Ergonomics for the Prevention of Musculoskeletal Disorders

Provisions and General Recommendations of the Swedish Work Environment Authority on Ergonomics for the Prevention of Musculoskeletal Disorders

ISBN 978-91-7930-565-9
ISSN 1650-3163

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Translation
In the event of disagreement concerning the interpretation and content of this text, the printed Swedish version shall have priority.

Provisions and general recommendations adopted by the Swedish Work Environment Authority are published in the Swedish Work Environment Authority's Statute Book (AFS).

Provisions are binding rules. General recommendations have a legal status different from that of provisions. General recommendations are not binding but contain recommendations on the implementation of the provisions which state how someone can or should act in a certain respect. They may, for example, inform on appropriate ways of fulfilling the requirements and point to practical solutions.

Please note that references to statutes always give the original number of the document concerned, regardless of any subsequent amendments and reprints.

Concerning amendments to and reprints of Provisions of the Swedish National Board of Occupational Safety and Health and of the Swedish Work Environment Authority, reference is made to the latest Statute Book Register of provisions and general recommendations.

Publisher: Anna Middelman

Elanders Sverige AB, 2011 364302

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AFS 2012:2
Published on
1 June 2012

Provisions and General Recommendations of the Swedish Work Environment Authority on Ergonomics for the Prevention of Musculoskeletal Disorders;

adopted 22 May 2012.

The Swedish Work Environment Authority issued the following pursuant to Section 18 of the Work Environment Ordinance (1977:1166) and establishes the following general recommendations.

Purpose

Section 1 The purpose of these provisions on ergonomics for the prevention of musculoskeletal disorders is to order and design workplaces and tasks so as to prevent risks of health-endangering or unnecessarily fatiguing loads.

Scope

Section 2 The provisions apply to every activity in which employees may be subjected to loads or other conditions in their work that may directly or indirectly have an adverse effect on the musculoskeletal system and vocal cords.

The employer is responsible for compliance with the provisions. Chapters 1 and 3 of the Work Environment Act (1977:1160) contain stipulations regarding certain obligations of persons other than employers. Where applicable, these provisions shall also apply to these persons.

Chapter 1 of the Work Environment Act states that the Act is in certain cases also applied to persons other than employees. Where applicable, these provisions shall also apply to these persons.

[1] Cf. Council Directive 90/269/EEC of 29 May 1990 on the minimum health and safety requirements for the manual handling of loads where there is a risk particularly of back

injury to workers (fourth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC) OJ L
156, 21.6.1990, p. 9, Celex 31990L0269).

Definitions

Section 3 These provisions use the following definitions:

Musculoskeletal disorders	Disorders of the musculoskeletal system, i.e. all forms of ill-health in the musculoskeletal system that may be connected with working conditions. The disorders may have been caused by the work or something else, but are aggravated by the work. The term includes everything from mild, temporary disorders to lifelong injuries.
Ergonomics	That part of the broader term of ergonomics dealing with how loads in work affect the musculoskeletal system.
Manual handling	Any transporting or supporting of a load, by one or more workers, including lifting, putting down, pushing, pulling, carrying or moving of a load.
Repetitive work	Work that entails the repetition of similar working movements over and over again. The time for each operation is short, and the movements take place to such a degree that the employee may be affected by disorders of the musculoskeletal system.
Musculoskeletal system	The parts of the body and the structures (muscles, tendons, skeleton, cartilage, ligaments and nerves) that make the body assume various postures and move.

Investigation and risk assessment

Section 4 The employer shall investigate whether the employees perform work by means of work postures and working movements, manual handling and repetitive work that may be health-endangering or unnecessarily fatiguing. Visual conditions must also be investigated to determine whether these have an adverse effect on work postures and working movements.

The employer shall assess whether the loads individually or in combination may entail the risk of injuries to the musculoskeletal system and the vocal cords. The risks must be assessed on the basis of the loads' duration (how long), frequency (how often) and intensity (how much). The assessment must take into account physical, organisational and psychosocial factors in the work environment.

Stipulations on measures, follow-up and documentation of the risk assessment are contained in the Provisions of the Swedish Work Environment Authority on Systematic Work Environment Management. The same provisions also contain stipulations on the employer's obligation to engage, where necessary, occupational health services or equivalent external assistance.

Work postures and working movements

Section 5 As far as is practically possible, the employer shall order and design workplaces and tasks so that the employees can use work postures and working movements that are favourable to the body. Prolonged and recurrent work with a bent or twisted trunk should be avoided, as should work with the hands above shoulder height or below knee level. The same applies to work that entails the application of force in unfavourable work postures.

The employer shall provide special visual aids if these are needed to enable favourable work postures and working movements.

Manual handling and other application of force

Section 6 The employer shall order the workplace so as to reduce or avoid the risk of the employees being affected by musculoskeletal disorders, particularly in the back, during the manual handling of burdens and loads or during other tasks that require the application of force. The employer shall take suitable measures, especially with regard to the design of the work environment and the demands placed by the task. This means both organisational measures and the use of aids, especially technical equipment, in order to avoid employees needing to handle burdens and loads manually.

If it is not possible to avoid the manual handling of burdens and loads, the employer shall take measures and take into account the influencing factors given in Appendix A.

Repetitive work

Section 7 The employer shall ensure that there is normally no work that is repetitive, closely controlled or restricted. If, nevertheless, an employee must perform such work on account of particular circumstances, the employer shall prevent the risks of ill-health or accidents as a consequence of health-endangering or unnecessarily fatiguing loads. This preventive work must lead to increased

variation in the work, for example, through job rotation, job diversification or breaks.

Job decision latitude

Section 8 The employer shall ensure that the employees have possibilities of influencing the arrangement and conduct of their work so that they obtain adequate variation of movement and recovery.

Knowledge and information

Section 9 The employer shall ensure that the employees have adequate knowledge of

- suitable work postures and working movements,
- how technical equipment and aids should be used,
- the risks that unsuitable work postures, working movements and manual handling entail, and
- early signs of joint and muscle overload.

