respiratory irritation and dermatitis (but which is generally reversible).
- Target Organ Toxicity – some chemicals exhibit their toxicity at a specific organ (or “target”) such as the liver, kidneys, lungs, blood, eyes, ears, or the nervous system, including the reproductive system and the developing fetus.
- Sensitisation – exposure can lead to allergic reactions of the skin or the respiratory system (usually mediated by the immune system).

It is not feasible to eliminate all risk from activities involving chemical materials, but risk can be managed to an acceptable minimum. For inhalation exposure to chemicals, this level of minimum acceptable risk is defined by occupational exposure limits such as the Threshold Limit Values (see Section 7).

5.1.2 Physical Hazards

Chemical materials may present physical hazards as well as health hazards. The more common of these include: flammability, oxidising capacity, water reactivity, pressurised or compressed gases and liquids, and incompatibility and possible reactivity with other chemicals. When these potential hazards are present, awareness is critical for the proper storage and use of the relevant chemical materials.

Flammability (or combustibility) is the most common physical hazard that is associated with chemical materials in factories. An understanding of the **Flash Point**, a unique characteristic of flammable liquids, and of its distinction from the **Ignition Point**, another unique characteristic, is important for the awareness of the risk of flammability from chemical materials (see Figure 5.1). Both Flash Point and Ignition Point are temperatures, and they are both related to the likelihood of ignition. At the Flash Point temperature, there is sufficient vapour in the air immediately above an open container of the liquid that combustion will occur in the presence of an ignition source. At the Ignition Point temperature (much greater than the Flash Point), the heat from the local environment is sufficient to ignite the material. As a practical matter, chemical liquids with Flash Points which are less than typical factory temperatures (e.g. <35°C), warrant considerable attention in their storage and use.

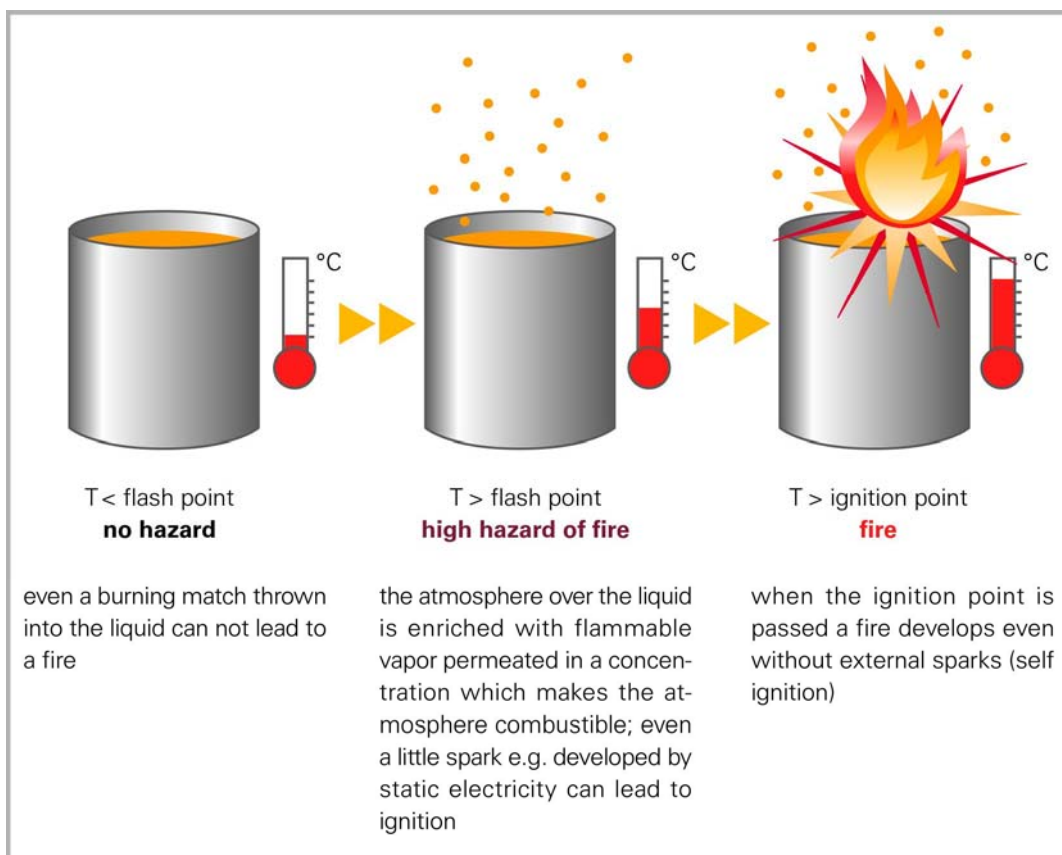


Figure 5.1 – Point of Ignition

5.2 Material Safety Data Sheets (MSDS)

Manufacturers and suppliers of chemicals are often required by law to provide their customers with MSDSs for their products. Even in the absence of such legal obligation, factories should insist on the receipt of the MSDS or equivalent written information for each chemical that they purchase.

The following categories of information should all be available on MSDSs:

<ul style="list-style-type: none"> • Substance identification: <ul style="list-style-type: none"> ○ Trade name ○ CAS # for each chemical ingredient ○ % of each ingredient • Chemical data: <ul style="list-style-type: none"> ○ Molecular formula and weight • Physical data: <ul style="list-style-type: none"> ○ Boiling point ○ Melting point ○ Solubility ○ Etc. • Toxicity data • Occupational exposure limits • Chemical reactivity and incompatibilities • Fire and explosion data: <ul style="list-style-type: none"> ○ Fire/explosion hazard ○ Flash point ○ Explosive limits ○ Ignition point/auto-ignition temperature 	<ul style="list-style-type: none"> • Fire extinguishing media • Health effects and First Aid measures <ul style="list-style-type: none"> ○ Signs and symptoms of exposure ○ Effects of inhalation, ingestion, and eye and skin contact ○ Antidotes or other treatments • Safe handling, storage and disposal requirements • Recommended spill and leak response procedures • Protective equipment <ul style="list-style-type: none"> ○ Personal protective equipment to avoid exposure ○ Protective measures for production equipment or other factory installations • Additional relevant information: <ul style="list-style-type: none"> ○ Contact information for the chemical manufacturer/supplier ○ Date of the last MSDS revision
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5.3 Chemical Safety Data Sheets (CSDS)

MSDSs provide detailed information on the properties of chemicals, but they may not be very useful for advising workers in the use and handling of these chemicals. Therefore, Operation Procedures and Chemical Safety Data Sheets (CSDS) should be created to provide brief summary information on chemical use and handling (see Figure 5.2). These should be written in simple language that is understandable to the workers and should be posted conspicuously at locations where the relevant chemicals are stored or used.

It may be appropriate for different chemicals with similar properties and hazards to be described in a single Operation Procedure, thus reducing the paperwork in the factory. Operation Procedures are working documents and part of the H&S Management System, and as such should be kept on file with the MSDS. They also should be posted with the related CSDS in production work areas.

Substance Identification	
Acetone	
Hazards for man and environment	
Breathing in, swallowing or absorption through the skin may result in health damage. May cause irritation etc. Increased risk of fire etc.	
Protective Measures	
Work only with fresh air supply, above all in the floor area. Use only intrinsically safe fans etc. Avoid contact with eyes, skin and clothing etc.	
First Aid	
After eye contact: Rinse for 10 minutes with water or with eye wash solution. After skin contact: Take off soiled clothing etc.	
Disposal	
Do not pour into the sewage or a refuse bin! For disposal collect in...	

Figure 5.2 – A Sample CSDS

5.4 Storage of Hazardous Materials

As described, chemicals present a variety of hazards and proper storage is necessary to minimise the risk of fire, explosion, serious personal injury and environmental contamination (see Figure 5.3).

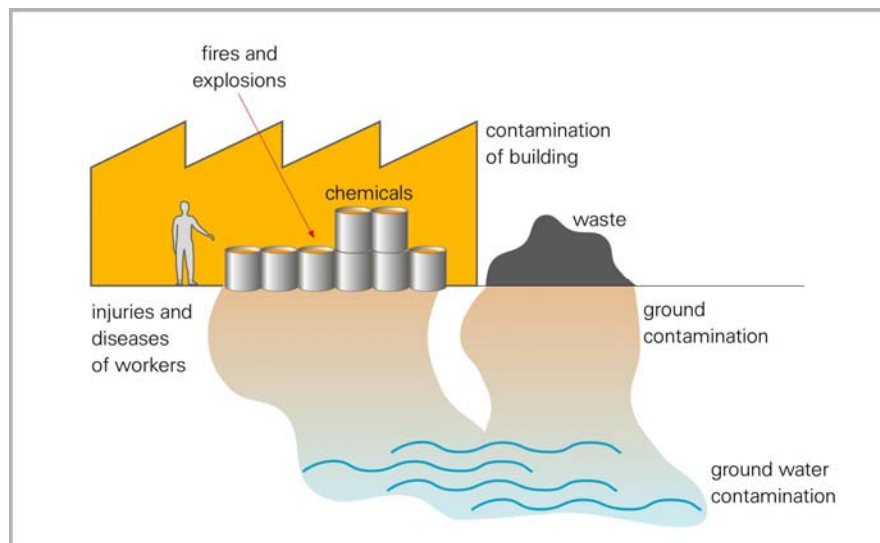


Figure 5.3 – Possible Impacts and Risks from Chemical Storage

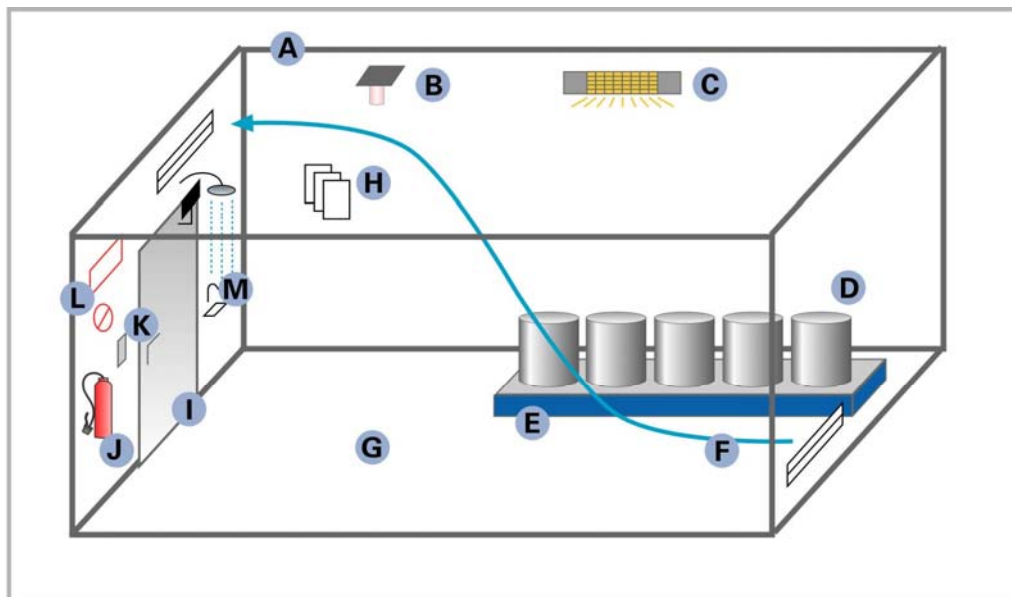
The MSDS for each chemical at the factory should include basic information and instructions related to the proper storage of that material. If the MSDS is inadequate, then additional resources should be consulted.

As a general rule, only a single day's supply of a chemical should be present and available for use on production floors. Otherwise, all hazardous chemicals should be stored in designated locations that are segregated from production areas, office areas, dormitories, kitchens, etc. The following table provides recommendations for such chemical storage areas.

5.5 Chemical Storage Guidelines

<p>Chemical Storage Rooms (see Figure 5.4):</p> <ul style="list-style-type: none"> • All electrical installations (lights, switches, ventilation equipment, wiring, junction boxes, other equipment) should be explosion-proof or protected. • Lightning protection should be installed. • The facility should be kept in a general state of cleanliness. • There should be an appropriate water supply for eye or body cleaning within a distance of 30 metres. • This water supply should be tested regularly. • Containers should be inspected upon receipt to ensure that the contents, concentrations and quality comply with purchasing specifications. • There should be legible and durable labels on all containers. • Containers should be kept closed or capped when not in use. • Secondary containment should be available for hazardous liquid storage to prevent ground and water contamination. 	<p>Large Storage Vessels:</p> <ul style="list-style-type: none"> • Secondary containment should be available. • Warning signs for chemical and fire hazards. • Flammable and combustible materials should be segregated from oxidising agents, reactive materials, etc. • Adsorbent materials and cleaners should be available for use in the event of minor spills or releases. • Warning signs should be clearly visible. • Adequate ventilation is required. • No floor drains are permitted. • Doors should have a fire-resistance rating of 30 minutes (T 30). • For fire extinguishers, refer to Section 3. Storage areas of >2000 square meters should have an additional 50kg extinguisher on wheels (also: see note below). • Metal containers should be transported in a manner that avoids sparking. • There should be regular inspection of storage areas for leakage, container conditions, and expired products. • An updated list of the chemical materials in inventory should be available (see Table 5.1). • MSDS and CSDS should be available. • Vessels should be protected from direct sunlight. • Appropriate temperatures should be maintained (extreme heat and cold should be avoided).
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Note: All flammable chemical storage areas should be equipped with automatic fire extinguishing systems. Consult your SEA representative for additional guidance.



- A** fire resistant building ●
 - B** vapor/smoke detection system ●
 - C** explosion-proof lights ●
 - D** containers:
 - grounded/bonded ●
 - closed ●●
 - labelled ●●
 - E** secondary containment ●●
 - F** forced ventilation across the storage room ●●
 - G** no floor drains ●●
 - H** CSDS's ●●
 - I** self closing fire resistant door ●
 - J** fire extinguisher or appropriate fixed system ●
 - K** explosion-proof light switch ●
 - L** warning signs ●●
 - M** emergency shower and eye wash facility ●●
- required for storage of flammable chemicals
● required for storage of other hazardous chemicals

Figure 5.4 – Guidelines for a Chemical Storage Area

5.6 Guidelines for Chemical Containers

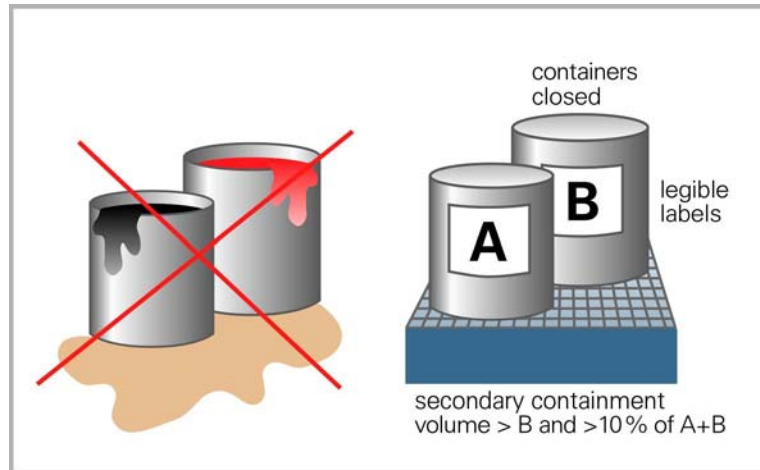


Figure 5.5 - Guidelines for Chemical Containers

Chemicals should be stored in such a manner that minimal impact to workers and the environment may occur. To ensure this, the following measures are required:

- Containers, drums or dispensers, when not actually in use, should be closed with an air-tight lid
- All containers, drums or dispensers require legible and durable labels with wording in the appropriate local language and in English
- Secondary containment should be provided to prevent leaks, spills and other releases to the ground. Such secondary containment should meet the following specifications:
 - Constructed of a durable material (e.g. metal) and resistant to the stored chemical liquid (corrosion-proof if necessary).
 - The volume capacity of the secondary containment should be at least 10% of the total chemical volume being stored within it, but in no case should it be less than the volume of the single largest container within the secondary containment (see Figure 5.5).

As an alternative arrangement, the complete storage room can be constructed as a secondary containment system. In this case, the floor must be sealed with an impermeable coating (e.g. special paint) since a regular concrete floor is porous to many organic solvents. Sills also have to be constructed of impermeable material.

Proper tools and equipment must be used for opening containers and drums. Grounding and bonding of containers during flammable liquid transfer are recommended.

5.7 Storage Separation

To minimise the potential impact of chemical leaks and spills, and the possible consequences of fires in chemical storage areas, it is important that incompatible chemical materials be stored with adequate separation. So, for example, the following precautions should be taken:

- Chemicals that are oxidisers or oxidising agents should be kept away from flammable liquid storage.
- Toxic but non-flammable chemicals that may form even more highly toxic chemicals during combustion should be stored away from flammable liquids.
- Chemicals that may react with each other should be stored remotely from each other.
- Water-reactive chemicals should be stored separately from water-based (aqueous) chemicals.

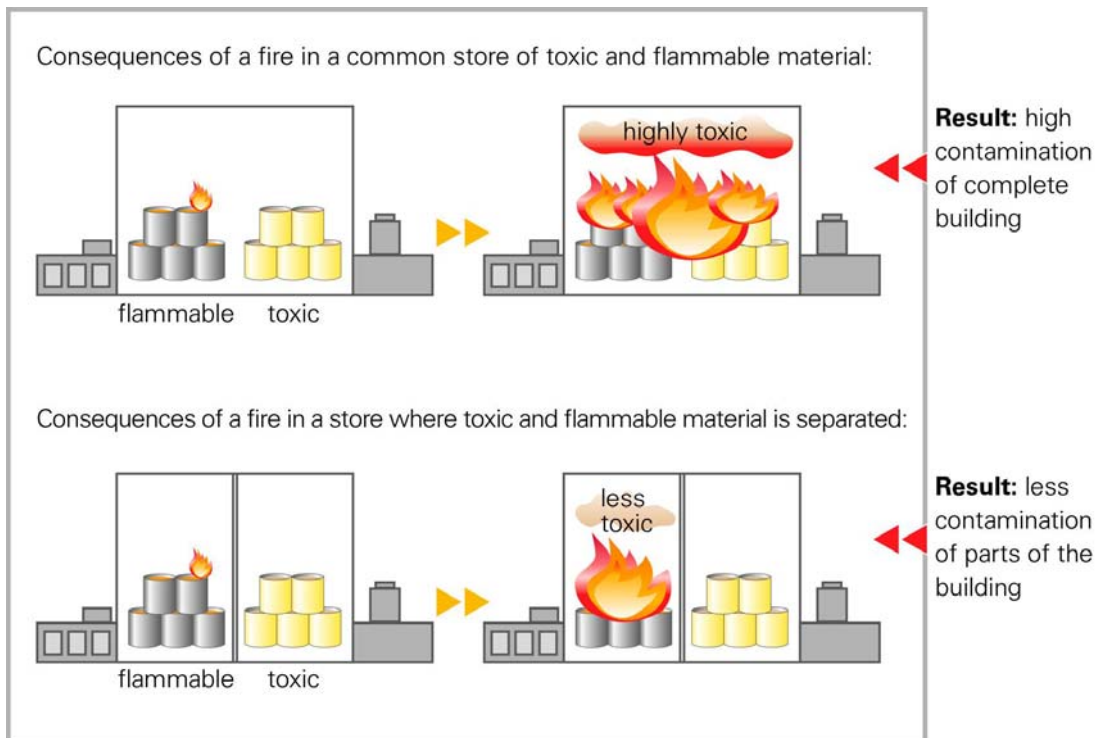


Figure 5.6 – Storage of Compatible Chemicals

5.8 Documentation of Chemical Inventory

To provide a readily available assessment of the hazard potential of the chemical materials in inventory at a factory, a list should be developed and updated regularly. At a minimum, this list should have information on the identification of the chemical or material, the approximate volume in inventory, its relative flammability, toxicity, and the hazard potential for groundwater (if any). The following table provides an example:

Chemical Inventory List					
Name of Chemical & Ingredients	Estimated Volume in Storage	Flammability	Toxicity	Water Hazard Potential	Storage Location
Primer with Acetone	2,750 litres	High	Irritation Nervous system	Low	Building 4
MEK	1,800 litres	High	Irritation Nervous system	Medium	Building 4
Hydraulic Oil	830 litres	Low	Irritation	High	Warehouse

Table 5.1 – Chemical Inventory List

Section 6 – Use of Hazardous Materials in Production

Workers in production areas must recognise that the chemicals and other materials that they use can be hazardous to their health and present other risks to their safety and to the environment. If workers have a basic understanding of the potential hazards of materials, and of the proper precautions and other measures that can be taken to avoid these risks, then they will be more likely to utilise them. While this document focuses on the impacts to workers as a result of using hazardous chemicals, the adidas Group Environmental Guidelines provide further information on the potential impacts to the natural environment.

To increase worker awareness of the potential hazards that are associated with hazardous materials that they are using, to minimise these hazards, and to ensure that worker exposure to these materials is kept to an acceptable level, the following precautions are recommended.

