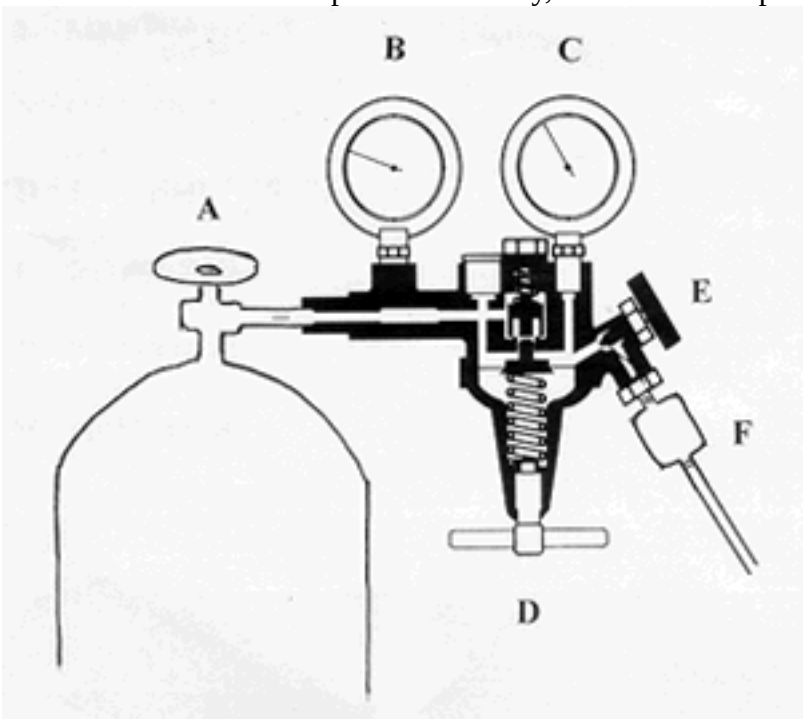
## Pressure bottles/gas cylinders

The workshop manages the delivery of pressure bottles. They also mount the manometer and make sure that the pressure bottle is secured with a chain. It is prohibited to mount manometers yourself.

Premises in which pressure bottles are used must for the sake of the fire services be marked with a sign that reads: In case of fire remove pressurized cylinders.


When the manometer is operated correctly, it is safe to use pressurized gas.




Manometer

## To open:

- Check that the regulation valve D has been relieved, i.e. turned off, so that it is loose and that the needle valve E is closed.
- Open the main tap A
- The bottle's pressure is now visible at manometer B
- Slowly turn the regulation valve D on, so that the desired pressure appears on manometer C
- Open the needle valve E

## To close:

- Turn off the main tap A
- Loosen the regulation valve D
- When both manometers is at 0, the needle valve E is closed

## Drawing of liquid nitrogen

The first time you draw liquid nitrogen, it happens under supervision from the responsible laboratory technician. Forwards, you are allowed to perform the procedure in consideration of the following guidelines.

1. Wear protective glasses/protective face screen and gloves
2. Check that the safety valve on the nitrogen container has been loosened
3. Open the black tap on the tupe of the nitrogen container
4. The tube from the pressure bottle is connected to the nitrogen container
5. A dewar vessel is placed under the tap
6. The pressure bottle is opened, as described in the section about pressure bottles

- Draw off the appropriate amount and close in reverse order

Liquid nitrogen is stored in a specially prepared tank, from which you can pour directly.

**Sonicator (ultrasound)**

May only be used in a "soundproof" room using earplugs.

## Electrical safety in laboratories

**Denmark has one of the world's most safe and stable electric systems.**

Have you ever heard of people in Denmark, who have died from electric shock from the electricity network?

The reason is our legislation - the Heavy Current Regulation, which in details describes how all electrical installations are to be built and who are allowed to do it! All permanent installations must for example be mounted by an electrician and approved by a licensed electrician.

If everyone is going to sustain the confidence in the safety measures, it is particularly important that we, in a workplace where research placings are built by the staff, manage to provide information for **everyone** about electricity safety. The placing must be approved by the WE- group.

## How dangerous is it?

The electric current can directly impact the human body. If the body is intact and healthy, transitory currents have to exceed 30 mA in order to be life-threatening (the RCCB normally disconnects if the fault current exceeds 30 mA).