The employee shall receive information on the weight of the loads being handled. Where possible, the employee shall receive exact information on the load's weight and where the load's centre of gravity or heaviest side is when its content is unevenly distributed.

The employee shall receive instructions and the opportunity to train a suitable technique for the task in question. The employer shall follow up on compliance with the instructions.

This statute enters into force on 1 December 2012. The statute repeals the Provisions of the Swedish National Board of Occupational Safety and Health (AFS 1998:1) on Ergonomics for the Prevention of Musculoskeletal Disorders and the Provisions of the Swedish National Board of Occupational Safety and Health (AFS 2000:1) on Manual Handling.

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Appendix A

Factors influencing manual handling

The following factors shall be considered when taking measures to reduce the risks of musculoskeletal disorders in manual handling. The factors need to be assessed together in order to obtain a complete assessment. The more influencing factors there are, the lower the recommended maximum weight as compared with ideal conditions.

1. Characteristics of the burden or load:
   Manual handling may present a risk of injury if the burden or load
   - is too heavy or too large,
   - is unwieldy or difficult to grasp,
   - is unstable or has contents likely to shift,
   - is positioned in a manner requiring it to be held or manipulated at a distance from the trunk, or with a bending or twisting of the trunk, or
   - is likely, because of its contours or properties, to risk injury to workers, particularly in the event of a collision.

2. Physical effort required:
   A physical effort may present a risk of injury if it
   - is too strenuous,
   - is only achieved by a twisting movement of the trunk,
   - is likely to result in a sudden movement of the burden or load, or
   - is made with poor balance.

3. Design of the work environment:
   The design of the work environment may present a risk of injury. The risks increase if
   - there is not enough room, in particular vertically, to carry out the activity,
   - the floor is uneven, thus presenting tripping hazards, or is slippery,
   - the workplace or the work environment prevents the employee from handling the burden or load at a safe height or with a suitable posture,
   - there are variations in the level of the floor or the working surface, requiring the load to be manipulated on different levels,
   - the floor or foot rest is unstable, or
   - the temperature, humidity or ventilation is unsuitable.

4. Requirements of the activity:
   The activity may present a risk of injury if it entails
   - over-frequent or over-prolonged physical effort involving in particular the spine,
   - an insufficient bodily rest or recovery period,
   - excessive lifting, lowering or carrying distances, or
   - a rate of work imposed by the process and which cannot be altered by the worker.

5. Individual factors:
   The worker may be at risk of injury if he/she
   - is physically unsuited to carry out the task,
   - is wearing unsuitable clothing, footwear or other items, or
   - does not have adequate or appropriate knowledge or training.

General Recommendations of the Swedish Work Environment Authority on the implementation of the Provisions on Ergonomics for the Prevention of Musculoskeletal Disorders

Guidance on Section 1 Purpose

Health-endangering loads are high loads, repeated loads, static muscle work and one-sided loads. Even very low loads may be health-endangering or unnecessarily fatiguing. A fatiguing physical load is not necessarily health-endangering, but entails serious risks if it is repeated frequently and prolonged. It is possible to rectify an unnecessarily fatiguing load.

The human body is made for movement and loads. But a right mix of movement, load and recovery is needed to maintain the body's functions and achieve a favourable load. Tasks and workplaces need to be ordered and designed, already in their planning, construction and furnishing, to enable favourable, healthy loads. This also applies to the design and purchase of products and services.

Guidance on Section 2 Scope

The Work Environment Act applies to all work that an employee performs on behalf of an employer. The Work Environment Act also applies to a certain extent outside professional life. Pupils, inmates of an institution and persons who are engaged in service under the Total Defence Service Act are in some respects equated with employees, e.g. regarding the nature of the work environment (Chapter 1, Section 3 of the Work Environment Act). These provisions therefore also apply in, e.g. schools.

The responsibility of those other than employers

The Work Environment Act and these provisions also apply in certain parts for, e.g.

- those who conduct commercial activities without employees, alone or together with a family member,
- those who order execution of building or construction work and their subcontractors,
- architects, construction planners and others participating in the planning and designing within the framework of their commissions,
- the building work environment coordinator,
- those who manufacture prefabricated buildings and constructions,
- those who are responsible for the coordination of work

environment questions,

- employees,
- those who manufacture, import, deliver or provide a machine, tool, protective equipment or other technical device,
- those who deliver or make a packaged product available,
- those who install a technical device,
- those who hire rented labour,
- those who control a worksite and
- those who provide premises or land.

Those who control a worksite are responsible for ensuring that fixed devices and other devices at the workplace provide good ergonomics conditions. This responsibility also applies to workers other than their own employees. This means, for example, that employers responsible at a shop or restaurant should ensure that loading bays, lifts and the like are available both for their own employees and for other workers who are on the worksite for only short periods. This responsibility also encompasses movable equipment, such as mobile loading devices or trolleys.

Those who hire rented labour have a responsibility which in principle corresponds to an employer's work environment responsibility since those who hire rented labour organise the labour and exercise the direct work management. This means, among other things, carrying out a risk assessment of the tasks that a hired employee performs.

The Work Environment Act only applies in part for those who conduct commercial activities without employees, alone or together with a family member. Sole traders or family businesses are obliged to adhere to that which is stipulated in and by virtue of the Work Environment Act regarding technical devices or hazardous substances which can cause ill-health and accidents, as well as at worksites shared with other workers. This means, for example, that sole traders or family businesses have an obligation to consult on matters including ergonomics conditions with others at a shared worksite, e.g. the person responsible for the coordination of work environment questions.

An increased responsibility for sole traders or family businesses applies with regard to building and civil engineering work. They must then comply with these provisions in their entirety.

Planning and designing

The planning and designing stage already creates the conditions for the work environment, both during the construction period and in the completed building. It is therefore very important to consider the factors regarding ergonomics in the planning and designing of construction works and surrounding environments. It is both expensive and inconvenient to make

changes once construction in progress or the building and its activities are ready to be put into service.