6.1 Guidelines for Chemical Use in Production Areas

<ul style="list-style-type: none"> • Every exposure to chemicals which can be avoided should be avoided. • Only the amounts of chemical materials needed for a single day should be kept in production areas. • Production areas should be kept free of chemical spills. • Hazardous chemicals should not be placed in containers or receptacles that are used generally for food/drink. • There should be no eating or drinking in areas where chemicals are used. • Containers not in current use should be covered properly. • All chemical containers should be labeled clearly (refer to Section 8). • CSDS and operation procedures should be posted near each work station. • MSDS should be readily available from the supervisor or safety coordinator. 	<ul style="list-style-type: none"> • Workers should receive training twice annually on the proper use and handling of hazardous chemicals. • Flammable chemicals should be kept away from ignition sources such as open flames, sparks, etc. • “No Smoking” signs should be posted in areas of flammable chemical use. • Emergency eyewash facilities should be available within 30 meters of work stations where chemicals are used, and should be flushed weekly. • Chemical mixing areas or stations should be physically separate from production lines. • Workers should be provided with personal protective equipment (PPE) that is appropriate for the potential hazards that they face.
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6.2 Personal Protective Equipment (PPE)

Factories must understand that the use of PPE should be the last resort, not the norm. Only if it is not possible to avoid the hazard by other means, such as material substitution, task redesign, or local exhaust ventilation systems, then PPE should be provided to the workers and its use should be required. Depending upon the actual conditions in the factory, the following PPE may be necessary to prevent exposure to hazardous chemicals:

Eye Protection (Safety glasses or goggles)	To protect against eye injury from splashing liquid chemicals such as solvents, adhesives and dyes; from flying solid objects or particles; from ultraviolet light radiation.
Impervious Gloves (e.g. rubber)	To protect against skin exposure to chemicals when the task makes such exposure likely.
Face Masks (Not tight-fitting respirators)	To protect against exposure to airborne dust or chemical particles (e.g. rubber compounding areas, buffing and grinding); to protect against nuisance odours from solvent vapours (only if a charcoal or carbon insert is in the face mask).
Liquid-resistant Footwear	To protect against skin exposure in work locations where liquid contact with the feet is likely.

Table 6.1 – Guide to PPE

Note: For further detail on the use of PPE, please refer to Section 16.

Section 7 – Worker Exposure to Hazardous Chemicals

7.1 Background Information

Chemicals can be categorised generally as one of two types:

- Organic chemicals: molecules that are based on chains of carbon atoms
- Inorganic chemicals: chemical compounds that do not contain carbon chains in their molecular structures (metals and their related compounds, e.g. salts)

A special group of organic compounds are known as the Volatile Organic Compounds, or VOCs. VOCs are those organic compounds that have a tendency to move from the liquid state to the gaseous state at room temperature. If an open container of a VOC is left for some time in a closed room, the vapour form of the VOC will accumulate in the space. The expression “VOC” refers to one or more of the entire group of these chemicals, and thus total VOC measurements may give information about the total amount of organic chemicals in the air to which workers may be exposed, but it gives little information about the relative toxicity of the mixture.

7.2 Routes of Exposure

Inhalation is the primary route by which workers are exposed to chemicals. Another significant route is absorption of the chemicals through the unprotected skin of workers (see Figure 7.1). Worker exposure via ingestion (i.e. eating or drinking) is less common since it can be avoided easily. Eating and drinking should be prohibited in factory locations of chemical usage or locations that have a potential for chemical contamination, and containers should be properly labeled to prevent accidental ingestion.

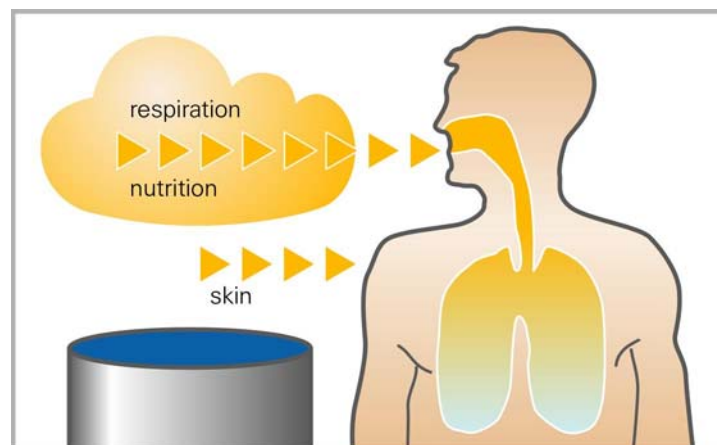


Figure 7.1 – Routes of Exposure

7.3 Occupational Exposure Limits for Chemicals in the Air

Prolonged or excessive exposure or contact with most hazardous chemicals can lead to adverse health symptoms, illness, disease, and, in extreme cases, death. Other hazardous chemicals can have similar adverse health effects after only short, or acute, contact with the chemical. Government agencies and professional organisations have established airborne exposure limits for a range of chemicals. These limits are intended to define workplace conditions to which it is thought that virtually all workers may be exposed on a regular basis without developing adverse health effects.

The Threshold Limit Values (TLVs), which are published annually by the American Conference of Governmental Industrial Hygienists (ACGIH), have been selected as the appropriate set of exposure limits for use in factories. The limits that are specified are minimum standards; they are not intended to supercede more stringent national or local standards that may exist.

The TLVs have been established on the basis of an 8-hour workday and a 40-hour work week. However, factory workers often have work schedules that approach 10-12 hour workdays and 60-hour work weeks. To account for the likelihood of longer work shifts, the TLVs are reduced proportionately as the workers' hours of chemical exposure increase.

The following guidelines list the ACGIH's 2006 TLVs for several chemicals that commonly are used in footwear and apparel manufacturing. Workplace concentrations of these chemicals and dusts should be maintained below these exposure limits. The exposure limits are expressed in concentration units of both "ppm" (parts per million in air) and "mg/m³" (milligrams per cubic metre of air).

Chemical	CAS #	TLV (8-hour day, 40-hour week)	TLV (12-hour day, 60-hour week)
Ethanol	64-17-5	1000 ppm 1880 mg/m ³	667 ppm 1253 mg/m ³
Acetone	67-64-1	500 ppm 1188 mg/m ³	333 ppm 792 mg/m ³
Ethyl Acetate	141-78-6	400 ppm 1440 mg/m ³	267 ppm 960 mg/m ³
n-Heptane	142-82-5	400 ppm 1640 mg/m ³	267 ppm 1093 mg/m ³
Methyl Cyclohexane	108-87-2	400 ppm 1610 mg/m ³	267 ppm 1073 mg/m ³
Isopropyl Alcohol (IPA)	67-63-0	200 ppm 492 mg/m ³	133 ppm 328 mg/m ³
Methyl Ethyl Ketone (MEK)	78-93-3	200 ppm 590 mg/m ³	133 ppm 393 mg/m ³
n-Butyl Acetate	123-86-4	150 ppm 713 mg/m ³	100 ppm 475 mg/m ³
Cyclohexane	110-82-7	100 ppm 344 mg/m ³	67 ppm 229 mg/m ³
Ethyl Benzene	100-41-4	100 ppm 434 mg/m ³	67 ppm 289 mg/m ³
Xylenes	1330-20-7	100 ppm 434 mg/m ³	67 ppm 289 mg/m ³
Methyl Isobutyl Ketone (MIBK)	108-10-1	50 ppm 205 mg/m ³	33 ppm 137 mg/m ³
n-Hexane	110-54-3	50 ppm 176 mg/m ³	33 ppm 117 mg/m ³
Methyl Methacrylate	80-62-6	50 ppm 205 mg/m ³	33 ppm 137 mg/m ³
Tetrahydrofuran (THF)	109-99-9	50 ppm 147 mg/m ³	33 ppm 98 mg/m ³
Ammonia	7664-41-7	25 ppm 17 mg/m ³	17 ppm 11 mg/m ³
n-Butyl Alcohol	71-36-3	20 ppm 61 mg/m ³	13 ppm 41 mg/m ³
Cyclohexanone	108-94-1	20 ppm 80 mg/m ³	13 ppm 53 mg/m ³
Isophorone	78-59-1	2 ppm 11 mg/m ³	1.3 ppm 7.3 mg/m ³
Dust / Particulate (total inhalable)	---	10 mg/m ³	6.7 mg/m ³
Dust / Particulate (respirable)	---	3 mg/m ³	2 mg/m ³
Particulate (polycyclic aromatics: cyclohexane-soluble)	---	0.2 mg/m ³	0.14 mg/m ³

Table 7.1 – Guidelines on TLVs

Note: Factories should note that the TLVs are reviewed on a regular basis, and may be revised on the basis of new scientific evidence of the adverse health effects of a particular chemical.

7.4 Worker Exposure to Multiple Chemicals

Given the nature of the materials used in some industries, workers may be exposed to more than one chemical during the work day. In the absence of evidence to the contrary, it is assumed that these multiple chemical exposures produce additive effects. The individual TLVs do not account for worker exposure to multiple chemicals.

To evaluate worker exposures to multiple chemicals, a term called the Exposure Fraction, or EF, has been defined. The EF value is an index of exposure which is calculated from the worker's measured exposure to a variety of chemicals and the individual TLVs for those chemicals to which he or she was exposed. An EF value equal to or greater than 1.0 indicates an unacceptably high worker exposure to chemicals. The aspirational goal for factories should be to maintain the cumulative chemical exposures of their workers to EF values of less than 0.5.

7.5 Banned Chemicals

To minimise occupational health risks to workers, the adidas Group has banned the use of certain chemicals. The following chemicals are prohibited due to their recognised high toxicity, their rapid absorption through skin, and/or the extreme difficulty of exposure control (CAS # in parentheses).

Benzene (71-43-2)	Toluene (108-88-3)
Methylene Chloride (75-09-2)	Trichloroethylene (79-01-6)
Perchloroethylene (127-18-4)	Carbon Tetrachloride (56-23-5)
N,N-Dimethylformamide (68-12-2)	Phenol (108-95-2)
Cellosolve (110-80-5)	Cellosolve Acetate (111-15-9)
Methyl Cellosolve (109-86-4)	Methyl Cellosolve Acetate (110-49-6)

Table 7.2 – List of Banned Chemicals

Some types of manufacturing operations, such as electronics, may employ a range of other chemicals that require strict control. Suppliers should consult with SEA to confirm the standards and guidelines that are applicable to their specific industry.

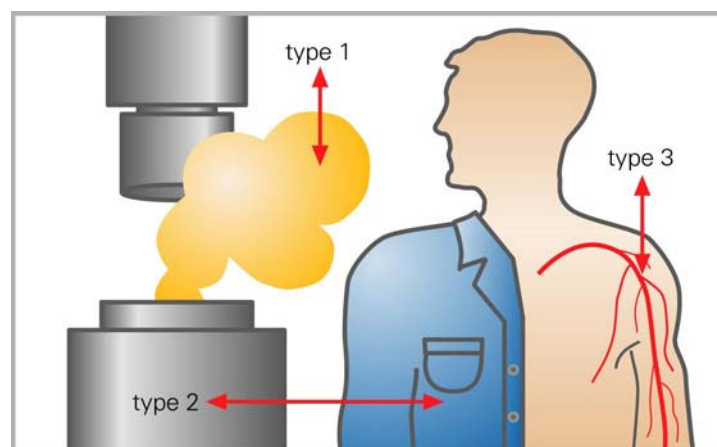


Figure 7.2 – Worker Exposure Measurements

There are three different general approaches to evaluate the chemical exposures of workers. Each has its own advantages and limitations.

7.5.1 Type 1: Workplace Area Measurements

This type of measurement is recorded at fixed positions throughout the factory, and thus likely does not represent the actual exposure of any individual worker. However, area measurements provide a determination of general conditions in the factory, and can identify the locations at which it may be prudent to perform personal exposure monitoring on workers.

7.5.2 Type 2: Personal Monitoring of Workers

This type of measurement is performed with a collection device, such as an organic vapour badge, which is worn by workers in the vicinity of their breathing zones (i.e. near their mouths/noses). If this monitoring is conducted over the entire course of a workday, then the exposure results may be compared to the TLVs. This type of monitoring accounts for worker mobility during the workday and also for differences in an individual's work practices that may impact a worker's exposure.

This type of exposure measurement should be conducted on those workers who are believed to be at highest risk of exposure, because of the chemicals that they use, the conditions of their work stations, or other factors that may determine exposure. For more information on personal monitoring of workers for VOC exposures, factories should consult their SEA representatives.

7.5.3 Type 3: Medical Surveillance

The ultimate measure of exposure to chemicals may be an evaluation of the worker's body: blood or urine analysis, diagnostic testing or other appropriate medical examination. Biological monitoring of workers may reveal the impact of all chemical exposures experienced by the workers, and not solely those from the factory.

A reasonably thorough evaluation of possible worker exposures to chemicals would involve a combination of Type 1 and Type 2 measurements. Medical surveillance may be required in some countries for specific industries or chemical exposures.

Section 8 – Colour Coding/Labelling

This section provides illustrations and explanations for the various safety signs that are required in factories. It also provides guidance on the suitable construction of signs and steps to maintain their effectiveness as a mode of communication to workers. Any signs that include wording should use the language appropriate for the workers. The following precautions and criteria apply:

- Signs and notices should be appropriate in number
- Signs and notices should be displayed clearly
- Signs and notices that are obsolete should be removed immediately
- Signs should be large enough to be clearly legible
- Signs should be of robust construction, corrosion and weather-resistant, and be readily fixed to their intended location
- Essential signs should be illuminated so they are visible when it is dark, foggy or there is smoke
- Signs and notices should be properly maintained, replaced and/or cleaned as necessary

As a guide, signs should be of different colour codes depending on their requirement:



















Safety Colour	Shape	Meaning/ Purpose	Example
Red Border Black Symbols White Back-ground	Round	Stop / Prohibition	 no fire  no drinking water  no smoking  do not extinguish with water  pedestrians prohibited
Black Border Yellow Back-ground Black Symbols	Triangular	Caution / Warning of Danger	Signs for areas:  corrosive substance  risk of fire  gas cylinder  risk of electrical shock  toxic hazard
Black Border Orange Back-ground Black Symbols	Square	Caution / Warning of Danger	Labels on chemicals:  corrosive substance  harmful substance  irritant substance  toxic substance  high toxic substance  flammable substance  highly flammable substance  environmental hazard



Figure 8.1 – Colour Coding/Labelling (Part 1)




















Safety Colour	Shape	Meaning/ Purpose	Example
Blue (Border and Background) White Symbols	Round	Mandatory Action	 wear eye protection  chain cylinders  wear ear protection  wear light breathing equipment  wear gloves  wear head protection  wear foot protection  drinking water
Green (Border and Background) White Symbols	Square	Safety Facilities	 doctor  eye wash facility  first aid  emergency shower  emergency telephone  exit direction  exit direction  assembly area
Red (Border and Background) White Symbols	Square	Fire Protection	 extinguisher  fire hose  ladder

Figure 8.2 – Colour Coding/ Labelling (Part 2)

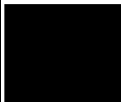
Colour	Colour in Text	Materials
	Dark Green	Water
	Light Blue	Compressed Air
	Silver or Grey	Steam
	Black	Other Liquids
	Brown	Mineral, Vegetable, Animal Oils
	Violet	Acids or Alkalis
	Yellow Ochre	Gases other than air
	Red	Fire Water Mains
	Orange	Electrical Services
	Cream	Foam Water Pipe
	Dark Blue	Freshwater

Figure 8.3 – Colour Code for Piping

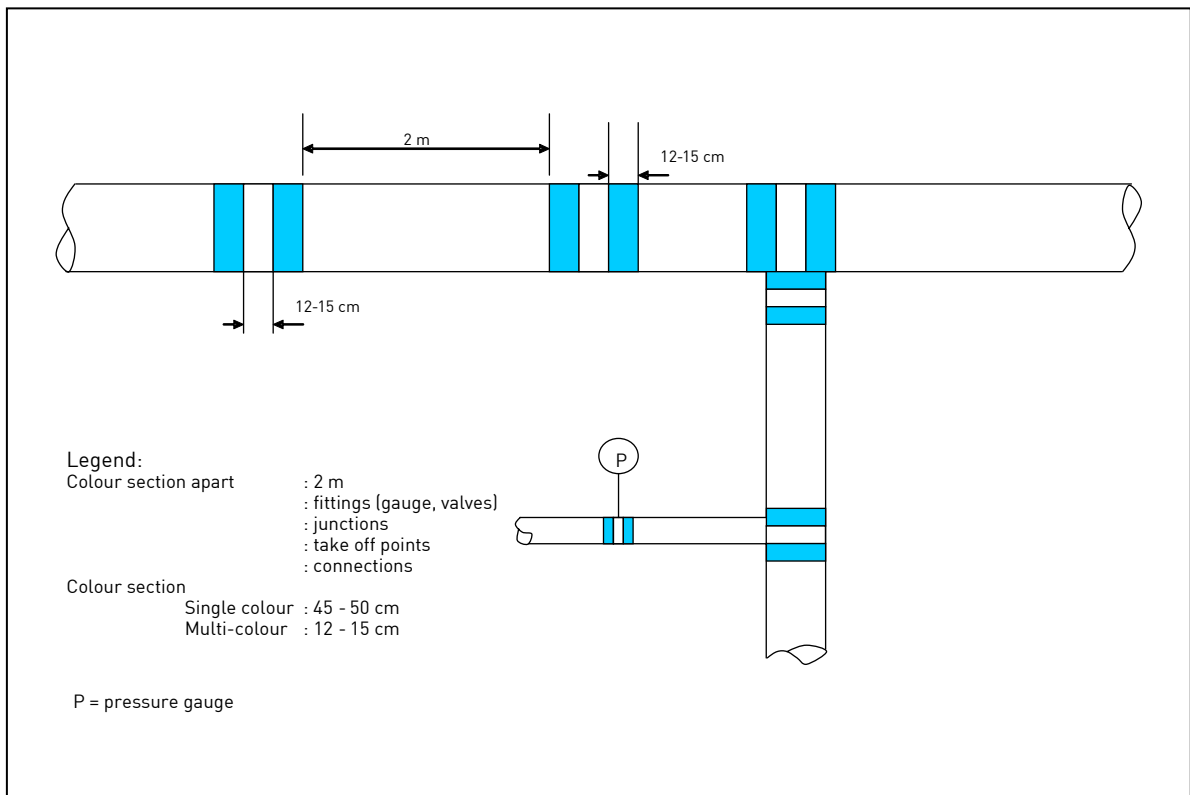


Figure 8.4 – Schematic Colour Code for Piping

Section 9 – Compressed Gases/Cylinders

The use of compressed gases has increased in recent years and their use for welding, cutting, heating and as a means of fighting fires is common in factories. The use of such gases brings risks and hazards when used in a confined space, and it is essential that the principal hazards are recognised and the precautions to be taken in the transport, storage, handling and use of cylinders are known and understood by all personnel.

Hazards associated with the use of compressed gases include oxygen displacement (and possible asphyxiation), fires, explosions, toxic gas exposures, and the physical hazards related to high pressure systems.

9.1 Guidelines on Use of Compressed Gases (Cylinders)

<p>Storage and Use of Cylinders (Figure 9.1)</p> <ul style="list-style-type: none"> • Storage outside the building under a roof. • Access only to authorized personnel (to change cylinders, perform maintenance work or inspection). • Flammable gas cylinders ≥ 7.5 m from open flames, hot surfaces, electric arcs, or other ignition sources. • Separation of oxygen and flammable gases by a distance of ≥ 6m (20 ft.). • Cylinders should be chained to a cart or wall (Figure 9.2), in an upright position, with a valve protection cap when not in use. • Separate storage of empty/spare and full cylinders. • Cylinders should be equipped with pressure relief valves and backflash arrestors. • No storage of other combustible materials near gas cylinders. • A metal storage cage should be connected to a lightning rod or other type of lightning protection. • Regular visual inspections of cylinder storage areas. 	<p>Where several flammable gas cylinders are connected, e.g. for kitchen appliances, the following measures are required:</p> <ul style="list-style-type: none"> • All cylinders must be located outside of the building. • Gas cylinders and the manifold connections should be enclosed in a suitable locked caged area. • Piping should be constructed of rigid metal compatible with the type of gas. • A means of effective isolation of the gas supply to the building.
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9.2 Guidelines for Storage of Cylinders

The potential risk from compressed gas cylinders is very often underestimated. As a consequence, serious accidents can happen which cost the lives of workers and the damage of buildings. Compressed gas cylinders are under extremely high pressure (up to 200 bar), and if the valve protection cap is not used, valves can shear or break if cylinders fall. This can lead to serious explosions and other damage related to the sudden release of pressurised gas. In some cases, it can cause destruction or damage of building materials such as concrete.

Another potential risk may result from leaking cylinder valves. Storage of flammable gas cylinders in poorly ventilated buildings or indoor spaces may result in the creation of an explosive and/or oxygen-deficient atmosphere. Thus, cylinders should be stored outside the main factory buildings as shown in Figure 9.1 below.