The **electric current** can directly impact the human body in three ways:

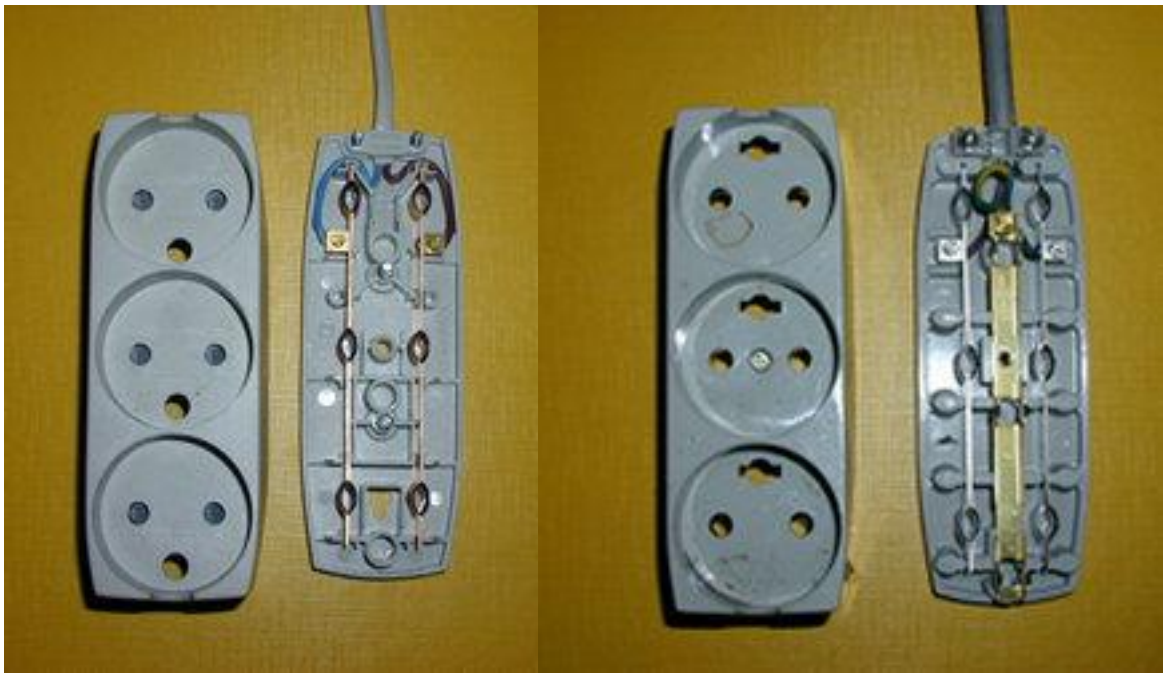
1. **Stimulation**- An alternating current can stimulate muscles and nerves. The impact of the stimulation varies from a small tickling to serious convulsion. It may be life threatening if the current passes the chest area. It may cause ventricular fillibration (insufficient heart function), which can continue to occur after the current is broken, but it may also cause a paralysis of the respiration musculature.
2. **Burns**- A direct or alternating current can, depending on size, frequency and duration, cause burns of different degrees.
3. **Galvanic influence**- Direct current can cause galvanic influence. Even a small direct current through a surface electrode (EKG electrode) can cause electrochemical cauterization of the skin.

**The impact of the current**
The table shows the effects of different current levels on the body (intact skin surface): Is valid for a healthy adult person of above 50 kilos and 50Hz alternating current!

| | |
|---|---|
| 100 uA | A tickling on the tongue is felt (low resistance in the mucosa), but not from hand to hand. |
| 1 mA | A tickling is felt from hand to hand. |
| 2-10 mA | Unpleasant pain, muscle contractions. |
| 16 mA | The ability to let go of a conducter ceases. |
| 25-100 mA | Pain, fainting, respiration stop. |
| 100 mA - 3A | Ventricular fibrillation, heat damages. |
| over 3A | Lasting myocardial contractions replaced by normal rhythm (used in connection with defibrillation). Tissus damage because of heating. |

## Power strips
In order to overcome the lack of power outlets, power strips (with three outlets) are often used. Be aware of **power strips without earth.**

**Powes strips without earth, in which plugs with earth can be inserted, must not be applied at IMB.**



**Power strip without earth** **Power strip with earth**

## Facts about electric safety:

The following items are a short summary of the lecture: "Electric safety in laboratories".