Developers – those ordering execution of construction work – control at an early stage much of what the work environment will be like, both during the construction period and in the completed building or facility. Developers decide, bear the costs and choose the consultants that are engaged and also design their commissions.

For example, selecting suitable construction products can avoid problems of ergonomics in the construction stage. Planning and designing installation spaces that are sufficiently large and easy to access for service and maintenance, and avoiding crawl spaces, can reduce the risk of musculoskeletal disorders, both during the construction period and in the use of the completed building or facility.

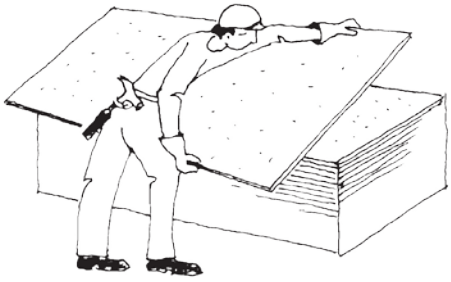


Figure 1. The work environment is influenced by construction planners. Consciously selecting better designed products reduces the load for construction workers.

Suitable access and transport routes for the movement and handling of equipment and materials should be arranged in the completed building so that this can be done with good ergonomics and a rational workflow. This means, among other things, that loading bays, lifts and the like that are used to deliver goods to shops, shopping centres, restaurants or warehouses should allow rolling handling. This responsibility also encompasses movable devices and work equipment provided for unloading or loading work, e.g. mobile loading devices, trolleys and pallet trucks.

It is important that the building's rooms, structural parts and furnishing are designed with respect to those who will be cleaning, e.g. that there is adequate space to perform the work and free passage for cleaning trolleys. Materials selected for, e.g. floors and walls should be compatible with the cleaning methods recommended by the developer for the future use of the premises.

Refuse storage spaces should be large enough to accommodate waste when this is source sorted and recycled, and be easy to keep clean. It is important

for it to be possible to roll transports to and from refuse storage spaces.

When planning, designing and building premises for health and social care, it is important to create adequate spaces, e.g. in sanitary rooms. The employees' work postures and working movements should not be obstructed by walls or furnishings when they are assisting those in need of care.

See also the provisions of the Swedish Work Environment Authority on workplace design and on building and civil engineering work.

Coordination

At changing workplaces, such as construction sites, careful and early planning, both in time and space, is especially important. Building and civil engineering work has special rules for coordination. There must be one building work environment coordinator for planning and designing (BAS-P) and one for the execution of the work (BAS-U). Their responsibility covers the building project as a whole, that is, the work of all contractors working on the project. BAS-P coordinates work environment questions in the project preparation stage. BAS-U manages coordination during the execution of the work and coordinates the control that the work is being carried out correctly from the work environment perspective and that it is in compliance with the work environment plan. It is important that BAS-P and, ultimately BAS-U, ensure that a lack of coordination does not result in unnecessary rearrangements of materials, that building hoists and building cranes used by several companies remain in place for as long as they are needed and that collisions in time and space are avoided between different professional groups. The period for which various operations are planned needs to be adapted so that transports can take place in an ergonomically correct manner and that aids and work equipment can be used. The design and positioning of material storage areas and access routes are examples of critical points that need to be taken into consideration. BAS-U's responsibility also includes ensuring that there are procedures regarding order and cleaning, and that it has been made clear who is to attend to this.

There is also a responsibility to coordinate work environment questions, and a person responsible for this, at fixed operating bases. Examples of this are shopping centres, business centres and service establishments, where several different operations use the same goods receptions, waste facilities, lifts and stairwells. There, it is important that operations are coordinated, e.g. times for cleaning, deliveries and transports, in order to avoid unnecessary physical loads. To prevent risks of musculoskeletal disorders, it may be appropriate for the person responsible for coordination to have the opportunity to participate in and comment on agreements regarding operations/maintenance and deliveries before these agreements are signed.

Employees

Without the committed involvement of employees, it is difficult to prevent musculoskeletal disorders in a sound manner. This is partly because personal conditions and attitudes influence the risks and partly because employees are able to identify ergonomic deficiencies in their work in a very direct and concrete way. Under the Work Environment Act, employees must be involved in work environment management and participate in the implementation of the measures that are needed to obtain a good work environment. But they must also follow the provisions that are laid down, using the equipment and observing the caution necessary to prevent ill-health and accidents. If employees judge that a task might entail risks of musculoskeletal disorders, they should notify their employer.

Manufacturers, importers, suppliers and providers

Manufacturers, importers, suppliers and providers are responsible for already considering factors regarding ergonomics in the manufacturing and delivery of their products so that these can be installed, used and maintained with good ergonomics conditions. But it is always the employer who is responsible for how their products are used in practice at a purchaser's premises.

Guidance on Section 4 Investigation and risk assessment

The physical loads that the employer needs to identify may be

- occasional high loads,
- repeated moderate loads,
- static muscle work,
- one-sided loads,
- very low loads.

Occasional high loads, such as a heavy lift, may present a risk of acute overload.

Repeated moderate loads may cause disorders if the work is performed over prolonged periods.

Static muscle work means that muscles are tensed without this resulting in movements of the joint over which these muscles extend. If then no opportunity to relax is provided, signs of overloading will set in after a while. The employee becomes fatigued, muscle function is inhibited and the muscles ache. In time, such loads can have harmful consequences. The weight of the body part is often sufficient for overloading to arise during static muscle work (Figure 2).

Figure 2. Examples of static load.

One-sided loads on muscles and joints arise when the same parts of the body are used in a similar manner for a prolonged period without the opportunity for rest or variation. This forces the surrounding, stabilising muscles to work virtually statically to make these working movements possible.

Very low loads can also cause disorders. Excessively low loads for a prolonged period, for example sedentary monitoring work, are unfavourable for, among other things, the musculoskeletal and circulatory systems. The musculoskeletal system requires continuous activation to maintain strength, range of movement and mobility.