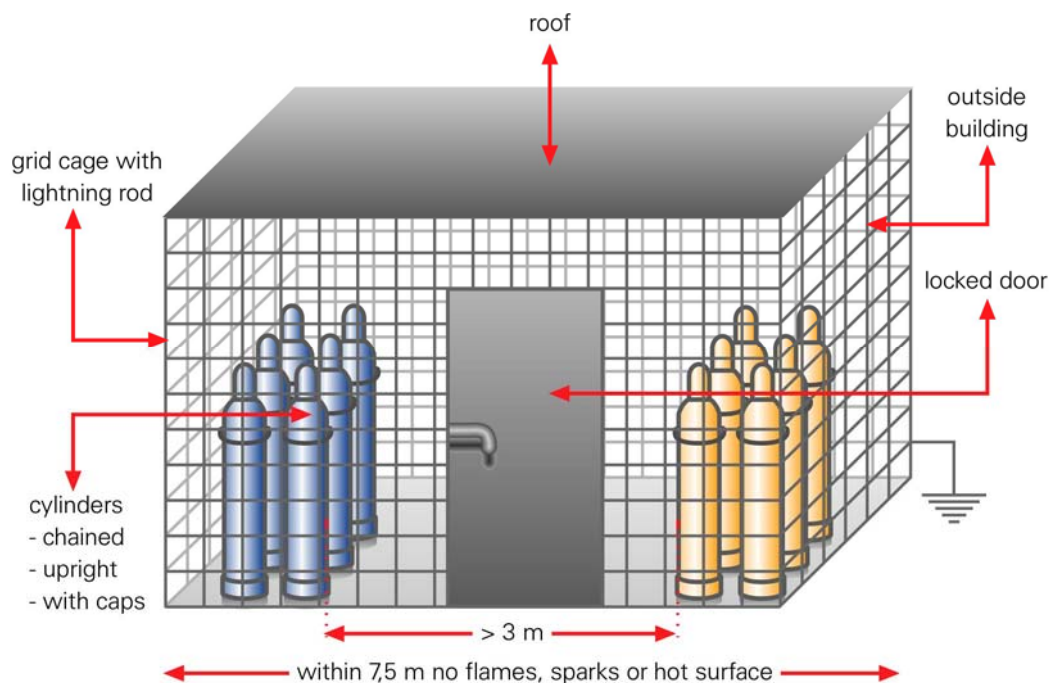


Figure 9.1 – External Storage of Cylinders

9.3 Mobile Welding Station (Cylinder Trolley)

Oxygen and acetylene cylinders are often used together for welding, burning and cutting tasks in different areas of the factory. When gas cylinders are used for this purpose, they should be installed and secured on a cylinder trolley.

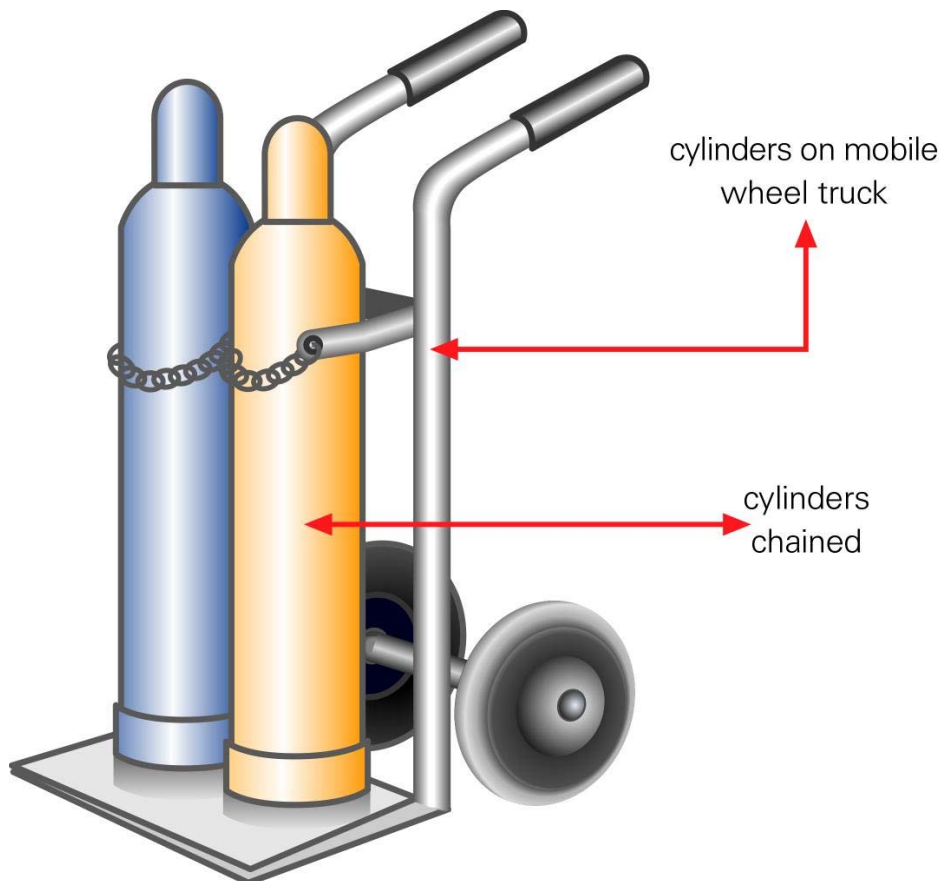


Figure 9.2 – Cylinder Trolley

Section 10 – General Housekeeping/Lighting/Electricity

Occupational accidents can be avoided with proper planning and maintenance of lighting, electricity and other utilities. The following sections outline the basic considerations to be taken into account in the management and maintenance of such installations and utilities.

10.1 Electrical Safety

Regular maintenance and repair of electrical installations and other utilities is a basic element in the avoidance of industrial accidents. Electrical safety is associated closely with fire safety. Overloaded or improperly maintained electrical wiring can lead to fires.

10.2 Guidelines on Electrical Safety

<p>High Voltage Areas and Generator Houses</p> <ul style="list-style-type: none"> • Restricted access to authorised workers only. • Appropriate hazard warning signs (refer to Section 8). • No material storage in high voltage areas. <p>Compressor Stations</p> <ul style="list-style-type: none"> • These should be separated from production areas, preferably at locations outside the building. • They should be in enclosed areas, even if outdoors, to reduce the noise emissions. • They should be equipped with a drip pan to prevent oil leaks to the ground. • The belt drive systems should be totally enclosed or guarded. • Air filters should be installed on the intake side. • Motors should be kept free of dust, grease, oil and fibers. 	<p>Electricity and Wiring</p> <ul style="list-style-type: none"> • Junction boxes, distribution panels and similar electrical equipment should be enclosed, damage-free, and should not be misused for direct connection to machines. • All wiring should have proper industrial connections. • All wiring should be insulated, replaced if damaged, and protected from mechanical damage (e.g. metal cable trays) and from extreme heat. • There should be a regular inspection and maintenance programme for all electrical equipment.
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10.3 General Housekeeping and Equipment

Reasonable housekeeping practices can reduce the number of fire and safety hazards in the factory. Such practices typically reflect the level of factory management interest in worker safety.

10.4 Guidelines on Housekeeping and Miscellaneous Equipment

<ul style="list-style-type: none"> • Production areas should be kept clean and floors should be dry. • Trash and production waste should be removed regularly and stored in covered containers. • Product and raw material storage should be in designated areas and should be tidy and organised. • There should be sufficient space between the ceilings and storage racks or machinery. 	<ul style="list-style-type: none"> • Machinery should not be left in operation if unattended. • Scaffolding for temporary work should be appropriately anchored, and fall protection measures should be taken for the workers (e.g. guarding or harnesses). • Portable tools and other loose materials should not be left in overhead locations.
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Note: Section 11 provides further details on the management and maintenance of equipment.

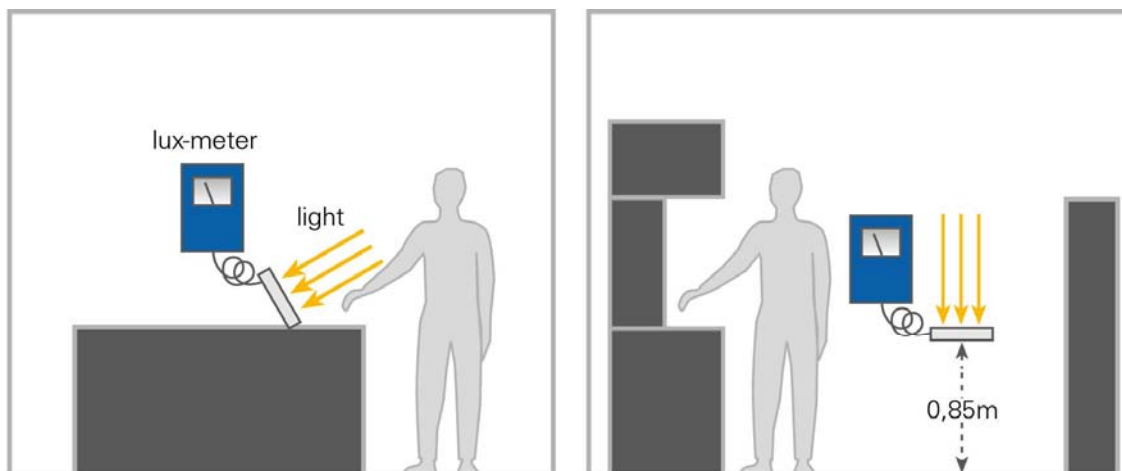
10.5 Lighting

Factory lighting may have an impact on worker safety, productivity and product quality. There may be different needs for lighting depending upon the particular machinery being used or the task in which the workers are involved. Certain manufacturing tasks (e.g. stitching) may require greater illumination than other tasks. Generally, the illumination that is provided should be sufficient to prevent accidents and be consistent with the production of high quality goods. Specific lighting values for various factory areas are recommended in Table 10.1.

There must be emergency lighting provided in general factory areas, in stairwells, and along all means of egress. This emergency lighting must have a power source that is independent of the general energy supply to the factory (e.g. battery-powered lights with continuous charging).

Factory Area	Illuminance Values (lux)
Office work areas	300 – 500
Storage areas and warehouses	> 50
Aisles	> 50
Stairs	> 100
Manufacturing: assembly, stitching and general manual operations	> 300
Machining: cutting, grinding, punching, laser cut, lathe, milling, drilling, electric sawing, etc.	> 500
Quality assurance and control	650 – 800
Toilets	> 100
First Aid rooms	> 500
Emergency lighting	>1, but also >1% of the general aisles lighting in the associated factory area

Table 10.1 – Recommendations for Lighting in Various Factory Areas



Measurement of Workplaces:

- at the working surface
- in the line of worker's vision

Measurement on Aisles, Stairs etc

- in 0,85 m height
- vertical orientation

Figure 10.1 – Measuring Lux Levels



typical electric hazards



Bad Practice

Figure 10.2 – Bad Practices Involving Electrical Wiring/Equipment

Compressor Stations

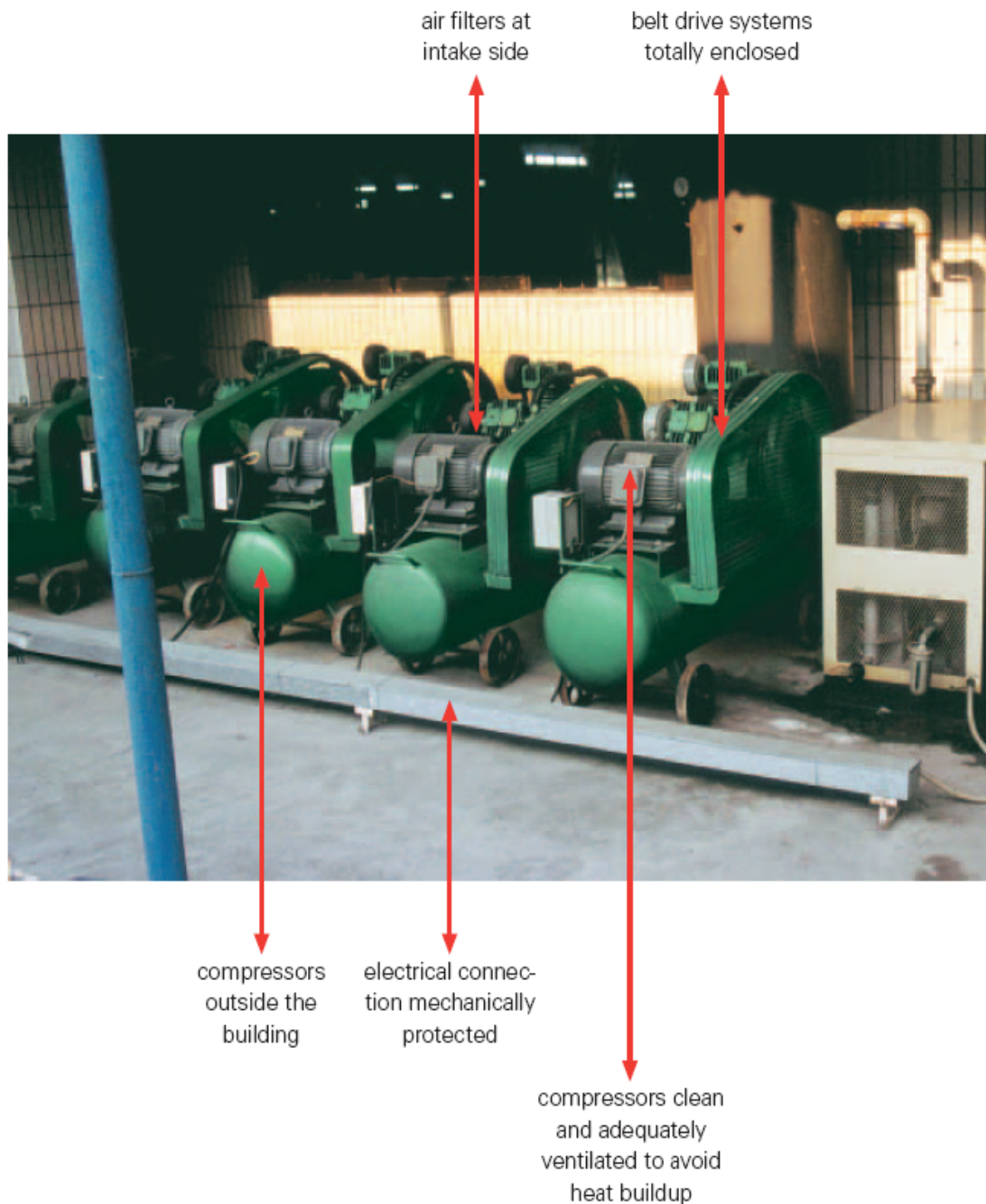


Figure 10.3 – Good Electrical Safety in Compressor Management

Section 11 – Machine Safety and Noise

The machinery that is used in factories may present a wide array of safety and health hazards to the workers. These hazards may be physical, electrical, thermal, auditory, or of other nature. The two basic principles of hazard control that should be considered in the reduction of machine hazards are: (1) elimination or reduction of the risk by fitting safety devices or guards to the machines, and (2) protection of the workers with appropriate personal protective equipment (PPE) that is specific for the particular risk.

11.1 General Guidelines for Machine Safety

<ul style="list-style-type: none"> • All machinery and lighting should be connected to their power source with appropriate industrial connections. • The machinery should be grounded (e.g. third prong). • Permanent electrical wiring should be encased in a metal conduit. • Individual machines should have their own emergency power shut-off switch within easy reach of the usual operator position. • All gear boxes should be enclosed, and only opened with special tools. • There should be machine safety training for all workers before they are allowed to operate any machine. This training should include a list of the required PPE and the emergency shut-down procedures. • There should be regular inspection and maintenance of all production machinery to ensure that all safety devices and mechanisms are effective, and inspection and maintenance records should be maintained by the factory. • Appropriate lockout/tagout procedures should be implemented during all equipment maintenance and repair work (refer to Section 20). 	<ul style="list-style-type: none"> • Working tools should be provided with appropriate protective devices to prevent injury to workers from squeezing, cuts or burns. • Local exhaust ventilation for the extraction of dusts or solvent vapours should be provided by separate systems, and the ductwork should be identified by different colours. • Eye protection should be worn by workers when there is risk of injury from flying particles or dust, splashed chemicals, or persistent glare or ultraviolet radiation. • Workers who operate mobile equipment or forklift trucks or lift heavy items should wear certified steel-toed safety shoes. • Appropriate gloves should be provided to protect workers' hands from mechanical, chemical or thermal hazards.
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Electrical safety should be a continuing concern when operating equipment. Electric current flowing through the body can cause shock, burns, and breathing difficulty. The alternating current at electrical mains (240 volts AC) is sufficient to cause fatal exposures. Flash burns can be caused by opening switches, removing fuses or shortening cables. Ignition hazards may result from electrical faults, short circuits, poor contacts, overloaded cables or connections, and other faulty equipment.

Physical hazards to the workers may arise from exposure to the point of operation on a particular machine or from other moving parts on the same machine. Compression, cutting or shearing of hands, feet, hair or other body parts can occur. Risk of impact to the eyes, face or other body parts may be caused by flying objects in grinding or buffing operations, wires from wheel brushes, or other tools (e.g. needles in stitching or sewing areas). To minimise the likelihood of these types of injuries to workers, the following specific recommendations are provided for certain machinery.

11.2 Specific Guidelines for Machine Safety

<ul style="list-style-type: none"> • There should be fixed guards or covers for all V-belt drives, pulleys, and buffing and grinding machines. • There should be needle and pulley guards on sewing machines. • There should be blade guards on cutting machines and table saws. • Guards may be constructed of solid material or grids; if grids, then the openings must be <12 mm to prevent insertion of fingers. • Two-hand switches should be used on all cutting machines, presses, and heat transfer machines unless guarding can be shown to be effective (a two-hand switch requires both hands to be on two buttons simultaneously for machine operation, thus removing the hands from the zone of exposure). • It is important that the factory ensures that workers do not defeat or override the two-hand switch safety feature. 	<ul style="list-style-type: none"> • Mills and calendars should be provided with multiple safety devices (see photographs for examples of good practices). • Interlocked guards and emergency stops should be provided on all revolving drums and rollers. • Electronic sensors that prevent machine operation or shut down power when body parts are detected in the zone of exposure are recommended as useful safety devices on appropriate machinery.
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Thermal hazards may be created by a variety of factory operations, such as steam systems or machinery operation that creates hot surfaces. Hot surfaces, pipes or other equipment should be marked with appropriate hazard warning signs. The degree of the thermal hazard depends upon the contact time and the thermal conductivity of the surface. Metal parts conduct thermal energy very well and therefore could cause a greater hazard than wooden parts at the same temperature. For the purpose of the H&S Guidelines, “hot surfaces” are defined as follows:

- Wooden parts or surfaces: >110°C
- Plastic parts or surfaces: >85°C
- Metal parts or surfaces: >60°C

Potential hazards from **ultraviolet (UV) radiation** may arise from the use of UV or “black” lights in production areas. Such UV lights should be shielded to prevent line-of-sight exposure to workers’ eyes. Also, workers at UV stations should be provided with special UV protective goggles or polycarbonate safety glasses that are rated at >98% UV reduction. (Refer to the “bad practice” photographs at the end of this section.)

Noise exposure is a common hazard in many factory locations. Daily exposure to excessive noise can lead to hearing loss in workers. To reduce the risk of this adverse health effect, factories are required to provide hearing protection (either earmuffs or earplugs) when workers have exposure to sound levels for the following durations:

Exposure duration during the workday	Sound level in decibels (dBA) at which hearing protection is required
≤ 2 hours	91 dBA
≤ 4 hours	88 dBA
≤ 8 hours	85 dBA
≤ 12 hours	82 dBA

Table 11.1 – Noise Exposure and Use of Hearing Protection

The hearing protectors that are provided to the workers by the factory must have an adequate Noise Reduction Rating (NRR) to reduce their exposure to sound levels less than those listed in Table 11.1 (refer to the detailed discussion of NRR values in Section 16). If any workers have continuous exposure to noise in excess of 100 dBA, they must be provided with both types of hearing protectors and should wear the earplugs under the earmuffs. All workers who use hearing protection should be trained in the proper use and maintenance of this protective equipment.

Recommendation: Factories which have workers with noise exposures in excess of the sound levels listed in Table 11.1 should implement an audiometric testing programme for these groups of exposed workers. Audiometric testing – i.e. testing the hearing ability of workers – will serve as a check on the effectiveness of the hearing protection and other noise control measures in the factory and will detect early hearing loss in workers so that additional intervention is possible. Preliminary testing of workers before they begin jobs in high noise exposure areas can establish baseline hearing abilities and may detect pre-existing hearing loss in workers. This testing of the exposed workers should be conducted on a regular basis (e.g. annually), and should be provided by a qualified audiometric testing company in accordance with appropriate testing procedures.