| | |
|---|---|
| Low current | Alternating voltage less than 24V and direct voltage of less than 50V are described as low current. Are not included by the heavy current regulations and are considered fairly safe at ordinary skin contact |
| Power current | Tensions over 24V alternating voltage or 50V direct voltage are described as power current which again is divided into low voltage (<380V) and high voltage (>380V). Power current can induce dangerous situations. |
| Responsibility | Supply and safety up until the consumer: The electric company. The wiring system and the further installations from here: The consumer you or (the employer). |
| What can I do? | You are only allowed to work on and repair things outside the power outlet, i.e. all connections. |
| What can I not do? | Everything that has to do with the permanent installation must as a principal rule only be installed or repaired by a licensed electrician. |
| How dangerous is it? | The electric current can directly impact the human body. If the body is intact and healthy, transitory currents have to exceed 30 mA in order to be life-threatening (the RCCB normally disconnects at 30 mA). |
| Earth cable | In order to lead away possible leaking electricity from the device, the conducting part is earthed. |
| Fuses | To protect the firm installation (W = I2* R.) against excessive heat generation, or as a safeguarding of devices. |
| RCCB [HFI] | Breaks the current if there is leaking current. (Remember to “exercise” the RCCB once a year). |
| Plug | Lack of earth. Defective relief. A plug dropped into salty water. |
| Power strips | Three-wall sockets without earth connection. Outdoor connectors. |
| Fire hazards | Wrong fuses, wrong de-insulating, halogen bulbs/heater close to inflammable material, covering of ventilation |
| Electrophoresis | Danger at high voltage, the power supply must break when the lid is opened. |

## RCCB

An RCCB is normally placed before the ordinary fuses. Its purpose is to break off the current if more than 30 mA of the current that is sent out happen to find other return routes (e.g. through a human being to earth). If the conducting surface of a device is earthed through the earth prong in the socket, any possible fault current will immediately activate the RCCB switch.

Remember that a RCCB must "exercise" at least once a year by pressing the test button which artificially conducts a current of 30 mA around the relay. If it does not break, a licensed electrician must be sent for.


## Earth cable

Electric equipment with a cladding of a conductive material may **in case of equipment errors** conduct current from the cladding (the cupboard) through a person who touches the conductive surface. In order to lead away this leaking current **the conductive part must be earthed**.

Without earth

With earth

Many devices use safety condensers from power grids to the earth connection in order to protect the device against impulse noise from the power grid. As a condenser conducts alternating voltage, there will be 110V on frames on a device with no earth connection.

These devices are often sold with an restriction (**as prescribed they must be earthed**). However they are often delivered with a plug without connection to the Danish electricity net's earth connection

It is not dangerous, as the current has been limited to <10 mA, but according to the table it can cause unpleasant pain and muscle contractions. This can lead to dangerous situations (unwillingly you might knock over resolutions etc).

# Depending on the power outlet - own responsibility

## What can I not do?

Everything that has to do with permanent installations must as a principal rule only be installed and repaired by a licensed electrician.

## Fuses

Are applied in order to protect against surplus heat generation in the permanent installation (W =I2* R) or as a safeguarding of devices.

**Never replace the fuse to higher number of amperes than prescribed.** (There is always a reason for a fuse to blow).


## Plugs

Devices are often sold with a restriction **(as prescribed they must be earthed)**. However they are often delivered with a plug without connection to the Danish electricity net's earth connection (2 prongs).

If it is a requirement that a device is earthed, **this** type of plug (3 prongs) must be mounted.

If a two prong plug is already mounted, **it needs to be replaced** in the electronics workshop. Under certain circumstances, it can be dangerous to use the device!

When removing a plug from the power outlet, pull the plug, not the wire.

## Low current

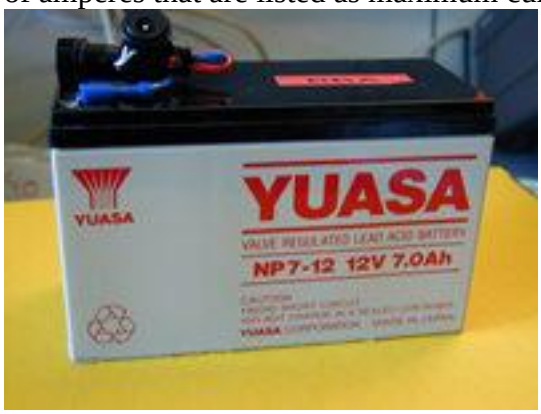
Alternating voltage less than 24V and direct voltage less than 50V are described as low current, are not included by the Heavy Current Regulation and are considered fairly safe with ordinary skin contact.