Health-endangering and unnecessarily fatiguing loads affect all body parts. It is often the back, neck and shoulders that are subjected to these loads, but other body parts also need to be considered. The hands may also be subjected to loads in the form of compressive forces. In work where the voice is important to the execution of the work, this load also needs to be assessed.

A favourable load is characterised by recurrent variation, balance between activity and recovery and limited duration. What constitutes a favourable load might vary greatly from person to person, depending on their individual conditions and sensitivity. It is also important to identify periods of favourable loads in the work when assessing how employees are loaded throughout their shift.

The concept of load dose is often used as a measure of the total load in order to estimate the risk of ill-health. The dose is calculated as a combination of how much, how heavily, how often and how long we have worked. 'How much' and 'how heavily' can be described as the intensity of the load. 'How often' is the frequency and 'how long' is the duration of the load. It is easy to understand that a high load dose can have a destructive effect on the body's

tissues. But it might be more difficult to realise that low doses can also have negative effects. The load types described above rarely occur separately in working life but are often combined.

Models for the assessment of work postures, manual handling and repetitive work (page 34) can be used to assess risks.

The assessment needs to take the following factors into account

- physical factors such as work space, work equipment, furnishings, lighting, air quality, temperature, draughts, vibrations, noise, acoustics, surfaces and personal protective equipment and work clothes,
- organisational factors such as work rate, time to perform the task, time for recovery, solitary work, job decision latitude and variation of load,
- psychosocial factors such as experience of social support and job satisfaction and the opportunity for influence and control in the work,
- the content of the task such as demands on precision, concentration, attention, thinking and the task's degree of difficulty,
- the employee's conditions such as experience, age, and physical and cognitive ability.

Visual conditions play a major role for the ability to perform the task in a favourable and safe manner.

Unsuitably designed workplaces, work premises, work equipment and work objects make it difficult to work in a way that is varied and sparing. This is, for example, the case in confined spaces, premises with variations in level, at work tables or with tools that are not adapted to the body measurements of users.

Figure 3. Work in a crawl space involves very awkward work postures.

Physical work environment factors can interact with and reinforce the risks of musculoskeletal disorders arising from, e.g. unsuitable work postures. This is, for example, the case for vibrations, noise, unsuitable acoustics, unsuitable lighting and unsuitable climate conditions. A high heat load decreases the ability to exercise great force for a prolonged period.

An unsuitable surface can cause strained work postures and working movements that load employees, especially in situations where they are handling burdens or are walking and standing a lot. Uneven, unsteady, sloping or slippery surfaces can only be partly counteracted by, for example, good working shoes. Therefore, there is often reason to improve them. Working shoes without a heel counter or low flexibility in the sole increase the risk of falls and musculoskeletal disorders of the back, hips and knees.

Personal protective equipment or work clothing can restrict freedom of movement or increase the heat load. Protective gloves might impair grip, while respiratory protective equipment may result in increased load on the respiratory and circulatory systems. Respiratory protective equipment and eye protectors can reduce the field of vision, thereby adversely affecting work postures.

Organisational and psychosocial factors in the work influence the load. Organisational deficiencies can cause unsuitable mental loads, which in turn can lead to muscle tension. Strong time pressure, excessive demands on oneself or from others or a task whose content places high demands on attention, concentration and thinking are examples of factors that may contribute to this. Other adverse factors of this kind are a lack of job decision latitude and inadequate social support. High performance targets in a working group may lead to a greatly intensified work rate and a division of roles within the group resulting in certain individuals being subjected to excessively repetitive or strenuous tasks. At the same time, physical work resulting in movements being repeated in a monotonous way can have an adverse effect on the mental load. It is also an example of how mental and physical factors interact.

Employees have different conditions for coping with physical demands. These conditions vary according to physical and mental strength, body measurements, sex, age, experience, fitness, motivation and, where applicable, disabilities. The starting point in the Work Environment Act is that balance between the demands of the work and the conditions of the person should be created in the first instance by adapting the work to the person. It is then important to take into account the different conditions of women and men in terms of loads and thus the risk of ill-health.

In evaluating the risks, it is important to pay attention to early signs of overloading as it can take months, perhaps years, for an injury to develop. It should also be kept in mind that body movement and loads, and challenges

to the individual, are a prerequisite for health and well-being. But there are individual variations in the degree of load to which the individual may be subjected. For persons with jobs that have high demands on their voices, it is important to be able to use the voice without need to exert it. Certain persons may be helped by using a microphone and speakers as an aid to reduce the load on the voice and to be heard better.

A poor work environment cannot generally be compensated by training strength and fitness. This particularly applies to one-sided, monotonous tasks. But lifestyle has significance for how employees feel at work and what energy they have left over for their leisure. Through exercise, training and an otherwise healthy lifestyle, individuals can keep their body in trim and maintain a good level of fitness.

Preventing and reducing the risk of being affected by musculoskeletal disorders means adapting and varying the load as regards the heaviness of the work, work rate and activating different parts of the body. Loads strengthen the body if these loads are not more than can be managed and if they are varied so as to permit recovery.

Measures should encompass a holistic perspective that takes into account human, technological and organisational factors. This concerns the individual's conditions, capacity and work technique, but also how the work is performed. Important considerations are how the work is divided, how to achieve cooperation, work rate, time to perform the work and the design and usability of the equipment used. It is important to take into account how these interact if effective measures are to be found that yield acceptable levels of load in the work.

The expert(s) engaged should have specific skills for identifying loads and assessing risks of musculoskeletal disorders from a holistic perspective. Experts should also be aware of the measures that are needed to enable workplaces and tasks to be ordered and designed so as to achieve favourable loads.

In order to prevent musculoskeletal disorders, particularly in jobs with great strains on the musculoskeletal system, it may sometimes be justified to conduct medical checks. Medical checks make it possible to detect early signs of disorders so that the work environment can be improved before the disorders have become more chronic and it can be seen whether there is a need for job adaptation. See also the provisions of the Swedish Work Environment Authority on medical checks in working life.