Dust suction at machinery



Protection over foot pedal of power driven machines



Machine with two-hand switch (does not work in one-hand modus)



Protective glove in cutting process

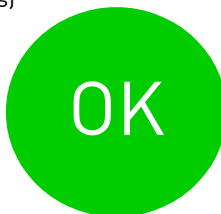


Figure 11.1 – Photos of Good Practices

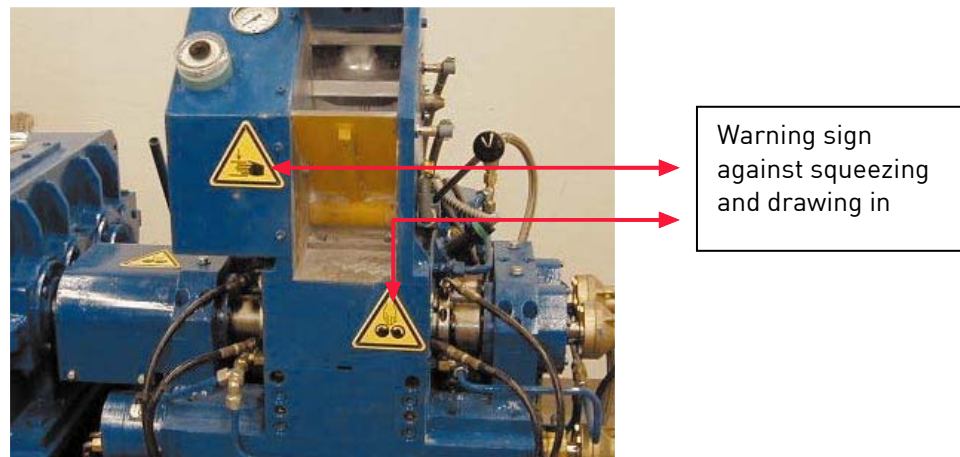
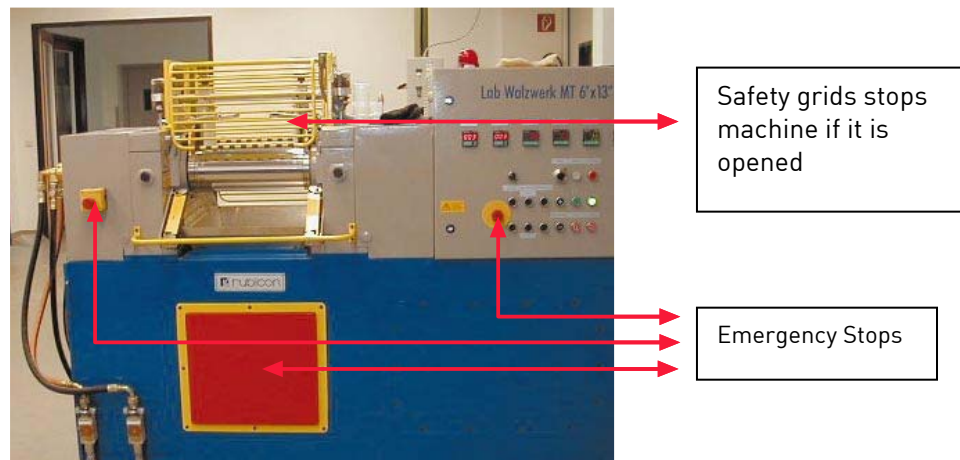
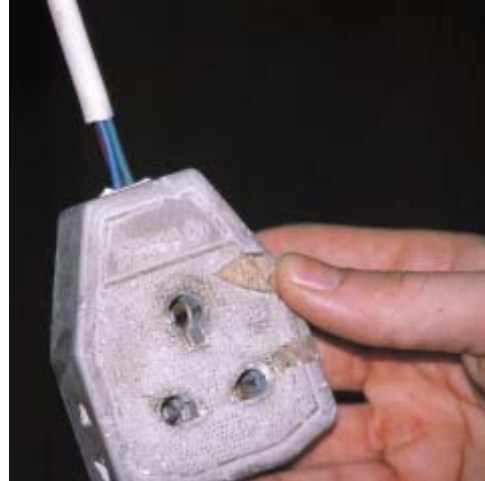


Figure 11.2 – Installation of Safety Devices Around Machinery

Open Gear Box



Damaged Insulation



No UV shield, no UV goggles



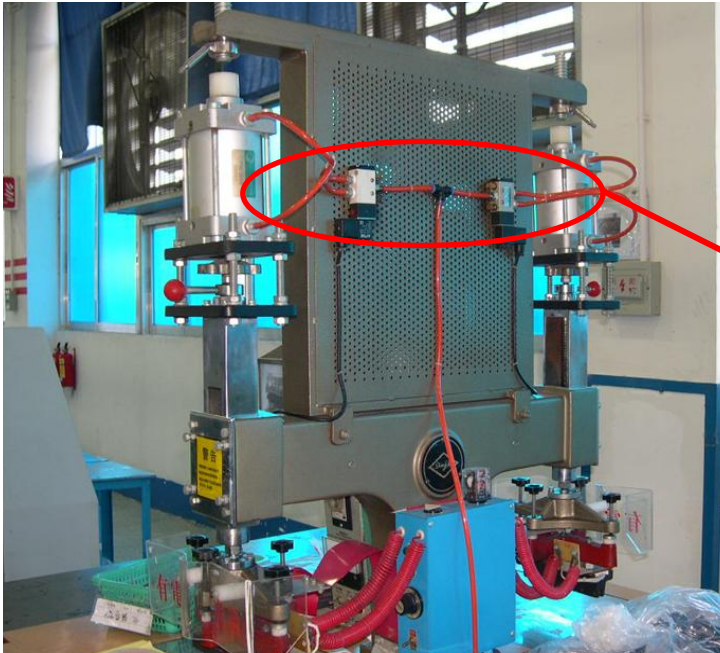
Missing Protection



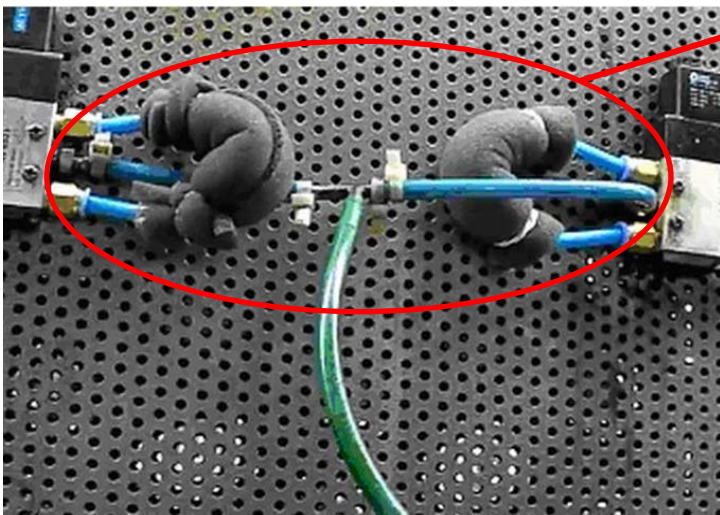
Figure 11.3 – Examples of Bad Machine Safety Practices

11.3 Good Practice Sharing

Here are some good practice examples which can be adopted to improve machinery safety around the workplace.



Before and after improvement made to a high frequency machine. The noise level from the pneumatic air exhaust outlet would normally hover at about 101 dBA.

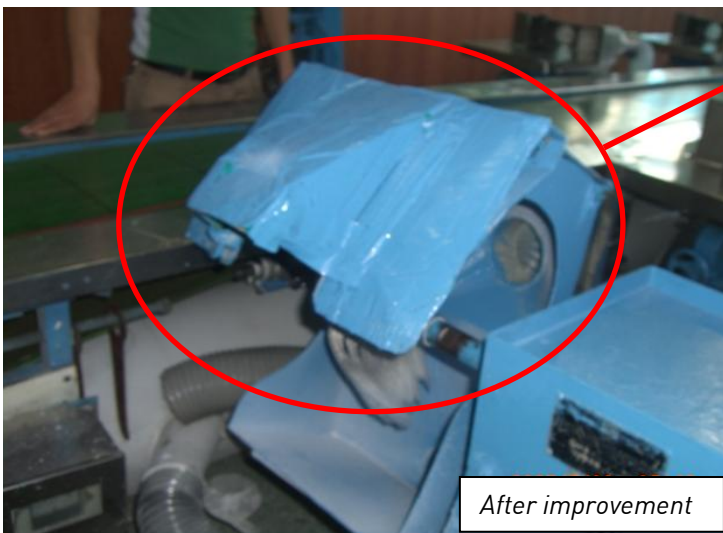


With the use of inexpensive foam material to muffle the noise emission source, the noise level has dropped to 76 dBA. The basic engineering control to improve each machine only cost RMB 4.

Figure 11.4 – Improvements to Equipment to Minimise Noise Levels



Before and after improvement to reduce noise level of machine.



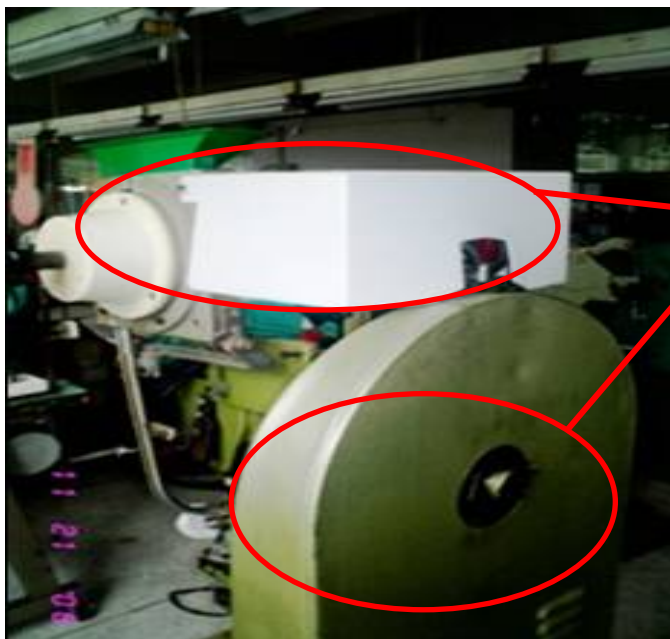
By adding a cover on the dust cleaning machine, noise emission can be reduced from 98dBA to 92dBA.

Figure 11.5 – Machine Guarding



This image shows a typical needle guard installed on a sewing machine to suit the type of work piece to be stitched together.

Figure 11.6 – Installation of Needle Guards on Sewing Machines



Moving parts are protected by a safety guard to prevent rubbing against electrical cables which could cause electrical hazards.

Figure 11.7 – Use of a Belt Guard to Reduce Mechanical Hazards



Basic guarding to protect against dust emission.

In-house fabricated noise silencer device made by installing a pipe and foam muffer to reduce noise at the air exhaust pipe. A possible noise level reduction of 10 dBA.

Figure 11.8 – Installation of Dust and Noise Protection on Machinery



Two-hand operation switches for material cutting machine.

Infrared induction system increases machine safety.

Figure 11.9 – Hand Switches and Infrared Devices Installed to Improve Machine Operation Safety



Use of barrier and guarding to reduce dust exposure from grinding.

Simple noise silencer device made from pipe and foam material to muffle noise at the source of emission.

Figure 11.10 – Installation of Dust and Noise Minimisation on Machinery

11.4 Bad Practice

Here are some bad practice examples which have been observed and should be mitigated.



Inadequate engineering control to insulate and reduce chemical exposure.

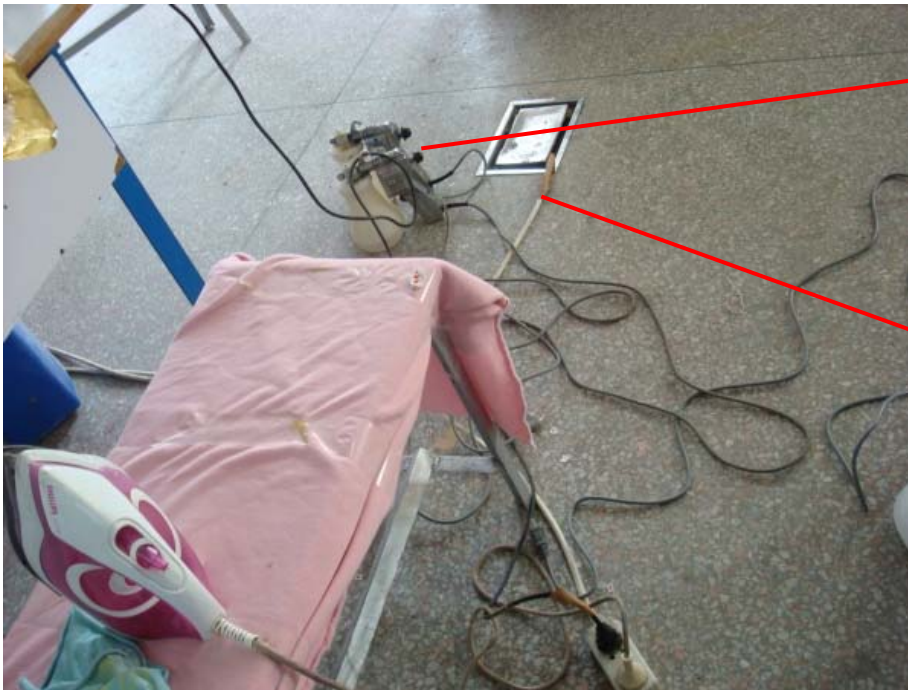
No PPE and poor working posture without effective back support.

Figure 11.11 – No Protection against Chemical Exposure



Unsafe set-up. Hand tools are haphazardly placed on the ground with multiple electrical cables.

Figure 11.12 – Improper Storage of Hand Tools and Cabling



Poor work station layout and weak control of chemical (spray gun for fabric stain cleaning).

Power cables present electrical hazard.

Figure 11.13 – Poor Layout of Work Station Increases Potential for Electrical and Safety Hazards



Poor maintenance of machine switches and control buttons. Risk of electrical shock and fire.

Figure 11.14 – Poor Maintenance of Machine Switches

Section 12 – Dormitory Facilities

Dormitory facilities that are operated by the factory should meet these H&S Guidelines and all applicable laws and regulations related to health, safety and the environment, including, but not limited to, fire safety, sanitation, risk protection and electrical, mechanical and structural safety. Further, dormitory conditions should reflect the interest of factory management in providing living arrangements which promote the dignity of workers and enhance the reputation and image of the factory. Dormitory buildings should be safe, clean and well-maintained.

12.1 Guidelines for Dormitory Facilities

<p>General</p> <ul style="list-style-type: none"> • Every dormitory shall be constructed in a manner that will provide occupants with protection against extreme weather conditions. • Any building license/permit as required by local regulation should be available and updated. • The floors shall be constructed of wood, asphalt or concrete. Wooden floors should be smooth and of tight construction. Floors should be kept in good repair. • The grounds and open areas surrounding the dormitory should be maintained in a clean and sanitary condition, free from rubbish. • Any storage areas for waste that is collected in the dormitories should be separate from living quarters. • Dormitory rooms must not be locked from the outside at night, but residents should be allowed to secure locks from the inside of rooms. • Storage of hazardous or combustible materials is prohibited in dormitories. • First Aid kits should be accessible in all dormitories and supplied with the materials specified in Section 4 of these Guidelines. • At least 1% of dormitory residents should be trained in First Aid. • The building and its facilities should have no material containing asbestos. 	<p>Sleeping Quarters</p> <ul style="list-style-type: none"> • Sleeping quarters should be segregated by gender. • Each room used for sleeping purposes shall contain at least 2 square meters of floor space per occupant, or should satisfy the local legal requirement if that provides for greater space. • The ceiling height should be at least 2.1 meters above the floor. • There should be no more than 8 people per room (no openings between rooms). • Beds, cots or bunks, and suitable storage facilities such as wall lockers, should be provided in every room that is used for sleeping purposes. • Each resident should have their own bed, cot or bunk. • Beds should be spaced no closer than 1 meter laterally (for bunk beds, 1.2 m). • All beds should be elevated at least 0.3 meters from the floor. • Double-decker bunk beds should have a minimum clearance of 0.7 meters between the upper and lower bunks, and between the upper bunk and the ceiling. Triple bunk beds are prohibited. • Storage facilities should be lockable. • Mosquito netting or window screens should be provided. • Recommendation: Curtains should be provided around each bed for privacy.
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Each room used for sleeping purposes should be provided with proper lighting, heating and ventilation for the comfort and safety of the residents.

<p>Lighting:</p> <ul style="list-style-type: none"> • Each sleeping room in a dormitory should have at least ceiling-type lighting fixtures. • Each laundry, kitchen, toilet or other room where residents may congregate should have at least one ceiling or wall light fixture. • Light levels in toilets and storage rooms should be at least 20 lux, and light levels in kitchens, sleeping rooms, and other rooms should be at least 30 lux (as measured 0.75m from the floor). <p>Heating:</p> <ul style="list-style-type: none"> • Recommendation: Every dormitory in cold climates should be provided with equipment that is capable of maintaining a temperature of at least 20°C in indoor spaces. • All heating systems must be well-maintained and safe to operate. 	<p>Ventilation:</p> <ul style="list-style-type: none"> • All sleeping quarters should be provided with windows, the total area of which should amount to at least one-tenth (10%) of the floor area of the space. • At least half of the window area should be constructed so that it may be opened for purposes of ventilation. • The windows must open to the outdoors or an outside courtyard, but may not open to an interior space. • In hot climates (>25°C), appropriate electrical fans or air conditioning should be provided.
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The suitability of other facilities within the dormitory building may also be significant for the health, safety and comfort of the residents. An adequate and convenient water supply which has been approved by the appropriate local health authority should be provided to each dormitory building for the purposes of drinking, cooking, bathing and laundry.

<p>Water Supply:</p> <ul style="list-style-type: none"> • The water supply is “adequate” if it is capable of delivering 130 liters of water per person per day to the dormitory. The peak rate capacity should be 2.5 times the average hourly demand. • The distribution lines should be capable of supplying water at normal operating pressures to all fixtures for simultaneous operation. • An adequate supply of hot and cold running water should be provided for bathing and laundry purposes. Facilities for heating water should be provided. Tepid water supply is acceptable for laundry equipment. 	<ul style="list-style-type: none"> • At least one handwash basin for every 6 residents in shared facilities. • At least one shower head for every 10 residents. • Doors should be provided in the showers for privacy. • An adequate supply of soap is required for handwashing and shower facilities. • Recommendation: In locations that may have extended periods with temperatures <20°C, hot and cold water should be available from a single tap. • Drinking water should be tested regularly if it is provided through an internal drinking water treatment facility, or to be completed with a certificate from the provider.
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Toilets, laundry areas, and garbage/trash accumulation containers also should have features that are consistent with the practical needs as well as the health and safety needs of the dormitory residents.

12.2 Guidelines for Other Facilities in Dormitory Buildings

<p>Laundry:</p> <ul style="list-style-type: none"> • At a minimum, there should be one laundry tray or tub for every 30 residents. These may be available in laundry areas or at other convenient and accessible locations in the dormitory building. • Facilities for the drying of clothes should be provided. This requirement is satisfied by having adequate sheltered space for the hanging of clothes to dry. <p>Floors:</p> <ul style="list-style-type: none"> • All floors in laundry, shower, toilet and handwashing areas should be constructed of smooth, but not slippery, materials which are impervious to moisture and easy to clean. • Floor drains should be provided at these same locations (shower stalls, shower rooms, laundry rooms and toilet areas) to remove waste water and facilitate cleaning. • All junctions of the curbing and the floor should be curved. 	<p>Garbage/Trash Containers:</p> <ul style="list-style-type: none"> • At least one container with cover should be provided for each dormitory room. • The containers should be rodent and fly-proof and impervious to liquids, and should be kept clean. • The containers should always be emptied when they are full, and no less than twice weekly. <p>Toilets:</p> <ul style="list-style-type: none"> • Refer to Section 13 – Sanitation and Hygiene: Toilet, Dining and Kitchen Facilities.
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Finally, there are certain aspects of fire safety that are important in dormitories.

<p>Fire Safety:</p> <ul style="list-style-type: none"> • Aisles and exits should be clear of obstructions, and exits should be marked clearly. • There should be at least two exit routes from each floor of the dormitory building. • All exit doors should be unlocked and should open outward. • Emergency evacuation plans and emergency telephone numbers should be posted at conspicuous locations. • Appropriate smoke detection and fire alarm systems are required, and no regularly occupied portion of the building should be >60m from an alarm button or pull box. • Emergency lighting should be installed and operational. • Sufficient fire extinguishing equipment should be available and should be inspected regularly. • Fire safety issues, emergency evacuation procedures, and training on the use of fire extinguishers (for some residents) should be included in the resident orientation.
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12.3 Good Practice



Well-lit, well-maintained and hygienic facilities for employees.

Figure 12.1 – Good Practice Facilities for Employees

Section 13 – Sanitation and Hygiene: Toilet, Dining and Kitchen Facilities

Sanitary conditions in toilets, bathrooms, food preparation and dining areas and throughout factory and dormitory buildings are important for the protection of the health of the residents. The following guidelines apply to all production, development, office, warehouse and dormitory/ residence areas at a facility.

The term '**personal service room**' is used frequently in this section of the Guidelines. This term is intended to include any room that is used for activities that are not directly related to production. Such activities include, but are not limited to, first aid rooms, medical service areas or clinics, dressing areas, showers and washing areas, toilets, food preparation and dining areas.

13.1 Guidelines for Building Construction

<ul style="list-style-type: none"> • All walls of personal service rooms should be tiled or clean painted. • Personal service rooms should have adequate ventilation to ensure that they are free of foul odors. • Floors should be maintained, so far as practicable, in dry condition. • Where wet processes are used, drainage should be provided and maintained, and platforms, false floors, mats or other dry standing places should be provided, where practicable, or appropriate waterproof footwear should be provided to the workers. 	<ul style="list-style-type: none"> • To facilitate cleaning processes, every floor should be kept free from protruding nails, splinters, loose boards, and unnecessary holes or openings. • Floors of personal service rooms should be sealed (tile or cement), slip-resistant, and wet-mopped at least twice per day with a cleaning solution containing a bacteriacide.
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13.2 Guidelines for Waste Disposal

<ul style="list-style-type: none"> • Any receptacle that is used for solid or liquid waste should be constructed so that it does not leak and may be cleaned thoroughly in order to be maintained in a sanitary condition. • All sweepings, solid or liquid wastes, refuse and garbage should be removed in such a manner as to avoid the creation of health risks, and as often as necessary to maintain sanitary conditions. 	<ul style="list-style-type: none"> • Vermin control: Every enclosed area of a factory facility should be constructed, equipped and maintained, so far as practicable, to prevent the entrance or harbourage of rodents, insects and other vermin. A continuing and effective extermination programme should be implemented wherever and whenever their presence is detected.
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The Guidelines address issues related to the water supply in two separate categories: potable (drinking) water and non-potable water.