**Alternating voltage** is typically used in a power grid adapter that functions as an external power supply for e.g. a Walkman.

**Direct voltage** is applied in batteries, but many net adapters also release direct voltage. Here the voltage is at a safe level.

**Accumulators**

When using accumulators be aware of the allowed maximal current. A gel accumulator may explode if the maximum current is exceeded. In this case a gel with components of accumulator acid is sprayed over the whole area. A method to avoid this is to install **a safeguard** on the number of amperes that are listed as maximum current.




### Eye wash bottles or eye rinsers located directly on faucets:

Must be located at every laboratory washbasin. The eye wash bottle is a disposable bottle with a sterile sodium chloride resolution 0.9 %. Because of bacteria risk in a used bottle it must be discarded, even though you do not use all of it. A new bottle is available from the WE-representative, and the person who has used the eye wash bottle is responsible for replacing it.

Remember to regularly check expiry date!!

In case of acids or bases in the eyes, rinse thoroughly with 0.9 % sodium chloride resolution. In case of acid corrosion, a scab is created which will protect the tissue so that the cauterization does not deepen. Base corrosions are more critical. A base corrosion does not create wounds, but water-soluble products that cause the cauterization to continue and deepen. If the rinsing does not continue for a very long time, there is a risk that the cornea is damaged.

**First aid kits**


First aid kits contain:

For minor damages: disinfection napkins, band aid roll, small compress dressing, band aids, fingertip band aids and dederon bandage.

For larger damages: Arm bandage, large compress dressing, tweezers, alu carpet, gauze compresses, scissors, disposable gloves and first aid leaflet

The first aid kits are located:

| | |
|---|---|
| Anatomy and Neurobiology: | Above the wash basin in STUDENT LAB (room 0.51A) |
| Immunology and Microbiology: | In the "pigeon hole" in the corridor |
| Physiology and Pharmacology: | At the secretariat |

The first aid kits are also located in the sections in WP25. More information is described in the local supplements to KIROS:

It is the WE-representative who takes care refilling the boxes. If you notice that it is time for refilling, please pass the information.

**Emergency showers**

Emergency showers are places in the corridors. They are regularly controlled by the WE-representative who is thereby responsible for their function.

In case of a person fire, the most effective extinction method is to place the person on fire under the shower and let him stay there until the ambulance arrives. In the case of corrosion accidents, it is also important to rinse thoroughly and for a long time. Especially in connection with base corrosions it is important to continue rinsing for a long time.

## Power strip cover

Placings with electricity in wet rooms call for screening of plugs and wall sockets. Your WE- representative has red power strip covers for the purpose. It is strictly prohibited not to use the covers, see the section about electric safety.

## In case of spillage

If you happen to shatter a bottle of toxic chemicals on the floor, start to evacuate the laboratory and cordon it off, call assistance to keep guard and fetch a WE-representative. It is then estimated how the gathering and cleaning is to be conducted. If it is estimate that we can manage the cleaning ourselves, breathing protections and Chemsorb pillow/granulat are fetched from the emergency stock.

Two people (dressed in breathing protection, gloves and laboratory coats) always perform the clean-up. Make sure to bring the necessary tools and waste containers. At the same time, make sure that someone is present outside the room to raise the alarm in case the cleaning team becomes ill.

Place the pillow onto the pool of chemical and wait until the liquid has been absorbed. Each pillow absorbs about 2 l., depending on the viscosity of the liquid. Otherwise, follow the instructions on the emergency stock.

## Face-/eye protection

Protective glasses must in principle be used at all laboratory work. It can seem unnecessary, but protective glasses must as a minimum be worn when working with:

- Corrosive liquids, with risk of squirts or sprays.
- Health hazardous radiation, e.g. UV-light and radiation.
- Mechanical subjects with risk of getting e.g. glass splinters in the eye.

It is not advisable to wear contact lenses when working in a chemical laboratory. Corrosives will gather around the contact lens and worsen the cauterization, in spite of quick rinsing.

IMB has several hard plastic protective glasses. If you wear ordinary glasses, they can often replace protective glasses.