Guidance on Section 5 Work postures and working movements

Care should be taken if the joints are subjected to loads frequently or for prolonged periods when they are heavily flexed, extended or rotated. In these extreme positions, the joints can be damaged more easily, and the muscles

have an inferior capacity both to develop force and to work in a coordinated manner. But it is good to sometimes take our mobility to its limits.

It is worth noting that the various body parts' own weight can constitute a considerable load in certain postures (Figure 4).

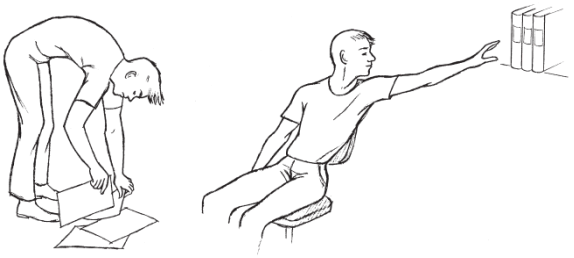


Figure 4. The body parts' own weight often constitutes a great load.

A well-designed workplace is in part characterised by the opportunity to spend much of the time in an upright work posture with the shoulders lowered and the upper arms close to the torso.

The working height is roughly the height of the employee's elbows, regardless of whether the work involves sitting or standing (Figure 5). But different types of tasks require different working heights (Figure 6). The best way to adapt the working height of work equipment, e.g. work tables and work chairs, is to be able to adjust it so that all employees can set working heights relative to their body size. It should be quickly and easily possible to change the setting of the work table and work chair if several employees are alternately using the same work table on more than an occasional basis. Individual adaptation can also be achieved, e.g. by means of fixed work tables with different heights or by being able to raise or lower the surface on which the employee stands or sits.

The outer working area of the hands on the horizontal plane is limited by the reach of the arm, while the main part of the work done by the hands should lie within the inner working area (Figure 7 p. 22). The more prolonged the tasks and the greater the precision they demand, the more necessary it is that the work is performed with completely relaxed arms and shoulders close to and in front of the body, i.e. centrally in the inner working area.

A space that is large enough for the work, no matter whether the employee is walking, sitting or standing, allows the employee to move in a relaxed, dynamic and well-balanced way. A good principle when designing workplaces is: “Ensure that the little person can reach and that the big person can fit.”

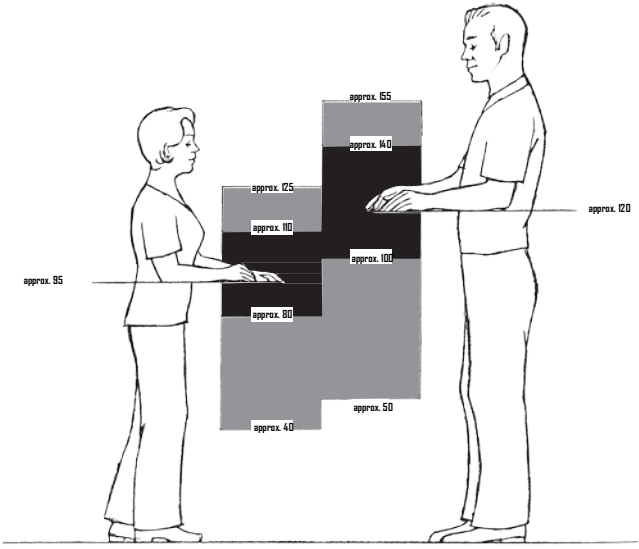


Figure 5. Suitable working heights for a large and small person, respectively, measured in centimetres. But note that 95 per cent of Swedish men are smaller than the man in the figure, and 95 per cent of Swedish women are bigger than the woman. Normally, the employee's elbow height is the most suitable height.

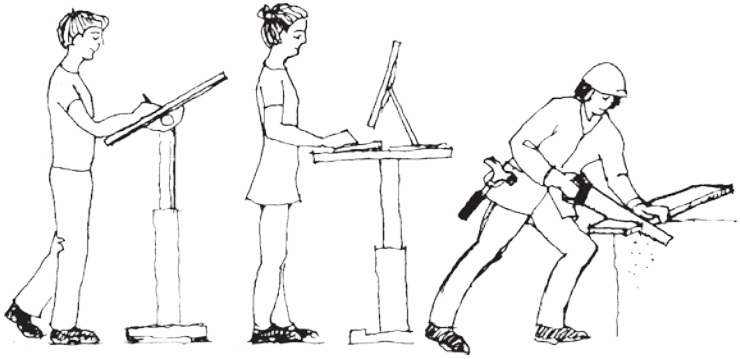


Figure 6. Different working heights for different types of work. In precision work, it is suitable to position the work object a little higher because visual control is important. On the other hand, work requiring greater force should be positioned below elbow height.

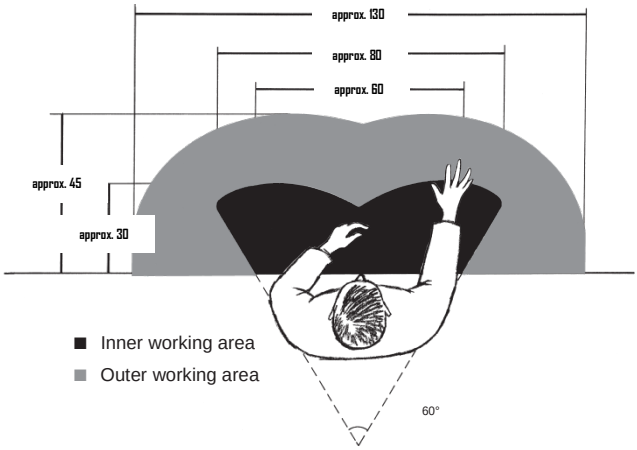


Figure 7. Working areas for the hands, measured in centimetres.