<p>Potable Water:</p> <ul style="list-style-type: none"> • Potable water should be provided in all factories and dormitories for drinking, personal washing, cooking, and the washing of foods, cooking and eating utensils, food preparation and processing areas and personal service rooms. • Drinking water dispensers should be designed, constructed, and serviced so that sanitary conditions are maintained. They should be capable of being closed, and equipped with a tap. • The drinking water supply should not be located inside toilet areas. • Open holding containers such as barrels, pails or tanks from which drinking water must be dipped or poured, whether they are fitted with a cover or not, are prohibited. • A common drinking cup or other shared utensils are prohibited. 	<p>Non-Potable Water:</p> <ul style="list-style-type: none"> • Outlets or spigots for non-potable water, such as water for industrial or fire-fighting purposes, should be posted or otherwise marked in a manner that indicates clearly that the water is unsafe for use for other purposes, such as drinking, washing or laundry. • Construction of non-potable water systems should be such as to prevent back-flow or back-siphonage into any potable water system. • Non-potable water should never be used for personal washing, the washing of cooking and eating utensils, and laundry. • Non-potable water may be used for the cleaning of work areas other than food processing and preparation areas and personal service rooms, provided that it does not contain concentrations of chemicals, fecal coliform (bacteria from feces), or other substances that could create unsanitary conditions or be harmful to workers.
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'Toilet facility' is defined, for the purpose of these Guidelines, as a fixture maintained within a toilet room for the purpose of urination or defecation, or both. The number of toilet facilities, in separate toilet rooms for each gender, should comply with Table 13.1 below. The number of facilities for each gender should be based on the actual number of workers or residents of that gender for whom the facilities are furnished.

Number of workers or residents of each gender	Minimum number of water closets	Minimum number of sinks*
1 - 15	1	1
16 - 35	2	2
36 - 55	3	3
56 - 80	4	4
81 - 110	5	5
111 - 150	6	6
> 150	**	**

* In dormitories, the ratio of sinks or wash basins per resident must be no less than one to six.

** There must be at least one additional fixture for each additional increment of 40 workers.

Table 13.1 – Toilet Facilities for Workers

Where toilet rooms will be occupied by only a single person at a time, it should be possible for the user to lock it from the inside, and it should contain at least one water closet, as opposed to the toilet room that may serve persons of either gender and does not need to be segregated. However, where such single-occupancy toilet rooms have more than one toilet facility, only one such facility in the room may be counted for the purpose of compliance with Table 13.1.

Where toilet facilities will not be used by women, urinals may be provided instead of water closets, but in no case may the number of water closets be reduced to less than two thirds of the number that is specified in Table 13.1.

Urinals should be provided on the basis of one unit, or 0.6 metres of urinal trough, for each increment of 25 men. The floor from the wall to a distance of at least 0.4 metres from the outer edge of the urinal trough should be constructed of material that is impervious to moisture.

13.3 Guidelines for Toilet Facilities

<ul style="list-style-type: none"> • Toilet rooms should be marked distinctly “for men” and “for women” by signs printed in the native language of the workers/residents, or marked with easily recognisable symbols or pictures. • If the toilet rooms for each gender are adjacent spaces, they should be separated by solid walls or partitions that extend from floor to ceiling. • Toilet rooms must have an opaque window to the outdoors which can be opened for ventilation, and/or they must have an adequate exhaust ventilation system. • Each water closet should occupy a separate compartment with a door and walls, or partitions between the fixtures that are sufficiently high to ensure privacy. There should be no open toilets. • Urinals should be provided with an adequate water flush. Urinal troughs should drain freely, and the drain construction should be such that it excludes flies and rodents. 	<ul style="list-style-type: none"> • Facilities for the washing of menstrual cloths should be provided in women’s toilet rooms. • Toilet paper should be provided to the workers/residents. • Hand-drying facilities (paper towels, clean cloth towels, electric dryer, or other) should be provided in each toilet room. • Waste bins with tight closable covers should be provided in each toilet stall, and should be emptied regularly. • In dormitories, no sleeping quarters should be located farther than 60m from a toilet room. • Lighting should be provided for toilet rooms for all hours of day and night. The illumination level should be at least 20 lux (at 0.75m above the floor). • Each toilet room should be provided with sinks with clean hot and cold (or tepid) running water, either within the room or immediately outside it. The number of sinks should comply with Table 13.1. • Hand soap or similar cleansing agents should be provided. • Toilet and shower areas should be cleaned daily with a disinfectant cleaner.
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The following guidelines relate to the proper practices and precautions that should be taken in canteens, kitchens and other food service areas in factories and dormitories. Factories must comply with all local sanitation regulations and/or the adidas Group Guidelines, whichever is more stringent. It is expected that all worker food service facilities and operations will reflect the practice of sound hygienic principles. The food that is served should be nutritious, free from spoilage, and should be stored, handled, processed and prepared in a manner that would protect it against contamination.

13.4 Guidelines for Kitchens and Canteen Facilities

<ul style="list-style-type: none"> • Cooked food services should be provided by the factory if the workers have no other reasonable opportunities to obtain cooked food. • A properly constructed kitchen and dining hall, adequate in size and separated from the sleeping quarters of workers, should be provided unless outside facilities for cooked food are available for the workers. • Direct openings between living or sleeping quarters of workers and the kitchen or dining hall are prohibited. • The kitchen and canteen buildings should provide adequate protection from the weather. • Seating capacity should be enough for all workers who may be scheduled to eat during any shift. • No person with any communicable disease should be employed or permitted to work in the preparation, cooking, serving, or other handling of food, foodstuffs, or any materials used therein, in a kitchen or canteen that operates in connection with a dormitory or is used regularly by dormitory residents. • All kitchen workers should have health certificates from the relevant local authority. • Sanitary food storage: All food containers should be stored away from the floor, and should not be stored in toilet rooms or in any factory areas where there may be exposure to or contact with toxic chemical materials. 	<ul style="list-style-type: none"> • Cold room and freezer refrigeration systems should be operated at the correct recommended temperatures. • Workers and residents should not be allowed to consume food or beverages in toilet rooms or in any factory area where there may be contact with toxic chemical materials. • The use of hair restraints by kitchen and food service workers is required. • Floors should be maintained as dry as practicable and constructed with drains or alternative working and walking surfaces such as false floors, platforms, mats, etc. should be provided where practicable, or water-proof footwear should be used by workers. • Vermin control: Every kitchen or canteen should be constructed and maintained in such a manner as to prevent the entry and harbourage of rodents, insects and other vermin. A continuing and effective extermination programme should be implemented whenever and wherever the presence of vermin is detected. • Kitchen ventilation systems must be adequate to remove excessive steam, heat, vapours, odours and smoke, and there should be regular proper maintenance of the ventilation ducts. • A type ABC or type K fire extinguisher should be available in kitchens for use in the event of a grease or electrical fire (type K is specific for cooking oil fires). Some kitchen workers should be trained in its use.
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Factories and their kitchen staff must recognise that there is a distinction between the **cleaning** and **sanitising** of food preparation equipment, utensils and tableware, and that both cleaning and sanitising are necessary for the maintenance of sanitary conditions in kitchens and canteen facilities. Cleaning involves the removal of food and other residue from the equipment, utensils and tableware, whereas sanitising achieves the elimination of potentially harmful micro-organisms from the same materials. Sanitising is not a substitute for cleaning: if food or residue has not been removed from a surface, the surface will not be sanitised.

If manual cleaning of equipment, utensils or tableware is conducted, then a detergent solution should be used and a minimum water temperature of 43°C (110°F).

There are a number of methods by which sanitising may be performed. Heat sanitising can be done manually, in a dishwasher or other equipment. A temperature of at least 74°C (165°F) is required for the heat sanitising process to be effective.

Chemical sanitising methods represent the other common alternative methods. The instructions of the manufacturer should be followed with regard to the necessary concentration of the active chemical ingredient, the water temperature, and other parameters. Chlorine, iodine and quarternary ammonium compounds are three common chemical sanitising agents.

Health and Safety Guidelines - Technical Application

Section 14 – Material Storage Areas and Ladder Safety

This section of the H&S Guidelines applies to warehouses and other locations of material storage other than chemical storage areas. The activities in these storage areas may create a number of risks to the workers, such as:

- Slips and falls, including falls from heights
- Cuts and amputations
- Crushing injury from material handling, falling objects, or vehicle operation
- Air quality issues related to vehicle operation
- Electrical hazards
- Thermal burns
- Musculoskeletal injury from repeated, awkward and/or intense physical activity
- Battery charging hazards – electrical and corrosive chemicals

While these storage areas often do not have many regular occupants, they do face similar **fire safety issues** as other factory locations. There should be clearly marked unobstructed aisles and egress routes, and appropriate signs for exits. Rubbish and other waste materials should be disposed of regularly and not permitted to accumulate in the aisles. Likewise, containers or stacks of materials should not be permitted to remain in the aisles. Appropriate types of fire extinguishers should be mounted near the exit doors from storage areas. These precautions assume greater significance here because some of the occupants may not be regularly employed in the storage areas, and may not be familiar with the evacuation plan.

14.1 Material Storage Guidelines

<ul style="list-style-type: none"> • Different materials should be stored separately by type. • The width of a main route in a warehouse should be no less than 2 metres. 	<ul style="list-style-type: none"> • The distance between every two stacks should be no less than 1 metre. • Stacks need to be at least 0.5 m away from walls.
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The storage practices in these areas should reflect the factory’s concern for worker safety. All shelves and racks should be secured properly to permanent structures in the storage area. This factor assumes greater importance if forklift trucks are in use, since shelves and racks can be damaged or items can be displaced from them as a result of a collision. Goods and materials should be stacked with the heavier items on bottom shelves, and should not exceed the specified load capacity of the shelves or racks. Pallets should be used for materials that will be stacked or retrieved by forklift. Workers should avoid climbing on the shelves and racks to place or remove materials.

In addition to safe storage practices, the factory may determine that the use of one or more types of personal protective equipment (PPE) is warranted in its storage areas. Such PPE may include impact-resistant safety shoes, hard hats and gloves to protect against cuts and abrasions.

If workers must be on a walking or working surface that has unprotected sides or edges and is six feet (~1.8 metres) or more above the floor or lower working surface, then they must be protected from falling. Adequate fall protection systems may consist of guardrails, safety nets, warning line systems, or safety monitor systems. Personal fall protection, such as a securely attached body harness, may also be appropriate.

Recommendation: Use of free-standing mobile platform steps is preferable to the use of ladders in warehouses and material storage areas, if the aisle widths are sufficient to accommodate this equipment.

14.2 Lifting and Manual Handling of Materials

Of necessity, these storage areas involve workers in a variety of **material handling operations**. Workers should be instructed on the proper approach to lifting and manual handling of materials to minimise any stress, strain or injury.

Lower back injuries comprise a relatively high percentage of all work-related injuries and represent a significant source of pain to the affected workers and significant cost to the factories. Lower back injuries often result from the lifting, reaching, twisting and bending activities that are required of workers in the performance of their jobs.

To reduce the prevalence of such back injuries, efforts should be directed at both the workers and the tasks. The factory should provide training and related assistance to workers whose jobs require these activities on a regular basis. It is recommended that every significant lifting or material handling task be evaluated by a qualified person on the factory staff to determine if there is another way to accomplish the same objective. Before and during a lifting activity or other type of manual handling of materials, workers should follow some relevant ergonomic tips:

14.3 An Ergonomic Approach to Lifting

- Consider alternative ways to accomplish the same lifting or handling.
- Assess the weight of the object before attempting lifting or handling.
- Ask for assistance if necessary.
- Determine the best way to hold or manoeuvre the object before lifting the object.
- During repetitive lifting activities, try to minimise the vertical distance of the lift from origin to destination, and minimise the amount of twisting and bending.
- Use the legs for lifting rather than the back.
- Use the feet to turn, rather than twisting the trunk of the body.

Note: Further information on material storage and handling can be found in the adidas Group's *Assessing Ergonomic Hazards Guidance Note*.

14.4 Use of Forklift Trucks in Storage Areas

Forklift trucks are common in larger storage areas where there is sufficient room for their operation. While forklifts reduce the need for otherwise difficult manual handling of materials, they are also a major cause of accidents and injuries in warehouse environments. Proper training of all forklift truck operators is essential to their safe operation.

Diesel or gasoline-powered forklift trucks can emit air contaminants such as carbon monoxide and particulates to which workers may be exposed. Generally, propane-fuelled or electric equipment is the preferable alternative.

14.5 Guidelines for the Safe Operation of Forklift Trucks

<ul style="list-style-type: none"> • All traffic routes should be marked clearly (and should be one-way only if possible) and kept free of obstructions. • Surfaces of the traffic routes should be smooth and even. • The routes should avoid sharp bends and blind corners. Where necessary, use well-positioned mirrors or audible alarms. • Forklift trucks should have warning lights and audible signals for reverse travel. 	<ul style="list-style-type: none"> • Forklift trucks should not be overloaded with materials. • Forklift trucks should not be used to lift workers so they can perform activities at heights. • Battery charging areas for electric forklift trucks should be located at a safe distance from storage of combustible materials.
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Recommendation: Forklift trucks should be equipped with rollover protection, protection against falling objects, and seat belts or other restraints for the operator.

14.6 Ladder Safety

Ladders are a commonly used piece of equipment in a variety of worker activities both in material storage areas and in other factory locations. All portable wooden and metal ladders should be inspected regularly for damage or defects and should be removed from service until the completion of any necessary repairs. The inspections should include the following:

- Ladders should be free from sharp edges and splinters
- There should be no broken steps, rungs or side rails
- Steps or rungs must be in good condition – the joint between the step and the side rails must be tight in wooden ladders, and the rungs of metal ladders should be constructed of material that minimises the risk of slipping
- A locking device should be available for step ladders so that they are secure when opened
- Any frayed or badly worn rope should be replaced on extension ladders
- All moving parts should operate freely
- Safety feet should be in good condition
- Metal ladders should have side rails made of non-conductive material where the worker or the ladder might contact electrically energised parts



Figure 14.1 – Scaffold in Operation

14.7 Guidelines on the Safe Use of Ladders

<ul style="list-style-type: none">• As a general rule, ladders should be positioned at a pitch so that the working height is ~4 times the horizontal distance from the foot of the ladder to the wall.• When ascending or descending, the climber should face the ladder.• A ladder should not be used by more than one worker at the same time.• A ladder should be positioned securely in place on a firm level surface.• Ladders should not be placed on boxes, barrels or drums to obtain additional height.	<ul style="list-style-type: none">• Ladders should not be tied or fastened together for additional height.• Ladders should not be positioned in front of doors unless the door is locked or guarded.• Ladders should not be used in a horizontal position as a platform or scaffold.
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Figure 14.2 – Mobile Platform

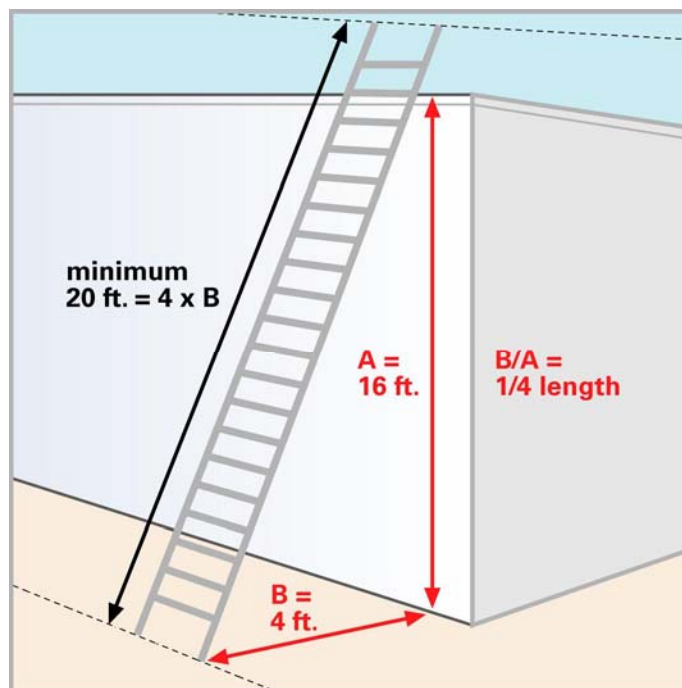


Figure 14.3 – 4:1 Ladder Positioning

Section 15 – Contractor Safety

The activities of outside contractors can introduce many hazards to the factory, some of which may be quite different from the hazards arising from typical production operations. The factory and the contractor must communicate effectively before the contractor begins work to ensure the safety of both the factory workers and the contractor’s workers. As a preliminary requirement, the factory should verify that the contractor’s personnel are qualified to perform the intended work in a safe and professional manner, while complying with all applicable local and national regulations.

Possible Contractor Activity	Related Hazards or Safety Issues
Trenching or excavation work	<ul style="list-style-type: none"> • Possible confined space issues • Engulfment and physical hazards – shoring and sloping issues • Damage to underground utilities, tanks, etc.
Work on electrical systems, steam systems, or other energised equipment	<ul style="list-style-type: none"> • Lockout/Tagout issues • Uncontrolled release of electrical or mechanical energy and risk of physical injury to workers • Disruption of production
Work at heights	<ul style="list-style-type: none"> • Scaffold safety issues • Ladder safety • Falling objects
Hot Work (e.g. welding, torch cutting, brazing, etc.)	<ul style="list-style-type: none"> • Fire and personnel safety issues • Air contaminants and exposure • Ultraviolet radiation hazard
Use of chemical materials	<ul style="list-style-type: none"> • Possible chemical spills or releases to the environment • Air contaminants and exposure • Hazardous waste generation
Use of cranes and rigging	<ul style="list-style-type: none"> • Damage to property • Physical injury to workers

Table 15.1 – Relating Contractor’s Work to Safety Hazards

Communication with any outside contractor who will be conducting work on factory grounds must include instruction on the reporting of emergencies and the proper evacuation procedures in the event of a fire. The scheduling of the contractor work should take into consideration potential disruptions to production and potential safety and health risks to factory workers in the vicinity.

A brief discussion of the major contractor activities and the precautions that should be taken by the factory is presented below.

15.1 Trenching and Excavation

Any contractor work that will involve excavation and work in trenches requires advance planning to the extent that the factory should verify that the work will not damage or disrupt underground utilities, storage tanks, or other facilities. Trenches with depths ≥ 5 feet in which work will be conducted should have proper shoring or sloping. If there are possible air contaminant or oxygen deficiency issues, testing should be conducted prior to worker entry into the trench.

15.2 Electrical Systems

Contractor work on electrical systems or equipment, or on other systems that may have stored energy of some type, needs close communication between the factory and the contractor. The lockout/tagout (LO/TO) procedures of the contractor should be requested by the factory. In the absence of such procedures, the factory should insist that the contractor comply with the LO/TO guidelines in these H&S Guidelines. Factory workers in the vicinity of such contractor activity should be informed of the work and the LO/TO precautions that have been implemented.



Figure 15.1 – Lockout/Tagout in Operation

Much contractor activity may occur at heights, with resulting risks of falls to the contractor personnel and of falling objects to factory workers and equipment. The guidelines on Ladder Safety in Section 14 should apply to the contractor and his equipment. If scaffolds are used by a contractor, the following guidelines are recommended.

15.3 Guidelines on Scaffold Safety

<ul style="list-style-type: none"> • The scaffold should be secured to a permanent structure or structures. • The footing or anchorage must be sound, rigid and capable of carrying the maximum intended load without settling or displacement. • All work levels more than 10 feet above the floor or ground should have guardrails. 	<ul style="list-style-type: none"> • If the scaffold is in a location where people may work or pass under the scaffold, there should be a toeboard and a screen between the toeboard and the guardrail. • The scaffold should not be altered or moved horizontally when in use. • There should be full diagonal face bracing in both directions on pole scaffolds.
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15.4 Hot Work

Hot Work performed by contractors may create a significant fire risk. The factory should be aware when such work is performed, and fire extinguishing equipment should be made available to the contractor's personnel if they lack their own. The work should be performed away from stores of combustible materials or flammable chemicals. If welding is conducted in production areas during factory working hours, the work should be enclosed in fire-resistant welding curtains. A fire watch should be instituted for a period of 30-60 minutes at the conclusion of the hot work to ensure the absence of a work-related fire.

15.5 Chemical Handling

Chemical materials that are used by contractors are likely to present the same range of hazards as those used in factory production. The factory should request Material Safety Data Sheets (MSDSs) for all chemical materials that will be brought on site by the contractor, so that any unusual hazards or highly toxic materials can be identified. Contractors should have appropriate materials to contain and clean a spill or release of any chemical that they use. They should ensure that there is sufficient ventilation in the work area to minimise the risk of chemical exposures to their own personnel and to factory workers. Any chemical wastes that are generated in the course of the contractor work should be removed from the factory grounds by the contractor.