It can be discussed whether protective glasses are sufficient. If there is a risk of getting squirts in the eyes, the risk of squirts in the face is also present. Therefore, instead of protective glasses you can choose to use a face shield. You can also choose to move your placing into a fume cupboard, and thus avoid protective gear.

Protective glasses

## Filter half mask respirator

There are many factors to consider before having ensured the correct protection. Before usage a representative from the WE-group must therefore always be contacted. The filters have limited durability, limited protection level and different limitations have been specified for each filter type.

The protection level indicates the filter's ability to reduce the concentration of a substance. You therefore also need to know the limits for substance concentration.

Classification of filters: Use the colour code (8 different), class (3), and classification number (EN number).

Filter half-mask respirators are worn at IMB in connection with fixation of lab animals and in case of animal allergies.

## Gloves

Gloves can offer a good protection if they are used correctly, and on the other hand they may be a false safety if used incorrectly.

**Correct use of gloves**

Implies that you carefully consider the situation. Dispose the gloves if they come into contact with chemicals. Change gloves often for the sake of the hand hygiene, and remove the gloves before you answer the phone, open a door, or use a pencil.

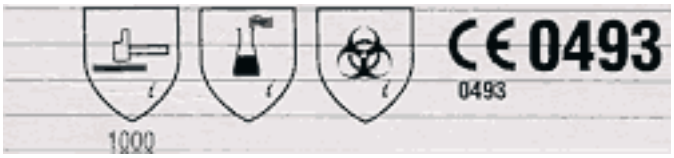
**Choice of gloves**

Choice of the correct type of gloves for the purpose is the first requisite for optimal protection.

The glove's resistance against the chemical or the mixture you wish to protect against is crucial for the choice of glove. In this context, be aware that mixtures often behave differently than clean chemicals. The glove's resistance is often indicated in breakthrough time.

The breakthrough time indicates the number of minutes it takes for a chemical, in the lowest measurable concentration, to break through the glove material. Information about what the glove has been tested for and its resistant time against a given chemical is available from the supplier and on their homepages. E.g. at web the address:www.ansell.dk

One should only buy gloves, which have been tested according to the European standards for protection gloves. On the box you can e.g. read the following specifications:




The CE marking is a guarantee that the European standards have been observed. 0493 is the ID number of the independent control institute that has tested the glove. The pictograms indicate that the glove has been tested for chemical resistance and microorganisms respectively.

It is impossible to say that certain types of gloves are suitable to work with certain material groups or chemicals. Therefore you are in each single case obliged to acquire information about how the chemical reacts with the glove, before choosing a glove.

As mentioned the information is available from the glove manufacturer or in the supplier manual for the chemical. If you are in doubt, you can address the WE-representative who may be able to acquire additional information about gloves and chemicals in different databases.

But remember! All gloves are so dense that the moisture from the hand stays in the glove. This leads to a softening of the skin and reduces its natural barrier characteristics. Moisture in the glove, plus possible powder, plus possible glove materials (see the latex- glove) quickly constitute a poor environment for the hand, which is why we recommend to put on a cotton glove underneath the disposable glove when a task lasts for a long time.

The problem with remains of latex proteins in latex gloves has been well-known for many years. The manufacturers continually improve their products. Therefore you can now get extra, extra pre-rinsed latex gloves. New information about different gloves' breakthrough time is continually updated.

Minimize contact between gloves and chemicals. And only wear only disposable gloves. They need to be changed, if they are contaminated. Therefore, considerations about which type of glove you need are only crucial with particularly hazardous and reactive substances. Disposable gloves protect against squirts. If necessary, perform a test.

## Glove types

At IMB we have several types of chemical gloves that normally meet the demands.


**Conform +**
Is a latex glove that is available with or without powder. Latex gloves have been produced by natural rubber, which has the unfortunate characteristic to contain small quantities of protein (most often denoted latex protein). Remains of latex protein, as well as accelerators (often Thiuram) from the vulcanization process remains in the glove. It can cause eczema, so-called latex allergy. Latex allergy is a persistently rising problem, which must be taken seriously.

Latex gloves without powder are chlorinated in order to ease application and removal. As a bonus the treatment cleanses the glove of surplus protein and accelerators. It is therefore recommended to use un-powdered gloves if you have tendency for eczema.

The suppliers also acknowledge the problems with the different types of gloves, e.g. above mentioned allergy risk, and continuing product improvements are seen.