Standing and walking is good for operations requiring great mobility, force and reach. Standing up to work also provides a good overview of a large working area. One way to develop force and to increase reach that is sparing to the body is to make use of weight transfer, i.e. transferring the weight of the body from one leg to the other and back again. This can be done backwards and forwards or from side to side (Figure 8).

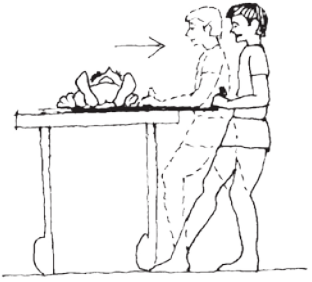


Figure 8. Weight transfer.

The disadvantages of only standing are the constant load on the heart and circulatory system and on the foot and leg joints. Comments on the significance of the surface are found on page 18. To reduce the load and provide suitable variation, some tasks can be performed in a sit-standing or sitting position (Figure 9). If the work cannot be performed in this way, it is important that there at least be opportunity to sit down during breaks, e.g. when a shop assistant does not have any customers or for hotel receptionists and waiting staff.

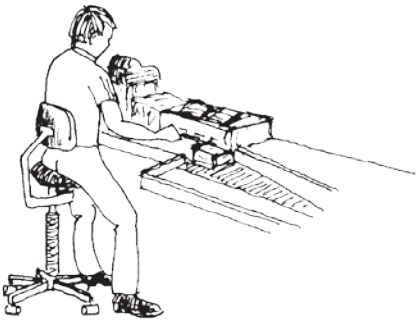


Figure 9. Sit-stand seat with load-braked castors.

Sitting provides good stability in precision work and may be necessary for pedal work. Sedentary work is less taxing than standing because it entails less load on the blood circulation. Disadvantages compared with standing are that mobility and reach are less, as are the opportunities to develop force. In a sitting posture, the load on the back is a little greater than in a standing posture because the pelvis is tilted backwards. This relationship can be remedied to some extent by the chair having a good backrest, adjustable armrests and tiltable seat. Prolonged sitting gives reason to investigate whether some of the tasks can be performed standing. The work needs to be organised so that there is cause to get up every now and then. Sitting still results in too little physical activity for the body, and so it is necessary to stand and walk regularly during a shift.

Hand-intensive work involves continuous hand movements with a high speed of movement, often in combination with movements towards extreme positions or strenuous tasks. The risk of musculoskeletal injuries in the arm and hand is influenced by the level of force, body posture and speed of movement. Pressure and vibrations can contribute to injuries in the hand and fingers. Read more about grip and tools on page 28.

Work while kneeling, crouching or squatting can sometimes be necessary, but increases the risk of overloading individual parts of the body. It is also very taxing to perform manual work in the supine position since this often involves work with raised arms lacking support. It is important to limit such work postures as far as possible. Technical solutions might perhaps completely change the task or at least improve its conditions. Another way to reduce the risks is to limit the work's duration, both the length of individual shifts and the spread of shifts over the day.

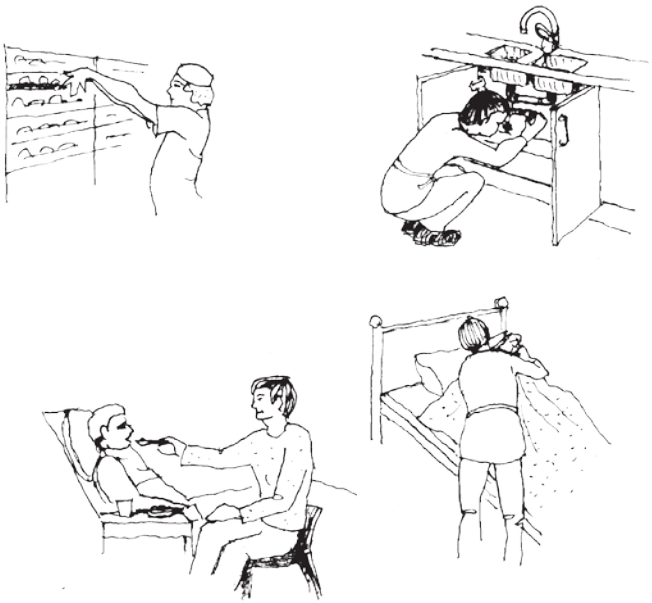


Figure 10. Flexed, twisted and extended work postures always entail risks.

Working in a heavily flexed, twisted or extended posture may entail loads that are directly unsuitable since the joints are then loaded near or in their extreme positions (Figure 10). Work postures and working movements in which the wrists are noticeably flexed or the hands are above the shoulders, below the knees or far out from the body are not uncommon. If operations of this kind are prolonged or recurrent, the working conditions need to be changed.

If the work posture is simultaneously flexed and twisted or extended and twisted, the risk of injury is considerable. The risk is especially great when performing manual handling in a work posture that is simultaneously flexed and twisted (see also the guidance on Section 6). Another very strenuous situation for the body is if, during the work, the employee is more or less fixed in a certain position without being able to change it. Here, the strains are aggravated if objects are also being handled. Musculoskeletal disorders can easily arise if a flexed or twisted work posture has to be assumed in a sudden and uncontrolled manner, e.g. when catching someone losing his balance.

The work posture is of significance to breathing and the voice. Being able to use the voice without exertion is important in activities that have high demands on the voice. Tension in parts of the body increases the risk of straining and fatiguing the voice. These body parts are the abdomen, diaphragm, back, chest, throat, neck, shoulders and jaw. A varied and relaxed

work posture is therefore important for being able to use the voice to best effect. If there are no voice aids or there are factors in the work environment that subject the voice to loads, this can lead to tension in the muscles necessary for voice production and to wear on the mucous membrane of the vocal cords.