The use of cranes and rigging by contractors in the movement of equipment or materials may present a risk of damage to factory equipment and risk of physical injury to factory workers. All contractor personnel should be qualified to operate such equipment. The factory should request the inspection records for the specific equipment to be used for the work to minimise the likelihood of an accident.

Section 16 – Personal Protective Equipment (PPE) Requirements

Throughout the H&S Guidelines, requirements or recommendations appear for the provision of and use by the workers of personal protective equipment (PPE). In the hierarchy of exposure control methods, PPE should be viewed by the factories as the “last resort”. Therefore, wherever feasible, choose other types of control methods first. However, in certain situations the use of PPE is the only reasonable approach to prevent or reduce the likelihood of worker exposure to a particular hazard.

At least three factors should be considered by factories in their decisions to provide PPE to a particular group of workers in order to achieve effective protection:

1. The type of PPE must be appropriate for the hazard faced by the workers
2. The PPE must fit the workers
3. The PPE must be replaced as necessary

The first of these factors is perhaps the most significant: **the appropriate choice of PPE**. While it is obvious that eye protection should be worn to avoid hazards to the eyes, and gloves should be worn to protect against injury to the hands, there is a further level of detail with regard to PPE selection that must be considered.

16.1 Gloves

Gloves are perhaps the most common type of PPE that is used in factories, and they are worn to protect against a wide range of chemical, mechanical (physical) and thermal hazards. Yet a particular type of glove will not offer protection against every type of hazard. The following guidelines are offered on the issue of glove selection:

16.2 Guidelines on the Selection of Protective Gloves

<ul style="list-style-type: none"> • Gloves that are intended to protect against chemicals must be impervious to the particular chemical or general class of chemical, and generally made from some type of rubber. • Plain cotton gloves are not useful against liquid chemicals, since they will absorb the chemical and then hold it against the worker’s skin. • Rubber-coated cotton gloves (i.e. rubber on the fingers and palm) are acceptable for work with chemicals that does not involve immersion of the hands into liquid. 	<ul style="list-style-type: none"> • Specific information on glove materials and their ratings as protection against various classes of chemicals is available from the glove manufacturers or on the internet. • Gloves to be used against thermal hazards must be sufficient to protect against the intensity of exposure. • Hand protection in cutting areas and in material warehouses must be suitable for the particular physical risk (cutting, shearing, puncture, etc.)
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16.3 Hearing Protection

For a proper selection of hearing protection, some explanation of the Noise Reduction Rating (NRR) is necessary because of the inconsistent and likely confusing use of decibel weighting scales. The NRR is a numerical rating in decibels of the protection, or attenuation, of sound that is provided by various types of hearing protectors (HP) under ideal circumstances of use. It usually appears on the packaging of the hearing protection devices. The NRR determination is based on methods developed by the US EPA, and the NRR values are decibels on the C-weighting scale (dBC). Most sound level measurements and worker exposure data from factories are in decibels on the A-weighting scale (dBA).

To estimate the worker exposure that will result in the ideal use of a particular hearing protection device, and to verify that this exposure will be less than the limits that are specified in Table 11.1, the following calculation is performed:

$$\text{Exposure with HP (dBA)} = \text{Exposure without HP (dBA)} - [\text{NRR (dBC)} - 7 \text{ dB}]$$

In the equation above, the amount of attenuation provided by the device is [NRR – 7 dB], which obviously is less than the NRR value that is printed on the packaging.

A second issue that arises in the evaluation of hearing protection is related to the second factor that is listed above: **the PPE must fit the worker**. The attenuation calculated from the NRR value is the maximum protection that can be obtained by workers if the protective device fits their ears well and is worn properly. However, research has shown that the actual reduction in worker noise exposure is often less than what is calculated from the NRR: for ear plugs, it may be as little as half, or $(0.5 \times [\text{NRR} - 7 \text{ dB}])$, while with ear muffs on average it is ~75%, or $(0.75 \times [\text{NRR} - 7 \text{ dB}])$. This research information suggests the importance of proper training for workers who are expected to wear hearing protection.

16.4 Respiratory Protection

Similar to the use of hearing protection, the effective use of respiratory protection, e.g. dust masks or rubber masks with air-purifying cartridges, also depends to a large extent on the fit of the equipment to the worker. Ill-fitting masks, or masks that are not worn properly by workers, may provide little or no protection from the airborne hazard.





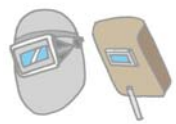




The improper fit of other types of PPE may have consequences that go beyond the degree of protection that the PPE provides to the worker. Ill-fitting PPE is less likely to be accepted and worn by the workers, can impact the productivity of the workers and/or the quality of their work, and, in extreme cases, may create new hazards that did not exist previously (e.g. poorly fitting safety shoes could lead to trip/fall hazards).














Finally, all types of PPE have finite useful lifetimes, like other types of equipment or clothing, and **PPE must be replaced on a regular basis**. For example, protective gloves that have tears or holes in the material should be replaced as soon as possible. Hearing protectors may accumulate sweat, chemical residues, dirt and grease, and also need to be replaced regularly to prevent ear infections or irritation. A final example is the cartridges that are used in tight-fitting rubber respirators: these have a limited capacity to capture chemicals and should be replaced before saturation occurs. For hazardous chemical exposures, i.e. when a chemical exposure exceeds its TLV or the cumulative chemical exposure (EF value) exceeds 1.0, these cartridges must be replaced daily in order to provide effective removal of the airborne chemicals.

The specific references to PPE in the H&S Guidelines do not represent every conceivable need for the use of PPE by workers, but they do identify situations or potential hazards for which PPE is a common method of control. These include:

Section of H&S Guidelines	Reference to Use of PPE
Section 4: First Aid	<ul style="list-style-type: none"> • Use of PPE to protect the first aid provider against exposure to bloodborne pathogens (e.g. gloves, CPR barrier, eye protection if necessary).
Section 5/6: Chemical Safety Management	<ul style="list-style-type: none"> • Information on PPE is available on MSDSs, and should be included in the CSDSs and Operation Procedures that are created by the factories. • PPE should be appropriate for the worker and the actual hazard and may include eye protection, gloves, face masks and footwear.
Section 11: Machine Safety and Noise	<p>PPE use should be specific for the risk, and may include:</p> <ul style="list-style-type: none"> • Eye protection against chemical hazards, physical hazards and UV radiation • Gloves for use against chemical, mechanical and thermal hazards • Foot protection against mechanical impact hazards • Hearing protection against high noise exposures
Section 13: Sanitation and Hygiene: Toilets, Dining and Kitchen Facilities	<ul style="list-style-type: none"> • Waterproof and slip-resistant footwear should be provided where necessary
Section 14: Material Storage Areas and Ladder Safety	<ul style="list-style-type: none"> • Fall protection devices such as harnesses should be provided where there is a risk of falling ≥ 1.8 metres (6 feet) and no other protective measures are available
Section 22: Ergonomic Considerations in Equipment Purchases and Work Station Design	<ul style="list-style-type: none"> • PPE should fit its user

Table 16.1 – Cross Reference of PPE Requirements in Other Sections of these Guidelines

Functions of PPE	Feature and Characteristics
Protective Goggles (Suitable for protection from dust, particles, flying chips, chemical splattering and smoke.)	
Goggles with direct vents are not suitable for protection from chemical splattering or smoke.	
Fitted with indirect vents.	
Safety Glasses (Suitable for protection from particles, flying chips and the impact of fragments.)	
Frontal protection.	
Fitted with side protection.	
Electric arc welding helmets and face shields suitable for protection from electric arc welding, electric sparks, strong UV radiation (can be used together with safety goggles).	
Hearing Protection	
Cotton earplugs: disposable earplugs for short-term use - not suitable for high noise levels.	
Elastic earplugs: washable, reusable earplugs.	
Foam earplugs: When compressed and inserted into the ear cavity, they expand to completely fill the ear cavity.	
Ear muffs: They offer a high level of sound reduction and are suitable for high noise levels. They can be used in combination with a safety helmet.	

Respiration Protection	
Dust respirators (not suitable for oxygen deficient environments)	
Cartridge or canister (not suitable for oxygen deficient environments)	
Breathing apparatus (a) Self-contained breathing apparatus, or (b) linked to an air supply system.	
Head Protection	
Use head gear which conforms to recognised safety standards.	
Hand and Arm Protection	
Gloves for common tasks (cotton/ leather)	
Gloves for handling chemicals	
Heat-resistant gloves	
Cold-resistant gloves	
Cut-resistant gloves	
Anti-shock gloves	
Disposable gloves	
Gloves for electrical work	
Foot Protection	
Select footwear that fits the purpose and conforms to recognised safety standards.	











Body Protection	
General purpose protective clothing: Work clothing to prevent cuts; suitable for employees operating sharp blades and machines. Including raincoats.	
Heat-resistant work clothing/aprons: Used for welding to prevent burns from sparks, fragments and flying molten metals.	
High-temperature work clothing: For employees working around smelting furnaces, firemen etc.	
Low-temperature work clothing: For employees working for long periods in refrigerated conditions.	
Anti-electrostatic work clothing: Suitable for workplaces where flammable materials are handled or where static charges might affect the quality of electronic products.	
Impermeable work clothing for protection against chemicals: chemical spill handling and asbestos handling etc.	
Life jackets: Reduce the risk of drowning when an employee falls into water. For example at water treatment plants, or reservoirs.	
Reflective clothing: For working in busy traffic; brightly-coloured reflective clothing can increase the visibility of employees and reduce their chances of being struck by vehicles or machinery.	
Fall Protection	
Full body harness is used to prevent falls.	
General purpose safety belt and its lanyard are used to restrict movement while working.	

Table 16.2 – PPE Types and Their Functions

Section 17 – Worker H&S Training Requirements

Worker training on relevant issues in these H&S Guidelines is as important as other training related to job performance. All factory workers and dormitory residents face risks related to fire and safety. Some workers must perform tasks that require the handling and use of hazardous chemical materials or the operation of machinery and other equipment. Other workers have responsibilities that may include the provision of first aid services or the use of fire extinguishers. Whatever the particular H&S issue, the factory should provide a basic level of information and education to the potentially affected workers so that their tasks are performed in a safe and productive manner. To determine which type of training should be provided to which groups of workers, a training needs assessment should be conducted.

Specific recommendations for training and training content are made throughout these H&S Guidelines. These do not encompass every conceivable need for training, but they do identify those contexts in which effective worker training will enhance worker health and safety and reduce significantly the risks that are presented by the chemical and physical hazards in the factory. These include:

Section of H&S Guidelines	Worker Training Needs
Section 1: Management	<ul style="list-style-type: none"> • Worker roles in the fire and emergency preparedness plan • Evacuation drills • Written training materials and procedures that cover all relevant H&S training
Section 3: Fire Safety	<ul style="list-style-type: none"> • Training on evacuation procedures and the location and use of alarm boxes or other devices • Evacuation drills • Fire extinguisher training for those workers expected to respond
Section 4: First Aid	<ul style="list-style-type: none"> • Training for first aid providers • Training on the hazards of bloodborne pathogens
Section 5/6: Chemical Safety Management	<ul style="list-style-type: none"> • Basic understanding of the potential hazards of chemicals and the proper precautions and measures to avoid exposure to these risks • Training conducted twice annually for production workers • For workers who use PPE: training on the need for, and proper use of, the equipment • Chemical Safety Data Sheets (CSDS) and Operation Procedures to be prepared by the factory as information resources available to production workers
Section 9: Compressed Gases/ Cylinders	<ul style="list-style-type: none"> • Training of relevant workers on the hazards of compressed gases and the proper precautions for handling
Section 11: Machine Safety and Noise	<ul style="list-style-type: none"> • Training for all machine operators on the proper operation of their equipment, the emergency shut-down procedures, and the required PPE • Training for all workers in high noise areas on the reason for, and proper use of, hearing protection

Section of H&S Guidelines	Worker Training Needs
Section 12: Dormitories	<ul style="list-style-type: none"> • Training of first aid providers (see Section 4) • Fire safety training for dormitory residents (see Section 3)
Section 14: Material Storage Areas and Ladder Safety	<ul style="list-style-type: none"> • Training of all forklift truck operators • Use of ladder and working at heights
Section 18: Occupational Hazards Risk Assessment	<ul style="list-style-type: none"> • Training of supervisors, management staff and H&S coordinators to carry out basic risk assessments for occupational Health & Safety hazards at workplaces
Section 19: Hot Work Environments and Heat Stress	<ul style="list-style-type: none"> • Training of workers and supervisors in high heat areas on the importance of fluid replacement and on recognition of the early signs and symptoms of heat stress
Section 20: Lifting and Manual Handling of Materials	<ul style="list-style-type: none"> • Training on proper lifting techniques
Section 21: Lockout/Tagout Procedure	<ul style="list-style-type: none"> • Specific training for workers who must use LO/TO procedures in the course of their jobs • Awareness training for other workers so that LO/TO devices are recognised and respected
Section 22: Ergonomics – Biomechanic Risk Factors	<ul style="list-style-type: none"> • Training workers to be aware of biomechanics risk factors and to reduce occupational injuries by adopting correct working postures

Table 17.1 – Cross Reference of Worker Training Requirements in Other Guidelines Sections

NOTE: Training should be current and applicable. Workers should be trained at least once per year. Newcomers have to obtain basic safety training during induction. Long-serving workers also need to receive regular refresher training.

Section 18 – Occupational Hazards Risk Assessment

18.1 What is Risk Assessment?

Risk assessment is nothing more than a careful examination of what could cause harm to people in your workplace. It allows you to decide if you have taken enough precautions or whether you should take more.

The idea is to make sure that no one gets hurt or becomes ill. Ill health and accidents can ruin lives and also affect your business if production is lost, property or machinery damaged because of them.

Hazard

A hazard is anything that has the potential to cause harm (for example chemicals, electricity, working at height, etc.).

Risk

A risk is the likelihood (great or small) of harm being done.

What you need to decide is whether a hazard is significant, and whether you have taken satisfactory precautions to minimise the associated risk. It is important that you check this aspect when you assess the risks. For example, electricity can kill but the risk of it doing so in an office environment is remote, provided that the “live” components are insulated and metal casings are properly earthed (grounded).

18.2 How Do You Conduct a Risk Assessment?

It is important that you do not overcomplicate the task. In most industries the hazards are few and simple. Checking them is mainly a matter of common sense, but even so it is very necessary. You may have already assessed some of them, for example the use of toxic chemicals and solvents. For other hazards you probably already know if you have machinery that could cause harm, or if there is an awkward entrance or stairway that may cause an accident. If so, check that you have taken what reasonable precautions you can to avoid injury.

18.3 Risk Assessment Steps

Step 1: Look for the hazards

Step 2: Decide who might be harmed and how

Step 3: Evaluate the risks

Step 4: Record your findings

Step 5: New safety measures

18.4 Hazard Classes

Definition of Hazard Classes	
Hazard Class	List of Possible Hazardous Work and Facilities in an Establishment
Highly Hazardous	<ol style="list-style-type: none"> 1. Bulk flammable liquid installation (capacity >1 tonne) 2. Substantial hazardous material used in production <ul style="list-style-type: none"> • Toxic metals, chemicals, organic compound substances, fibrous and powdered materials • Dipping • Chroming • Cementing • Co-processing 3. Substantial use of robotic technology (>3 robots per cell) 4. Prolonged exposure to excessive noise level environment >85 dBA 5. Prolonged or excessive contact with most chemicals → Threshold Limit Values (TLVs) 6. Prolonged exposure to heat stress and strain conditions
Hazardous	<ol style="list-style-type: none"> 1. Substantial use of heavy machinery that is likely to create the following hazards: <ul style="list-style-type: none"> • Mechanical • Electrical • Chemical • Radiation • Thermal • Fire • Excessive noise level • Overcrowded workspace • Emission (contaminants, dust, volatile organic compounds, chemical vapours) 2. Flammable and toxic chemical storage/used in production <ul style="list-style-type: none"> • Cementing • Priming • Cleaning • Chemical mixing
Medium Hazard	<ul style="list-style-type: none"> • Warehousing • General manufacturing • Sewing • Commercial kitchen • Assembly work • Cleaning work • Packing
Low Hazard	<ul style="list-style-type: none"> • Office • Administrative • Qualitative analysis • Development • Planning • Costing • IT function • General cleaning work

Table 18.1 – Definition of Hazard Classes

18.5 Looking for Hazards

Walk around your workplace and look carefully for what could reasonably be expected to cause harm. At this stage, ignore the trivial items; these can be dealt with later. Concentrate on the significant hazards that may result in serious harm or effect several people.

Talk to your employees and ask them what they think. They may have noticed potential problems that are not immediately obvious.

Machinery manufacturers operating instructions, Material Safety Data Sheets etc. can also help you at this stage to identify the hazards and put risks in their true perspective, as can accident and ill-health records.

Make a list of some of the jobs, tasks and operations that you or other people perform, and for each one identify as many hazards as you can. A simple format is shown in the following table:

Job, Task, Operation	Hazard
<i>List of tasks</i>	<i>Types of Hazards</i>

Table 18.2 – A Simple Form to Tabulate Collected Information

Using the information gathered in the above form, select the most significant hazards. Review each one in turn and consider the following questions:

1. Can the hazard be removed or prevented altogether?
2. What else can be done to reduce and control the risks associated with this hazard?

18.6 Decide Who Might Be Harmed and How

You have a responsibility to safeguard anybody who may be affected by what you do. You should also consider people who may not be in the workplace all of the time; for example contractors, cleaners, visitors, maintenance personnel and so on. Special attention should be paid to young workers, new employees and pregnant women.

Include members of the public, or people with whom you share your workplace. For example, is your factory in a residential area or in an Industrial Zone with other factories alongside yours? Is there a chance that they could be harmed by your activities?

18.7 Evaluate the Risks

You now need to evaluate the risks that arise from the hazards you have noted and decide if the precautions you already have taken are adequate or whether you need to improve them.

Even after all precautions have been taken, a degree of risk will usually remain. What needs to be decided for each significant hazard is whether the remaining risk is high, medium or low.

First ask yourself if you have complied fully with any legal requirements and/or Occupational Health and Safety Laws. You should then ask yourself whether generally accepted industry standards have been met. But do not stop there; you should ensure that you have done everything that is reasonably practicable to keep your workplace safe, and this may mean taking additional precautions that are not defined in either legislation or industry standards. Your real aim is to minimise all risks by adding to and/or improving your precautions if necessary.

18.8 Risk Evaluation

Now list all the hazards that you previously noted and rate each one on a scale of 1 to 5 for the degree of harm that they may cause (refer to Table 18.3), and for the likelihood that the harm may happen (refer to Table 18.4) – that is the risk.

Hazard Rating: Severity of Injury

Score 5 as the highest and 1 as the lowest. For instance, a hazard rated 5 has the potential to cause very serious harm – for example a process that produces toxic fumes.

Severity Rates	
0	No hazard
1	Very low hazard
2	Low hazard
3	Medium hazard
4	High hazard
5	Very high hazard

Table 18.3 – Hazard Rating Scale

Probability Rating: The Likelihood of Harm Being Caused

Use a scale of 1-5: 1 as the least likely to happen through to 5 as very likely to happen. A category 5 risk would be one with a very high (80% or more) chance of happening, and a category 1 with a very remote (10% or less) chance of happening.

Probability of Happening	
1	< 10% probability
2	11 – 25% probability
3	26 – 50% probability
4	51 – 79% probability
5	> 80% probability

Table 18.4 – Probability Rating

Determining Risk Ratings

Once the hazard rating and likelihood of occurrence have been determined, the risk can be determined by:

Risk Level = Probability * Severity

Risk Rating		Rating Action Bands	
<i>To establish Residual Risk Rating, multiply "Probability" with "Severity".</i>			
Probability	Severity Rates	Risk Level	Action Required
1 <10%	1 Very low	1-5 Trivial risk	Action Required Level: 1 No further action is required. Monitor situation.
2 11-25%	2 Low	6-10 Tolerable risk	Action Required Level: 2 <ul style="list-style-type: none"> No additional controls are required. Consideration may be given to a more cost effective solution or improvement that imposes no additional cost burden. Monitoring is required to ensure that the controls are effective and maintained.
3 26-50%	3 Medium	11- 15 Moderate risk	Action Required Level: 3 <ul style="list-style-type: none"> Efforts should be made to reduce the risk, but the costs of prevention should be carefully measured and limited. Risk reduction measures should be implemented within a defined time period. Where the moderate risk is associated with extremely harmful consequences, further assessment may be necessary to establish more precisely the likelihood of harm as basis for determining the need for improved control measures.
4 51-79%	4 Highly	16 -20 Substantial risk	Action Required Level: 4 Stop work! It should not be started again until the risk has been reduced. Considerable resources have to be allocated to reduce the risk. Where the risk involves work in progress, urgent action should be taken.
5 >80%	5 Very high	>20 Intolerable risk	Action Required Level: 5 Work should not be started or continued until the risk has been reduced. If it is not possible to reduce risk even with unlimited resources, work has to remain prohibited.

Note: Tolerable means that the risk has been reduced to the lowest level that is reasonably practicable.