Latex gloves are easily broken through by organic solvents, but it has good stability towards ketones, acids and bases. Latex gloves can be worn as protection against squirts from chemical resolutions and powder chemicals.

**Vinyl**
The vinyl glove has been produced by PVC plastic, which does not have a particularly good chemical resistance. The glove can however be worn for the handling of acids and bases, oils, fats and powder chemicals. The glove is also very suitable for the handling of laboratory animals.

**TNT Blue**
Or the Touch 'n Tuffs, as they are also called, have been produced by 100 % nitril and are as far as is generally known free from additives. TNT Blue has a good grip and a good, however limited chemical resistance.

**Barrier**
The Barrier glove is a multi-layer-glove, which has been built up by Polyethylene and nylon. The glove is the replacement for the less comfortable 4H glove, and it is specifically ergonomics and comfort that has been improved. However, it is still inept but can be used with a latex glove on the outside in order to get better finger contact. The Barrier glove has a chemical resistance, which is not seen with other gloves.

## Earmuffs
Every year 2-3000 hearing damages are reported to the National Board of Industrial Injuries. That makes hearing damages the second most frequently reported work-related condition in Denmark. Hearing damages are irreversible, which in itself is a reason to take care.

Be aware that a hearing damage can arise in more than one way. Intense transitory impulses can, as well as continuous noise, result in a hearing damage.

There are no set limits as to when noise is disturbing. On the other hand there are guidelines for maximum noise levels. Whether noise is disturbing or not is best estimated by the one who works in it, and it is up to you to point out, if you have problems.

Noise can be softened and therefore the use of earmuffs is absolutely temporary solution. If it is not possible to limit the noise by casing or screening, you must wear earplugs or earmuffs. When working with ultrasound it is required to use earplugs.

At IMB earmuffs must be located at apparatus that uses ultrasound.

## Laboratory coats

It is always advised to wear a lab coat, when you are in laboratories. The lab coat protects your own clothes, and it is easy to change if you spill something.

If you work with chemicals that are classified, you must wear a lab coat.

Lab coats of polyester are less susceptible to influence of chemicals than cotton lab coats. But cotton lab coats do not melt and do not burn onto the skin, which polyester lab coats can do. You have to choose which lab coat you will use.

Lab coats, which are worn while working with isotopes, must only be used for this work, after which they have to be washed. If lab coats are contaminated they must be treated according to rules for waste.

Lab coats, which are worn in gene technological laboratories, must go into yellow laundry bags according to the directions.
Alternatively use disposable coats, which are combusted after use.

## Dust mask

Does not protect against gases and fumes, but some types have been approved for protection against aerosols. Some types of dust masks have been supplied with a valve, which lowers the expiration resistance and offers greater comfort. When working with laboratory animals, it is the researcher's own responsibility to estimate whether to wear a mask or not. A leaflet is available at the Biomedical Laboratory.

When choosing a dust mask you must consider what it has been approved for.

Approval takes place in three classes:

Class P1 (low effect)
Protects against dust to a limited extent. The filter must not be used, if the threshold limit value for the polluting material is under 5 $mg/m^3$.

Class P2 (average effect)
Protects against health hazardous and toxic dust, but not against radioactive dust, bacteria and virus. Some class P2 filters protect against aerosols.

Class P3 (high effect)
Protects like P2, as well as against radioactive dust, bacteria and virus. The mask can be used for both solid particles and liquid aerosols.

The protection factors of particle filters for filter face masks FFP1 and FFP2 corresponds to protection factors for half masks class P1 and P2. Only P3 filters have an indicated protection factor at 50.

**Anatomy and Neurobiology:** has personal dust masks
**Immunology and Microbiology:** has an older dust mask in the weighing room
**Physiology and Pharmacology:** has P1 and P2 dust masks in the chemical room

On the sections in WP25 dust masks are also located. More information is described in the local supplements to KIROS:

## Respirator

Use of respirators is a temporary solution. May not replace working in a fume cupboard.

Respirators only protect the user if the correct one is applied, it has been correctly maintained and is used properly.

Respirators and units, which are crucial for the protective function must be CE marked. The mark is always followed by a registration number for the independent testing institute that is responsible for the continuous check-up of the protection gear.

Surgical mask

Dust mask

Filter half mask

## Screen work

In 1999, in Denmark 12,635 incidents of work-related conditions were reported. A little more than 50 % of them were problems in the motor system. 4380 of these cases were repudiated by the National Board of Industrial Injuries.