Visual aids and lighting conditions

Being able to see the work object without exertion is important for reducing the risk of accidents and musculoskeletal disorders. The first and foremost need in order to perform work in a sound manner is adequate light that neither dazzles nor causes troublesome reflections. If the lighting and visual conditions are inadequate, employees compensate this by tensing not only the muscles in and around the eyes, but also muscles in, e.g. the neck and shoulders. They adjust their work posture to be able to see the work object. When the view is obstructed and things are in the way, working movements will also become more strained. In order not to develop tensions, it is important to take frequent breaks and vary the work with other things, even in good visual conditions, especially if the work is visually demanding. Even if the visual and lighting conditions are perfectly satisfactory, the employee may be occasionally forced to assume taxing work postures in order to see. It may then be necessary to instead make use of individually tested visual aids, especially adapted for the work. Employers are obligated to provide their employees with such aids. Examples of these visual aids are working glasses, special task lighting or a magnifying glass, but not, however, ordinary reading glasses.

Guidance on Section 6 Manual handling and other application of force

The employer should reduce the risks of musculoskeletal disorders in manual handling in the following order of priority:

1. investigating whether manual handling can be avoided comletely,
2. if it is not possible to completely avoid such handling: taking the necessary measures for the design of burdens and loads, work equipment and aids, work organisation and the general work environment, and
3. training and informing the employees so that they can help to minimise the overall risks.

Manual handling primarily means the traditional manual labour of lifting, carrying, pulling, dragging, etc. But the term also encompasses tasks such as moving goods to and from shelves, topping up machines and mixers with raw materials by hand, helping a patient to move, pushing and pulling trolleys and serving food and drink. Other tasks may entail employees having to use

considerable physical force without them primarily wanting to move objects. Examples are using hand-held machines or tools, such as chainsaws, operating controls with heavy resistance, bricklaying, spray painting, steering vehicles or work processes with buttons, levers and pedals, and opening doors. Sometimes, the greatest risk factor is the degree of precision in the handling rather than demands on the actual application of force. Figure 11 shows additional examples of manual handling or other application of force.

Heavy manual handling entails the risk of overloading the lumbar region in particular, but also the shoulders and arms. This is particularly noticeable when handling is combined with poor work postures. Lifting with heavily flexed knees, carrying heavy loads on stairs and on sloping, unsteady or hard surfaces also presents a risk of knee injuries. In addition, the heart, circulatory system and lungs are strained during heavy lifting and carrying. Work of this kind requires both strength and fitness, but even where employees have this, the work may still present risks.

Acute overloading of joints, muscles and tendons often arises as a result of manual handling that has deviated from the normal. Accidents of this kind can occur, for example, when a patient who is to be moved does not cooperate as expected, when the centre of gravity in a parcel changes due to its contents shifting, or when an employee slips or trips and makes a sudden, unsuitable movement in order to regain balance. In such situations, the load can become many times greater than normal. It is therefore important to plan in advance how a lift or movement should be performed in the best manner.

With a moderate investment, most transport operations can be carried out by means of rolling. This is particularly important when moving materials, equipment or goods over long distances. Carrying heavy or unwieldy burdens on stairs entails great risks of acute musculoskeletal disorders and other accidents. Stairs are therefore not suitable as the regular transport route to shops, restaurants and the like.

Current knowledge emphasises the following three aspects as the most significant for preventing back injuries:

- avoid heavy lifts if possible, use technical aids (Figure 12, page 28),
- keep the burden close to the body,
- avoid lifting and twisting simultaneously.

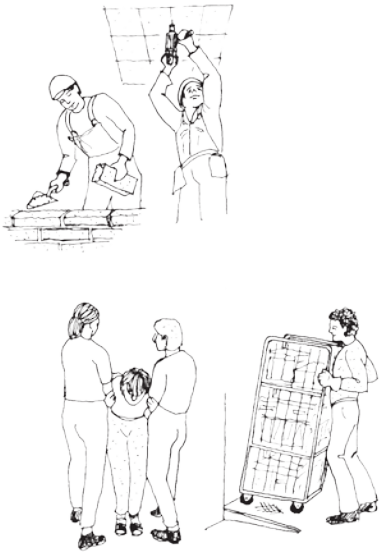


Figure 11. Various forms of manual handling and other application of force that may be harmful in the long term.

Lifting and moving persons

Normally, no manual lifting of persons needs to take place if

- the premises are spacious and well-planned,
- there is sufficient appropriate equipment readily available,
- employees can cooperate with each other and with the person in need of help in a sound manner, and
- employees use a good work technique.

It is possible to move people without lifting them manually. If technical aids are used, it is important that employees receive instructions and training in how to use the aid in that particular situation. It is particularly important to train technicians to move persons with different needs of assistance in different situations and to manage unforeseen events. Inadequate space may entail forcing the assistant into heavy handling in taxing work postures. A shortage of time can also induce undesirable behaviour.

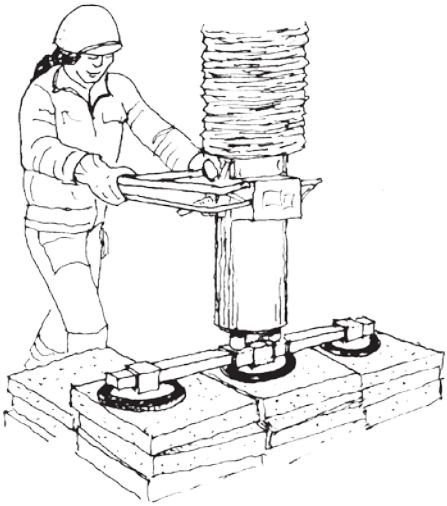


Figure 12. Example of a lifting aid.

Pushing and pulling

Pushing and pulling means moving an object that is either wholly or partially resting on the surface or is suspended, e.g. from a ceiling hoist. The force needed to start and keep an object in motion depends both on how heavy the object is and on how much friction there is between the object and the surface, as well as on the gradient of the surface. If employees are to be able to use great force on the object, they must be able to gain low friction, i.e. the friction between the shoes and the surface is important. There should be high friction between the object and the surface and low friction between the individual and the surface. It is important to avoid thresholds and other variations in level along transport routes.