Table 18.5 – Establish Residual Risk Rating

Task/Job	Hazard	Probability	Severity	Risk Level
Applying adhesive	Solvent fumes	4	3	4x3=12
	Skin contact	4	3	4x3=12
	Eye contact	4	3	4x3=12
Buffing	Dust inhalation	3	3	3x3=9

Table 18.6 – Example for Risk Rating Calculation in a Footwear Factory Premise (= Probability x Severity)

18.9 Record Your Findings

Just completing the assessment is only part of the operation; you should record your findings, conclusions and recommendations. A suggested format for a risk assessment is given at the end of this section of the H&S Guidelines.

Use this approach:

1. Write down the most significant hazards.
2. Record your most important conclusions – for example:
Solvent fumes from assembly line: local exhaust ventilation provided and regularly checked.
Or: Electrical installations: wiring, insulations and earth checked and found to be in good condition.

You should also inform your employees about your findings. There is no need to show how you did your assessment, provided that you can show:

- A proper check was made.
- You asked who might be affected.
- You dealt with the obvious significant hazards, taking into account the number of people who could be involved.

Assessments need to be suitable and sufficient, not perfect. The critical questions are:

- Are the precautions reasonable?
- Is there something to show that a proper check was made?

You should keep written documents for future use or reference; this can help later if you are questioned about the precautions you have taken. Such documents can also remind you to keep a check on specific issues and help show that you have complied with legal requirements.

To make things simpler, you can always refer to other documents, such as:

- Manuals
- Your health and safety policy arrangements
- Company rules
- Manufacturers' instructions

These may already list hazards and precautions. There is no need to repeat all these, and it is up to you whether you combine all the documents or keep them separate.

By maintaining records of risk assessments you can:

- Show that you are taking reasonable actions to reduce the risks to workers
- Maintain details of recommendations/actions taken to reduce risks
- Use previous risk assessment results when re-assessing tasks
- Develop generic assessments for similar tasks
- Review the effectiveness of existing and/or recommended controls
- Demonstrate to employees, regulatory authorities, customers, etc. that the risks arising from your operations have been assessed and appropriate actions taken

18.10 New Safety Measures

Improving health and safety in your factory does not necessarily mean spending large amounts of money. Covering slippery steps with non-slip material, or placing a mirror on a dangerous blind corner to help prevent vehicle accidents are inexpensive precautions when you consider the risks that these hazards cause.

You should also consider training, more safety notices, reviewing and changing working practices. If you find that you need to take actions to improve the health and safety in your workplace you should ask yourself:

- Can I eliminate the hazard altogether?
- If not, how can I control the risks so that harm is unlikely?

You should only resort to the use of PPE when there is nothing else you can reasonably do to reduce the risk.

If the work done in the workplace varies greatly, select those hazards which you can reasonably foresee and where you can assess the risks arising from them. After that, if you notice any unusual hazard, collect information about it and take whatever actions are necessary.

18.11 Review Your Assessment

Once completed, your risk assessment should be reviewed regularly, and revised if necessary.

There may be changes in health and safety laws or industry best practices that would require you to change your original assessment. Alternatively you may install new machinery or new processes that could lead to new hazards. If there is any significant change, you should add it to your original assessment to take into account the new hazards and the precautions required.

However, it is also good practice to regularly review your assessments. You do not need to amend them for every trivial or minor change or for each new job or task, but if the new job or task introduces significant new hazards of its own, you should consider them in their own right and do whatever you need to minimise the risk.

18.12 Health & Safety Risk Assessment Form Checklist

An example of a completed Health and Safety Risk Assessment form is shown in Table 18.7 below. You may find it helpful to group your points or questions under the following headings, which must all be covered, ideally in some detail.

- Company name and address
- Department/section assessed
- Date of assessment, assessor's name
- Next review date
- What hazards exist?
- Who might be at risk?
- What safety measures are in place?
- What further action needs to be taken?

Risk assessments may also be done in the context of the environment. Relevant information regarding conducting Environmental Risk Assessments can be found in the adidas Group Environmental Guidelines.

Health & Safety Risk Assessment Form

Site: Factory Building 1			Assessment No: 1		
Department: Production Assembly lines			Assessor's Name: Tom Lee		
Assessment Date: 30 th January 2009			Assessor's Signature:		
Number of persons at risk <i>Enter numbers against category</i>			Activity/Process Description: Assembly lines, cementing process		
Employees	Contractors	Others			
15					
No.	Hazards Involved	Existing Control measures	Probability x Severity = Rating		
1	Solvent vapour inhalation at line 1	No local extraction system installed to reduce VOC emissions. 5 workers were not provided with activated carbon masks.	4	4	16
2	Skin contact with chemicals at line 2	2 workers were not provided with information regarding the appropriate use of personal protection equipment.	4	3	12
3					0
4					0
5					0
Do any procedures/processes/plans relating to the task need to be amended or updated in light of your risk assessment findings? Yes No					
If "Yes" give details: Yes, Updating of PPE policy, training programme, worker medical screening policy and purchasing procedure are necessary.					
Health Surveillance or Medical Screening Required? Yes No					
If "Yes" give details: There is no regular medical screening to check workers chemical exposure level.					

Are current control measures adequate?				Yes	No
If "Yes" then the risk assessment is complete subject to management confirmation. No, there is no engineering and administering control to the use of hazardous chemical at the workplace. PPE control is weak.					
Are additional controls needed to reduce the risk level to below 16 (Refer to Table 18.5 adidas H&S Guidelines)?				Yes	No
If "Yes" specify below the controls to be implemented. Yes, install basic engineering control such as providing adequate local ventilation to reduce VOCs. Proper chemical safety training to be provided to affected workers. Provide correct type of personal protection equipment to workers.					
No.	Action Required Level	Identified Deficiency	Additional Control Measures Required		
1	5	No engineering, administrative and PPE controls to reduce hazardous chemical exposure level.	Local ventilation system is required to install to reduce contaminant to permissible level.		
2	5	Provide inadequate and incorrect use of PPE for chemical handling	To set up personal protection equipment policy and step up chemical safety training for affected workers.		
No.	Action by	Comments	Target Date	Completion Date	Signature (when completed)
1	Steven Lam	Job safety analysis was carried out to assess the design of the ventilation system layout.	28 February	15 February	
1	Mary Lou	Set medical screening policy for workers exposed to hazardous working conditions.	15 February	15 February	
1&2	Louisa Lim	Step up training programme for workers using PPE and beefing knowledge on Chemical Safety.	28 February	20 February	
2	Frank Tan	Revise purchasing procedure and engage Safety Officer to advise standard type of personal protection equipment for the factory.	28 February	25 February	
2	Paul Chan	To provide appropriate PPE to workers.	Immediately	Completed	

Have the additional controls been agreed? Yes No (Please check as appropriate)		
If "No" please specify reasons: Yes		
Have target date(s) been agreed? Yes No (Please check as appropriate)		
If "No" please specify reasons: Yes		
Management Confirmation		
<i>I have noted the above assessment and will take appropriate steps to ensure all the actions raised are completed satisfactorily.</i>		
Name (Block Capitals): (Manager responsible for the activity)	BRUCE CHEN	
Signed:	Date: 1 st February	
Risk Assessment Review		
<i>I confirm that the assessment remains valid, controls remain effective and there has been no increase in risk.</i>		
1 st Review date: 1 st March	Name: Peter Tong	Signed:
2 nd Review date:	Name:	Signed:
3 rd Review Date:	Name:	Signed:
Note: If the above statement cannot be verified then a re-assessment will be required to confirm that there has been no significant change to the activity/process.		

Table 18.7 – An Example of a Completed H&S Risk Assessment Form

Section 19 – Hot Work Environment and Heat Stress

19.1 Overview

Certain locations and processes in a factory may present a risk of heat stress and heat-related disorders to workers. Heat stress refers to the net heat load which the workers are subjected to from a variety of sources:

- Workload or physical activity
- Air temperature and humidity; the extent of air movement in the vicinity
- Radiant heat sources such as the sun or hot equipment, and the clothing requirements of the job

There can be a range of responses from individual workers to similar heat stress conditions. Individual factors that may influence a worker's response include:

- Age, gender, weight, physical fitness, pre-existing medical conditions
- Use of drugs or alcohol
- The worker's state of hydration

In addition, a process called acclimatisation typically occurs in workers who have experienced ~3 weeks of work under consistently similar conditions. This process represents a gradual physiological adaptation to the conditions, which improves a worker's ability to tolerate the heat stress.

To combat these factors that contribute to heat stress, there are two primary and related mechanisms by which heat is removed from the body:

1. Evaporation of sweat
2. Convection

which is a function of air temperature and air speed. Convective cooling (i.e. blowing air past a worker) only occurs when the air temperature is less than the skin temperature of the worker (typically 35°C, or 95°F). When the air temperature exceeds skin temperature, blowing air at a worker adds to the heat stress rather than cooling him/her.

If the factory conditions are such that the contributions to heat stress outweigh the worker's ability to remove this heat, the worker may begin to experience one or more of the following signs and symptoms:

- Profuse sweating
- Increased pulse rate, nausea, dizziness, light-headedness, confusion
- Sudden and severe fatigue

If the heat exposure continues without relief, the symptoms may become more severe: the worker may become manic, disoriented, delirious or unconscious. If the worker stops sweating and his/her skin becomes hot and dry, then immediate medical care is necessary.

19.2 Guidelines for Relief of Heat Stress in Workers

- Fluid replacement: provide small volumes of water or other replacement fluid on a regular basis (e.g. 1 cup [~250 milliliters] of fluid every 20 minutes)
- Shielding of radiant heat sources (e.g. hot equipment)
- Increase air velocity past workers if air temperature is <35°C
- Sensible clothing for workers
- Rest breaks in a cooler environment and/or job rotation in the hot environment
- Cooling vests or other water-cooled garments

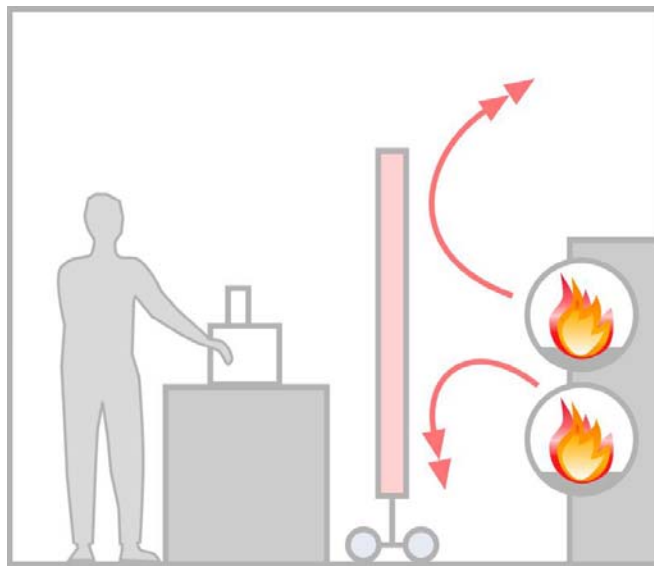


Figure 19.1 – Sheltering from Radiant Heat

A reasonable approach by factories to the issue of heat exposure to workers and potential heat stress problems should include: (1) the recognition of factory locations where heat exposure may be significant; (2) actions to reduce heat exposure and heat stress of the affected workers and (3) implementation of basic medical surveillance techniques.

The particular heat exposure control measures that should be implemented depend on the particular location, the task and the exposed workers. However, replacement of fluid that has been lost through sweating is always a critical measure. Thirst is a poor guide to rely upon for fluid intake: generally, a worker will not be thirsty until dehydration has already occurred. This is why a regular process of fluid replacement for heat-exposed workers is essential to avoid the more serious effects that may develop in workers.

The factory approach should include training of affected workers and their supervisors. This training should stress the importance of regular fluid replacement by workers, the role of workers in recognising the early signs and symptoms of heat stress as a means of avoiding more serious consequences, and the necessity for a reasonable adjustment of work expectations in hot work environments.

19.3 Recognition of Heat Stress in Workers: Basic Medical Surveillance

- Core body temperature >38°C (oral temperature >37.5°C)
- Sustained pulse rate over several minutes of [180 – worker age] beats per minute
- Recovery pulse rate one minute after peak work effort of >110 beats per minute
- Weight loss during a single work shift of >1.5% of body weight
- Symptoms of nausea, dizziness, light-headedness and/or severe fatigue

Air temperature alone is a poor indicator of the potential for heat stress in workers, although it can identify whether convective cooling may be used as a possible heat relief measure. Instead, the workers themselves – their physiological responses and the development of early signs and symptoms of exposure – provide more reliable indicators, and attention should be paid to the workers. Core body temperature is a good measure of heat stress in workers, but oral temperature is more easily obtained and is usually ~0.5°C less than the core temperature. Pulse rates are convenient measures, but the guidelines above presume normal cardiac health status in the workers. Listening to the workers themselves may identify problems at an early stage and help to avoid more severe effects.

Section 20 – Tagout/Lockout Procedure

20.1 Purpose

The purpose of the implementation of the 'Permit to Work System' is to safely control and monitor all work activities and operations which are required to take place on/in:

- Hot work
- Confined work areas
- Electrical systems
- Hazardous chemical handling
- Shutdown of fire protection system

20.2 Definitions

- **Contractor:** An organisation responsible to the factory for the design and/or supply of goods or services, for a complete project or installation.
- **Supervisor:** The contractor's employee directly responsible for the immediate supervision and control of a group of personnel employed by the contractor.

20.3 Procedure for Application

Part 1: Application – to be completed by Contractor

When a contractor needs to perform work as specified above, he must obtain the necessary '**Permit to Work System**' Forms (see Figures 20.1 – 20.3 below) from the Security Office.

Only the contractor's supervisor directly responsible for the work can apply for the permit, and that same person must continue to supervise the work until its completion.

The supervisor must declare that all statutory restrictions have been read, understood and adhered to by placing a tick in the box provided in Part 1 of the application form.

The contractor must provide details of the work to be undertaken and explain:

- The nature of work (description of work)
- The expected duration of the work (date and time)
- Where the work is to be carried out (location)

The contractor must determine if an electrical isolation is required and tick the appropriate box. If YES, then the contractor must stipulate exactly the description and tag number of the equipment to be isolated.

The contractor must also clearly stipulate in writing the number of personnel and identification card numbers (to be attached to the permit) of the workers under direct supervision of the contractor.

The contractor is not permitted to add additional workers to a valid permit.

After completion of Part 1, the sub-contractor's supervisor must submit the permit to the Facilities Department for assessment and approval.

Part 2: Endorsement – to be completed by Facilities Engineer

If an electrical isolation is required (as declared in the Application, Part 1), the Facilities Engineer must check and acknowledge the work to be done. He must also check and confirm the location of the intended work, the equipment description and the equipment tag.

If no electrical isolation is necessary, Part 2 of the form can be struck through and be deemed as N/A (not applicable).

An electrical isolation must be carried out by the Facilities Department using approved type padlocks to securely lock off the electrical isolator. The padlock keys shall be controlled by Facilities. The equipment concerned must be proven to be 'dead', using appropriate electrical test equipment.

The numbers of the padlock(s) used in the isolation must be recorded on the permit. Part 2 is completed only when it is endorsed by signature.

Part 3: Authorisation – to be completed by Facilities Engineer

The Facilities Engineer must check the area, equipment and any isolation carried out for the intended work prior to signing the authorisation. He will also indicate other safety requirements or conditions for the subcontractor to comply with.

He must then sign to indicate that he has checked, and is satisfied with, the provision and conditions of work.

For electrical systems

If applicable, he can hand over a key to the contractor allowing access to the switch room or area that is under the control of the Facilities Department. The care of the key must be the responsibility of the contractor for the duration of the work and must be handed back to the Facilities Department on completion of Part 4.

The contractor's supervisor must ensure that the Permit to Work is clearly displayed either:

- At the entrance door to a controlled access area, or
- At the equipment where the work is to be carried out

Part 4: Notification of Completion – to be completed by Contractor

Upon completion of the work, the contractor's supervisor must ensure that:

- All workers under his authority are made aware that the permit is to be cancelled and that no further work is to take place on that equipment or in that declared area.
- All workers have been made aware that any further work is 'unsafe'.
- All materials and tools have been removed from the worksite and the area has been cleaned thoroughly.
- All equipment isolated as part of the permit has been thoroughly checked to confirm that it is safe to turn on.

When satisfied that the above conditions have been met, the contractor must return any keys to the Security Office, sign the declaration in Part 4 and return the original copy of the permit to the Security Office.

Part 5: Equipment Re-Commissioning – to be completed by Facilities Engineer

The Facilities Engineer must check the area, equipment and any isolation previously carried out for the intended work.

When satisfied that the contractor has fulfilled the obligations in the *Notification of Completion*, the Facilities Department must re-commission the electrical system and sign Part 5.

The original permit is filed by Security for future reference.

20.4 Rules and Regulations

- Permits should only be valid for standard project working hours, which are 8.00 am to 6.00 pm, unless it is clearly stated on the permit that extended working hours are required. The Facilities or Maintenance Department should reserve the right to approve such extended hours.
- A contractor's employees who are not identified on the original permit are not allowed to enter areas or work on equipment under the control of the permit.
- The contractor is not allowed to add new workers' names to a valid permit.
- The contractor is not allowed to change or deface a valid permit.
- Contractors who are issued a key to a controlled area must be responsible for locking the door to the controlled area each time they leave. The Facilities Department should not be held liable for any equipment loss, damage or theft when a controlling key is issued to the contractor.
- Contractors who are caught not following the above procedures or deliberately disobeying the stated rules and regulations should have their permit cancelled.

Warning: Repeat offenders may be banned from working on site.

Permit To Work					
					Permit No:
APPLICATION BY SUBCONTRACTOR					
Name:		Company:			
Date of Permit:		Contact No. On Site:			
WORK DESCRIPTIONS					
Location of Work (Please refer to list of restricted areas which require a Permit to Work):					
Nature of Work:					
Date of Work Starts		Date of Work Ends		No. of Workers On Site	
		Factory Facilities Engineer		Subcontractor Supervisor On Site	
Name					
Designation					
Contact No. On Site					
Does Work Generating Odours?			<input type="checkbox"/> Yes <input type="checkbox"/> No		
If yes, state the following:			Cause of Odour:		
			Source of Odour:		
			Chemical Used:		
Is Hot Work involved?			<input type="checkbox"/> Yes <input type="checkbox"/> No		
If yes, please specify:			Date:		
			Start Time:		End Time:
		Factory Facilities Engineer		Subcontractor Supervisor On Site	
Name					
Designation					
Contact No. On Site					
NOTE: REQUESTOR IS TO COMPLY WITH ALL PRECAUTIONS AND INSTRUCTIONS SPECIFIED IN THE HOT WORK PERMIT.					
APPROVAL TO START WORK (To be approved by Factory Facilities Engineer)					
All safety precautions taken and procedures to be completed by contractor. Factory to supervise work to be carried out and ensure all precautions stated here are carried out:				Other Recommendations:	
Verified by		Date			
Approved by		Date			

Figure 20.1 – Example of a “Permit to Work” Form

Permit to Work on Electrical System					
This permit can only be obtained from Factory Security Dept.			Permit No. _____		
PART 1: APPLICATION- TO BE COMPLETED BY SUBCONTRACTOR					
Name of Subcontractor:					
Name of Supervisor Applying for Permit:		(Supervisor shall be fully responsible for all workers under his control)			
Location of Work:		(Sketch Attached)			
Date & Time of Work: (Duration)		From:		To:	
				No. of Workers:	
Statutory Restrictions/Conditions to be Complied with at the Location of Work:					
Cordon off or barricade work area. Provide warning signs. Do not stand on electrical equipment. Do not touch any electrical equipment.			Do not use liquids in vicinity of electrical equipment. Do not use electrical equipment as a means of support. Immediately report accidents, incidents or any damage.		
Detailed Description of Work:			Requested by Supervisor in Charge:		
			Name:		
			Date/Time:		
IS ELECTRICAL ISOLATION REQUIRED ? <input type="checkbox"/> YES <input type="checkbox"/> NO			Signature:		
EQUIPMENT DESCRIPTION: EQUIPMENT TAG NUMBER:					
PART 2: ELECTRICAL ISOLATION – TO BE COMPLETED BY FACTORY FACILITIES ENGINEER					
The requested equipment is turned off and padlocked and is safe to work on.					
SWITCHBOARD:			COMPARTMENT REFERENCE:		
ISOLATED BY:		(Print Name)		PADLOCK NUMBERS:	
Signature		Date of Isolation		Time of Isolation	
PART 3: AUTHORISATION – TO BE COMPLETED BY FACTORY FACILITIES ENGINEER					
Additional Restrictions or Conditions Which Shall Apply:					
Name:		Signature:		Date/Time:	
PART 4: DECLARATION OF COMPLETION OF WORK BY SUBCONTRACTOR (Must be by Applicant)					
I hereby declare that the above works have been completed and that all workers under my supervision have been notified of the cancellation of this permit. All materials and tools have been accounted for and removed from the work area. Any electrical isolation previously carried out may be removed and the system switched on.					
Name:		Signature:		Date/Time:	
PART 5: EQUIPMENT RE-COMMISSIONING – TO BE COMPLETED BY FACTORY FACILITIES ENGINEER					
Name:		Signature:		Date/Time:	
Note: Original copy – to be displayed at location of work and returned to Factory Facilities Dept. upon completion of work.					
ALL THE APPROPRIATE SIGNATURES MUST BE OBTAINED BEFORE WORK STARTS.					