From 1994 to 1999 there has been a significant rise in the number of reported work-related conditions within the office sector.

In connection with the first round of workplace assessments, the department's screen work places were estimated to be alright. Most employees, who sit by the computer every day, are aware of body signals, and many have already taken the initiatives to improve their screen workplaces.

So in spite of the above mentioned figures from Danish Working Environment Authority, the safety group concludes that the working conditions concerning ergonomics at IMB are alright.

## Good advice about screen work

Screen workplaces, at which the employee works for at least 2 hours a day, must meet the demands of the EU's directive for screen work. If you translate the directive, you need to consider the below mentioned when arranging your screen workplace:

The screen workplace has to be flexibly arranged. That means tables and chairs have to be height adjustable and adjustable to the employee's different tasks/work positions. Thighs and chair seat must be parallel, while the whole sole of the foot touches the floor.

The screen should be placed 50-70 cm from the eyes, and the top text line is to be 15 cm below eye level. Choose a dark text on light background.

The daily screen work should regularly be interrupted by other work, or by breaks.

The employee is entitled to an examination of eyes and vision, as well as free screen glasses, if the examination finds it necessary.

There has to be free space next to the keyboard for documents and the computer mouse. Moreover there has to be room to rest hands and arms on the table top. When using the mouse, the whole forearm has to be supported by the table top, and the upper arm has to be able to hang down along the body.

The workplace needs to be placed appropriately with regard to lamps and daylight in order to avoid inconvenient reflexes.

## More information

There exists a lot of information material about screen workplaces, work with mouse, arrangement of office workplaces and Monotonous Repetitive Work (DK: EGA) at both offices and in laboratories. Ask your safety representative, if you need good advice.

The safety representative can also facilitate contact to the faculty's physiotherapist, who can examine your work routines in order to help you to better ergonomic habits.

## Also visit the following web page: www.museskade.dk

## Alarm

All of the fume cupboards at IMB have been supplied with an alarm arrangement, which trigger a visual/acoustic alarm, if the exhaust device does not function satisfactory.

The control-arrangement measures the pressure difference between the outlet channel and the laboratory. If the difference in pressure becomes less than the pre-set values for the fume cupboard, the alarm is activated.

Be aware that the alarm is activated, when the battery is flat. Batteries for the alarms must be replaced by an electrician.

## Work in a fume cupboard

Polluted air is most effectively exhausted, when the source of pollution is placed at the back wall.

Shelves and large placings create turbulence.

The user cannot avoid influencing the air current. Work in quiet movements in order to avoid drawing pollution out of the fume cupboard.

## Fume cupboard requirements

The air speed in a fume cupboard must be sufficiently high to remove pollution from the cupboard, and at the same time the speed must not create turbulence, which draws polluted air from the fume cupboard.

The Danish Working Environment Authority recommends that the air speed in the opening of the fume cupboard is 0.5 m/s when the opening is equivalent to 40-50 cm.

This adjustment causes problems in case of smaller opening as the air speed will rise. This can lead to turbulence. It has been tried to solve the problem by constructing fume cupboard with so-called step less regulation. With these, the air speed in the opening is steady, regardless of the height of the

hatch. Some of IMB's fume cupboards already have step less regulation and new fume cupboards **have to** be installed with this kind of variable air flow

An annual trace gas measurement is conducted in fume cupboard. Results can be seen on http://fiteq.dk/

## The construction of process ventilation systems

The process ventilation eliminates local pollution, e.g. from a fume cupboard or a fume hood, and the air that is extracted is replaced by fresh air from the ventilation. In laboratories it is common to create a minor vacuum by regulating the injection, so that it is slightly less in quantity than the extracted air. A small vacuum will prevent polluted air from spreading to the surroundings. The opposite principle is utilized in e.g. sterile laboratories.

Fume cupboard

Fume hood

The operation of the University's fume cupboards is controlled from a general CTS installation (Central Tilstandskontrol and Styringsanlæg). Therefore a stoppage or other changes of the process exhaustion are reported from the Buildings Department through the WE-groups to the users.

## Flow benches

Are located several place on all floors.
The benches are used for sterile work and must be cleaned after use (70 % ethanol).
Handling and use of flow benches depend on the different functions. You will be informed before usage.