Figure 20.2 – Example of “Permit to Work on Electrical System” Form

Fire Protection System Shut-Down	
1. System to be shut down (please tick)	
<input type="checkbox"/> Automatic sprinklers <input type="checkbox"/> Alarm system <input type="checkbox"/> Firewater tank	<input type="checkbox"/> Fire pump(s) <input type="checkbox"/> Fire main <input type="checkbox"/> Other (e.g. CO2, Halon, etc.)
Provide details:	
Reason for shut-down:	
Area affected:	
Start time/date:	
Estimated duration:	
2. Precautions to be followed (please tick):	
<input type="checkbox"/> Use shut-off tag <input type="checkbox"/> Cease hazardous operations <input type="checkbox"/> Ban welding/cutting/hotwork <input type="checkbox"/> Notify Fire Department <input type="checkbox"/> Work to be continuous <input type="checkbox"/> Emergency connection planned	<input type="checkbox"/> Notify department heads <input type="checkbox"/> Hose/extinguishers available <input type="checkbox"/> No smoking <input type="checkbox"/> Notify alarm company <input type="checkbox"/> Additional watchman ...
3. Facilities Department Acknowledgement of Impairment:	
Name:	Date:
Attached additional comments: Yes / No	
4. System restored – time:	
System restored – time:	Date:
5. Facilities Engineer Acknowledgement of Restoration:	
Name:	Date:

Figure 20.3 – Example of a “Fire Protection System Shut-Down” Form

Fill out Section I prior to shut-down (48 hours in advance wherever possible) and forward to Facilities Department. Sign Section III upon restoration of impairment and resend.

Facilities Department to sign Section 3 when advised and Section 5 when restored.

Section 21 – Ergonomics

Sometimes called “human engineering”, Ergonomics is the study and design of jobs, work tasks, products, environments and systems in order to make them compatible with the needs, abilities and limitations of people and their bodies.

21.1 Biomechanical Risk Factors

Musculoskeletal injuries, or MSIs, are referred to by a variety of different names. They include repetitive strain injuries (RSIs), repetitive motion injuries, cumulative trauma disorders (CTDs), work-related upper limb disorders (WRULDs), and others. In each case, the name is used to describe injuries of the bones, joints, ligaments, tendons, muscles, and other soft tissues.

Although the causes of MSIs are difficult or sometimes impossible to determine, a number of risk factors have been shown to contribute to them. The following paragraphs discuss the factors that involve how the worker’s body functions during work, or what is termed the biomechanical risk factors. The remaining factors involve the workplace and the nature of the work being performed.

Three major factors involving how a worker’s body functions during work which can contribute to injuries are:

- Awkward body positions
- Excessive force (forceful exertions)
- Repetition

These factors often work in combination to affect and bring about injury in susceptible workers.



Figure 21.1 – Poor Work Position

21.2 Awkward Body Positions

21.2.1 The Problem

The key to reducing or eliminating the use of awkward body positions and work postures is to understand why they are being used in the first place. Awkward positions are often the result of the location and orientation of the object being worked on, poor workstation design, product design, tool design, or poor work habits. Several of these causes can be engineered out, eliminating the problem altogether. For example, a worker who bends over to lift objects out of large bins or cardboard boxes must assume an awkward body position. Raising and tilting the bins can easily eliminate the awkward position.

Neutral positions are those that the parts of the body naturally assume at rest, placing the least amount of stress on joints and tissues. As muscles, tendons, and ligaments move away from the central portion of their range of motion, they become stretched and vulnerable to injury. As they approach the end of their motion they become fully stretched, and further motion due to sudden movements or unexpected loads may cause tissue injury. As the angle of a joint increases or decreases past its neutral position, the amount of force that muscles acting on that joint can easily produce is reduced because they are no longer in their most favourable positions. To compensate for this mechanically-caused strength reduction, muscles try to develop more force and their tendons are placed in even greater tension. This is added stress that can lead to injury.

Less-than-optimal postures such as leaning forward from the waist for extended periods of time, or bending the neck downwards at an exaggerated angle, can load muscles with 'static work'. Static work involves muscles being tensed in fixed positions and over time, becoming tired, uncomfortable, and even painful. Production line workers who have to bend their necks and hold them in one position often experience strain in their neck and shoulder muscles. Sedentary work involving sitting or standing for long periods of time without movement can lead to pain and discomfort in the lower back.



1. No back support for awkward body position
2. Chair provides ineffective back support
3. Use of ergonomic studies to improve working posture

Figure 21.2 – Correction of Awkward Body/Sitting Positions

21.2.2 Potential Solutions

Awkward body positions and their effects can be reduced by:

- **Encouraging frequent changes of position.** This avoids becoming “locked” into one position for extended periods of time.
- **Avoiding forward and downward bending of the head and upper body.** This commonly occurs when tasks, work surfaces, or controls are too low relative to the worker’s standing or sitting position.
- **Avoiding having the arms held in a raised position,** either in front of the body or out to the sides with the elbows bent. Such positions are often the result of work surfaces or controls being too high relative to the worker’s standing or sitting position.
- **Avoiding twisted body positions.** Arrange the work and workstation so that twisting is avoided.
- **Avoiding positions that require a joint to be used for extended periods of time at the limit of its range of motion,** e.g. constant reaching behind the back can place considerable strain on the shoulder joint.
- **Providing adequate back support in all chairs or seats.** Back supports, preferably adjustable ones, improve posture, lessen fatigue, and make sitting for long periods of time more comfortable.
- **Optimising the position of arms and legs.** Ensure that the arms and legs are positioned within their most favourable range of motion when muscular force needs to be exerted.

21.3 Forceful Exertions

21.3.1 The Problem

Forceful exertions may overload muscles, tendons, and ligaments. Forceful exertions are commonly used when lifting, pushing, pulling and reaching. A packer on an assembly line for example may often use a highly forceful grip to assemble a lightweight item or lift a box or carton, especially if it is slippery or difficult to grasp. Workers who use tools such as handheld grinders for extended periods of time may be at risk of developing MSIs of the hand because of the amount of force needed to use, hold, and trigger the tools. Awkward wrist and arm positions may also contribute to the problem.



Figure 21.3 – Awkward Position in Packaging Area

Research studies have shown that work tasks should not require the worker to exert more than 30% of their maximum force for a particular muscle in a prolonged or repetitive manner. Any tasks that require the worker to exert a force in excess of 50% of a particular muscle's strength, including occasional tasks, should be avoided. The closer a loaded muscle is to its strength or range of motion limits, the greater the risk of tissue damage and injury.

For a given task, decreasing the required effort of load by as little as 10% allows a worker to perform their work at a constant level five to six times longer than if the effort or load had not been decreased. The load influences worker tiredness and discomfort much more than the length of time that the work is performed.



Figure 21.4 – Correct Position for Packing

21.3.2 Potential Solutions

High muscular forces can be reduced by:

- **Reducing the forces required to perform the task**, e.g. using mechanical aids when lifting and handling materials, using jigs, vices, and clamps rather than hands to grip parts, keeping sharp edges of tools and equipment sharp, reducing contact forces on switches and controls, lubricating and maintaining tools and equipment.
- **Distributing forces**, e.g. using a larger body part, such as the arm rather than a finger, to deliver the force.
- **Establishing better mechanical advantage**, e.g. with larger, better positioned tools, with levers, or by involving larger muscle groups.

21.4 Repetition

21.4.1 The Problem

Repetitive movements eventually wear the body down. Without sufficient time to recover between repetitions, muscles become tired and may cramp. Other muscles try to help but they may also become tired, cramp, and become injured. How quickly this happens depends on *how often* a repetitive motion is performed, *how quickly* it is performed, and for *how long* the repetitive work continues. Repetitive work is more of a problem when it is combined with awkward body positions and forceful exertions.



Figure 21.5 – Repetitive Work, with forward bending of the neck

21.4.2 Potential Solutions

Work exposure to repetitive work and its effect can be reduced through:

- **Automation of task or portions of the task.** Machines are particularly effective at performing repetitive tasks.
- **Job rotation.** This breaks up a worker's exposure to a particular repetitive movement. It is extremely important that the new task involves different movements and muscle groups.
- **Job diversity.** Training workers to perform a series of properly selected jobs rather than the same, simple one repetitively reduces monotony, boredom, and the potential for injury. Jobs with greater diversity often provide workers with a sense of accomplishment.
- **Job enrichment.** Workers are given responsibility for a wider range of duties that require a variety of skills and qualifications. As examples, these duties may include work planning, inspection activities, or customer contacts.
- **Frequent breaks.** Frequent, short breaks from work activities provide workers an opportunity to recover from their activities by stretching, changing body positions, or relaxing hard-working muscles.

21.5 Other Biomechanical Risk Factors

21.5.1 Compression and Impact Stress

Tissues can become compressed when they come into contact with the edges of workbenches, tool handles, machine corners and poorly designed seating (see Figure 21.6). Forces are concentrated on small areas of tissue, resulting in high localised pressure. This pressure can compress nerves, blood vessels, tendons and other soft tissues resulting in damage and injury.



Figure 21.6 – Cramped seating results in concentrated compression and impact stress

Using the hand, for example, as a hammer is a form of external tissue compression known as impact stress. Hand hammering can damage one of the arteries that pass through the wrist and palm, eventually affecting the function of the thumb.

21.5.2 Hand-Arm Vibration

Hand-arm vibration is vibration transmitted to the arms through the hands. It can damage both the small blood vessels and small nerves of the fingers, resulting in two specific injuries: vibration-induced white finger and vibratory neuropathy. Together, these injuries are known as the hand-arm vibration syndrome (HAVS) and result in numbness, loss of finger coordination and dexterity, clumsiness and an inability to perform fine motor tasks. Blanching or loss of colour in the skin usually starts at the tips of the fingers but progresses as exposure time increases. The most important sources of vibration due to tools include grinders and drills. In footwear factories, for example, special attention should be given to mid-sole and upper roughing.

Section 22 – Ventilation Design

Adequate ventilation of the factory environment is essential for: (1) the control of air quality and the removal of air contaminants that are emitted from production processes, and (2) the maintenance of acceptable thermal conditions for occupants and equipment. Ventilation plays an important role in worker health and comfort, and also may have an impact on product quality and the efficient operation of factory equipment.

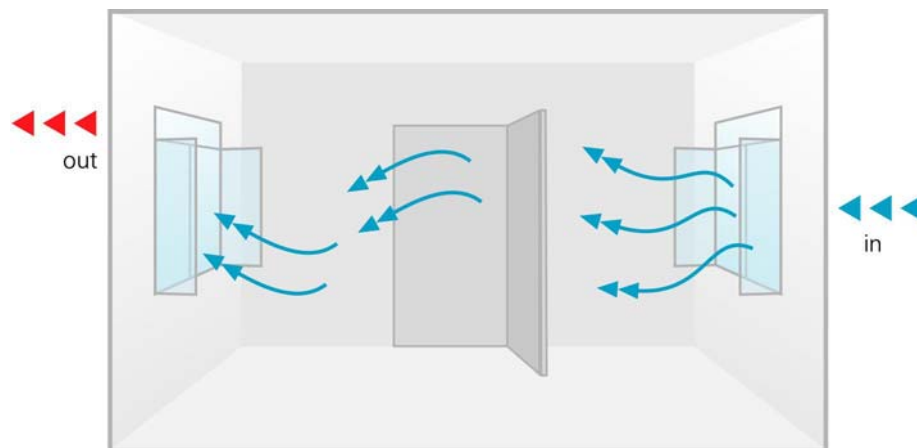


Figure 22.1 – Use of Natural Ventilation

To achieve these two objectives, most factories rely both on natural ventilation (e.g. windows, doors; see Figure 22.1) and mechanical ventilation (a variety of fan systems). Each type of ventilation offers its own advantages and disadvantages. For example, reliance on natural ventilation tends to provide an uneven distribution of dilution air, with obviously more dilution occurring closer to the periphery of the building where the windows and doors are located. However, variability in temperature is more likely at the periphery, with relatively more stable thermal conditions in the center of the factory area somewhat distant from windows and doors.

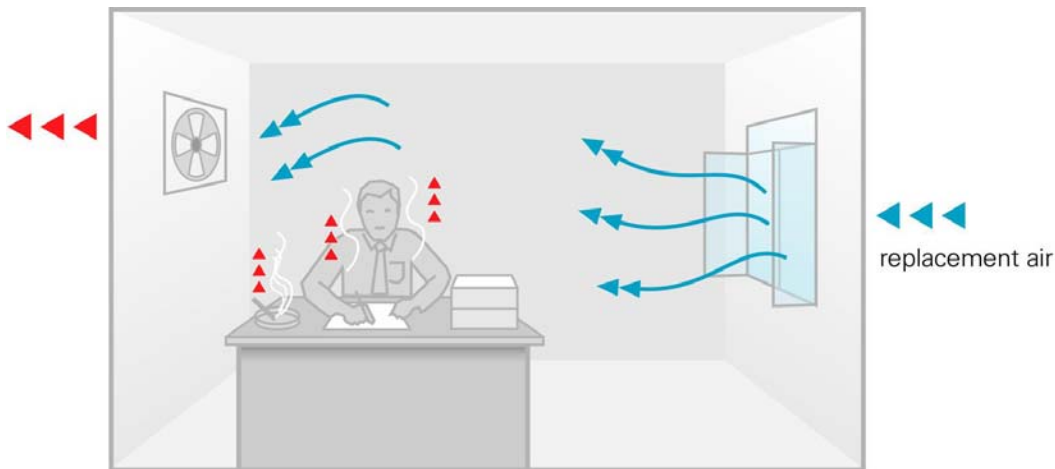


Figure 22.2 – Use of Exhaust Type Mechanical Ventilation

There are two general types of mechanical ventilation: supply and exhaust. Since supply air systems, such as air conditioners, are commonly used in the production areas of most factories, this section of the H&S Guidelines focuses on exhaust air systems; that is, mechanical systems that remove air from the factory environment. In addition to exhaust systems, most factories have installed circulating fans. Fans facilitate mixing and dilution of air contaminants and may have an impact on the thermal comfort of workers.

22.1 Guidelines on Ventilation

<ul style="list-style-type: none"> • Appropriate ventilation should be provided in locations where chemicals are stored, mixed and used; equipment should be explosion-proof if necessary. • Fan blades should be protected by grids (maximum grid size of 12 mm diameter). • Dust extraction systems should be installed at operations associated with substantial dust generation. 	<ul style="list-style-type: none"> • Local exhaust ventilation systems for dust or solvent vapours should be separate from each other and equipped with explosion-proof fans and motors. • There should be regular cleaning of fans and ductwork of ventilation systems.
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The two principal types of exhaust ventilation systems are known as general exhaust ventilation (GEV) and local exhaust ventilation (LEV). LEV systems are those that are designed to capture air contaminants at, or near, their source. Common examples in factories are canopy hoods, spray booths, downdraft ventilated work benches and hoods at grinding or buffing operations. The passive venting of drying ovens into exhaust ductwork also may be considered an LEV system. The effectiveness of LEV systems depends to a great extent on their proper design and operation, and factories should rely on qualified mechanical engineering contractors to do the design and installation of such systems rather than attempt this work on their own.

Even with proper design and operation of LEV systems, there are at least three other factors that may impact the effectiveness of these systems:

1. Proper maintenance procedures should be established and should include regular inspection, cleaning and repair, if warranted. This should encompass the entire LEV system, from the collecting hood, through the ductwork, to the fan and motor, and the discharge outlet. Lack of proper maintenance can reduce the effectiveness of LEV systems, particularly those involved in dust collection where the captured dust may settle in the ductwork.
2. Conflicting airflow patterns caused by other types of ventilation may reduce the effectiveness of LEV systems. The primary example of this situation is the strong airflow past canopy hoods that is often created by circulating fans in the aisles of production areas. While the air currents from the circulating fans may provide thermal comfort to the workers, they also reduce the effectiveness of the canopy hoods in capturing solvent vapours from the work operations.
3. Lack of instruction of the workers who work at LEV systems may also reduce their effectiveness. Workers should know how these systems should work in capturing air contaminants, so that they are more likely to employ work practices that are consistent with the protection of their health. For example, workers should know to apply chemicals under, and not outside, the edge of a canopy hood.

A variety of GEV systems may be present in factories. Examples include window exhaust fans, ceiling exhaust fans, and ducted systems with vents that pull air from the general factory environment. These systems also discharge air contaminants outside the factory, but they rely more on dilution, rather than efficient capture, to achieve acceptable air quality. Because of this, GEV systems must remove larger quantities of air than LEV systems in order to keep worker exposure below acceptable limits.

With both LEV and GEV systems, care must be taken to prevent the re-entry of the air contaminants being handled by the systems. For LEV systems, the discharge point for the air should be at a substantial distance from open windows or doors. Generally, a roof location for these stacks is preferable. GEV systems should not be located near similar mechanical systems in windows or at the ceiling that supply air to the factory interior.

APPENDIX: Glossary of Terms

Glossary of Terms	
AOX	Adsorbable Halogenated Organic Compounds. Considered to be an important consented discharge parameter for water treatment effluents. The AOX concentration is a routinely monitored parameter. A measurement often used in waste water testing to indicate the overall level of the halogens fluorine, chlorine, bromine and iodine.
CAS Number	The Chemical Abstracts Service number is an identification number which is used to undoubtedly identify a chemical compound.
COD	Chemical Oxygen Demand. A parameter used to determine the amount of organic chemicals in water, independent of their chemical nature. COD provides no information concerning the toxicity of waste water.
CPR	Cardiopulmonary Resuscitation. An emergency medical procedure for a victim of cardiac arrest or, in some circumstances, respiratory arrest.
CSDS	Chemical Safety Data Sheet. Provides information on the use and handling of chemicals. These should be written in simple language easily understandable for workers and should be posted conspicuously at locations where the relevant chemicals are stored or used.
CTD	Cumulative trauma disorders
dB(A)	Decibel Rating on A-Scale. When the "A weighting filter" is used to measure sound, the sound pressure level is given in units of dB(A) or dBA. Frequency levels are taken into account. The dB(A) scale is not linear but logarithmic. An increase of only 3 dB(A) doubles the hazard of hearing damage.
dB(C)	Decibel Rating on C-Scale. When the "C weighting filter" is used to measure sound, the sound pressure level is given in units of dB(C) or dBC. It is used to measure the Noise Reduction Rating (NRR).
EF	Exposure Fraction. This is used to evaluate worker exposure to multiple chemicals. The EF value is an index of exposure which is calculated from a worker's measured exposure to a variety of chemicals and the individual TLVs for those chemicals to which he/she was exposed.
EMS	Environmental Management System
EPA	Environmental Protection Agency
Ergonomics	Ergonomics is the study and design of jobs, work tasks, products, environments and systems in order to make them compatible with the needs, abilities and limitations of people and their bodies.
GEV	General Exhaust Ventilation
H&S	Health & Safety
HAVS	Hand-arm vibration syndrome
Hazardous Chemicals	These are chemicals which are toxic, flammable, explosive, harmful, irritating or damaging to the environment. Hazardous chemicals have to be indicated with a hazard symbol.
HP	Hearing Protection
LEV	Local Exhaust Ventilation

Glossary of Terms	
LO/TO	Lockout/Tagout. This is a safety procedure which is used in industry and research settings to ensure that dangerous machines are properly shut off and not started up again prior to the completion of maintenance or servicing work. It requires that hazardous power sources be "isolated and rendered inoperative" before any repair procedure is started.
Lux	Measurement to express the intensity of light. An intensity of 1 lux is given if a light current of 1 lumen (lm) illuminates a surface of 1 m ² (1 lux = 1 lm/m ²). The expression foot candle is defined as 1 lm per square foot (1 foot candle = 1 lm/sq ft).
MSDS	Material Safety Data Sheet. Provides comprehensive physical, chemical, medical and ecological data for chemicals. MSDSs are provided by the supplier of the chemicals.
NRR	Noise Reduction Rating. A numerical rating in decibels of the protection, or attenuation of sound that is provided by various types of hearing protectors under ideal circumstance of use.
Occupational Exposure	A measure of the intensity and/or extent to which the human body experiences a particular hazard such as hazardous chemicals, dust, noise, etc.
Ozone	Ozone is a molecule made of 3 oxygen atoms. In the air around us it is toxic, but in higher layers of the atmosphere it acts as a protection shield against hard UV radiation. Without the ozone layer, hard UV radiation of the sun would reach the earth's surface with life threatening results.
Ozone Depletion	This is an effect which is initialised by pollution of the atmosphere. Especially organic halogen compounds like halon 1211 have very high ozone depletion potential. With increasing depletion of the ozone layer an increase of mutations and cancer is observed.
PPE	Personal Protective Equipment. Examples for PPE are goggles, face masks, gloves, ear plugs etc.
RMB	Renminbi. Chinese currency unit
RSI	Repetitive strain injuries
SEA	Social & Environmental Affairs Department of the adidas Group
TLV	Threshold Limit Value. An occupational exposure value which nearly all workers can be exposed to day after day for a working lifetime without ill effect.
VOC	Volatile Organic Compounds. Solvents that can cause breathing and health problems. VOCs are by-products of the shoe manufacturing process.
Waste	Official definition of waste: <i>Waste is any unavoidable material resulting from an industrial operation for which there is no economic demand and which must be disposed of.</i> This definition, however, does not sufficiently consider the economic effects as driving force in waste management. Therefore we recommend use of the following definition: <i>Waste is purchased raw material that is treated with energy and water, processed by employees and subsequently not sold as product.</i>
WRULD	Work-related upper limb disorders