Work with hand-held machines, hand tools and controls

Hand-held machines and hand tools can contribute to musculoskeletal disorders in hands, wrists, arms and shoulders. One risk factor is vibrations; other risks depend on how the machines and tools are designed and how they are used. Machines and tools are not always adapted to those with small hands and lower muscle strength (Figure 13). Because women usually have both smaller hands and lower muscle strength than men, they are affected by a higher load when using these tools.

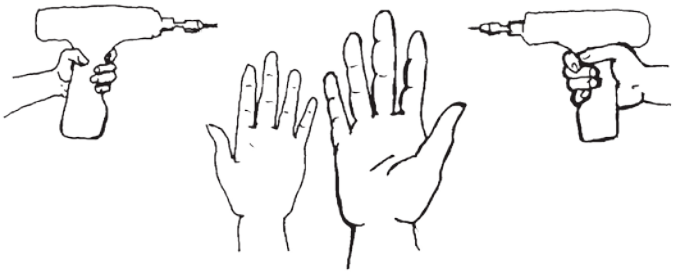


Figure 13. One and the same grip does not fit all hand sizes.

Work with hand-held machines or tools often demands not only strength but also precision. If the demands on precision are great, it can be difficult to avoid work entailing a static load, e.g. for a dentist or a watchmaker. In such cases, it is particularly important that the tools are functionally designed and that there are good opportunities for relief and rest.

To reduce the risks of musculoskeletal disorders, employers should provide their employees with hand-held machines and hand tools that

- allow appropriate grips adapted to the demands of strength and precision, with good friction and with the gripping force well distributed over the hand so as to avoid unsuitable point pressure, e.g. no sharp edges (Figure 14),
- fit the differing hand sizes of various users,
- are possible to use with both the right and left hands,
- allow a neutral position of the wrist and arm (= as when the hand is relaxed and resting on a table),
- allow employees to see and access the work object,
- have trigger forces with a reasonable control resistance,
- vibrate as little as possible,
- are as light as their function permits, and
- are well balanced.

Work using controls is primarily relevant in mobile machines and vehicles of different kinds, but also occurs in stationary workplaces. It is important that the controls are designed and positioned with respect to the employees' physical conditions, e.g. body size and capacity to develop force. This applies both to manually operated controls and to pedals and other leg- and foot-operated controls.

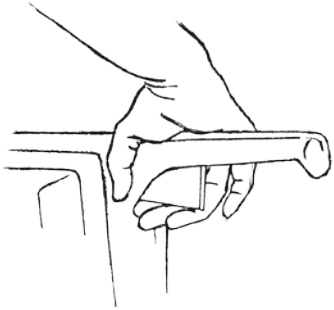


Figure 14. Dead man's handles and sharp edges are not a good combination.

Guidance on Section 7
Repetitive work

Repetitive work entails the employee performing one or a few tasks, with similar working movements, over and over again for a large part of the working day. The time from an operation beginning to the same operation recurring (the work cycle time) is short. The task is often only a small, limited part of an entire workflow. Moreover, it is often performed at a high tempo.

If the work is *closely controlled*, employees have little or no opportunities to influence factors such as work rate, the mutual order of tasks, the inflow of tasks, the time when the work is to be completed, how the work is to be performed and times for breaks and recovery. If the work is *restricted*, employees perform most of the work at one and the same workplace for the entire working day, e.g. at a computer workplace or in a driver's seat.

Continual repetition of the same movements gives rise to a constant, uniform load. The object being handled need hardly weigh anything at all;

The arms' own weight is sufficient to load muscles and joints in an unfavourable manner. The consequence of this might be the gradual onset of serious injuries that take a long time to heal. Once injured in this way, it is easy to regain these disorders when subjected to similar loads.

Some possible measures

Physical or technical measures alone are rarely sufficient if the work is not fully mechanised. The principal measure is rather to reduce the degree of repetition and to limit the time that an individual employee performs this type of work. By changing how the work is organised, employees can have greater opportunities for variation, participation and development. Three common measures:

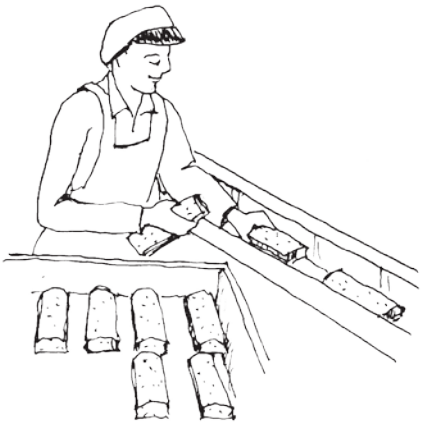


Figure 15. A repetitive job.

- Job rotation means changing between different tasks with a similar content. If job rotation is introduced, it is important that it really does vary the load. Job rotation as a means to counteract harmful physical loads often has a limited effect.
- Job diversification means that several different tasks are brought together, possibly including some supplementary tasks, such as maintenance and cleaning. The individual performs a greater part of a production flow than before. Job diversification typically leads to a longer work cycle.
- Job enhancement means that employees have broader tasks with different skills and qualifications requirements, e.g. through adding elements of work planning, control of results or customer contact.

Guidance on Section 8 Job decision latitude

A basic prerequisite for individual well-being and the opportunity for development is that employees have job decision latitude and may themselves influence the arrangement and conduct of their own work. Influence over the work also contributes to the prevention of musculoskeletal disorders, for example by employees having influence over planning and arranging, working method, the distribution of work and breaks, work rate, and over the acquisition and use of aids.

Social interaction at the worksite, i.e. the relationship with management

and colleagues, also plays an important role in how musculoskeletal disorders arise and how they are experienced.

Good job decision latitude means, among other things, being able to

- alternate between different tasks,
- alternate between sitting and standing work,
- take shorter breaks for recovery when employees themselves feel the need for this,
- choose or adapt the work rate,
- get help from someone else when necessary, and
- influence the acquisition of new equipment and the introduction of new working methods based on their own experiences.

Certain systems of remuneration, such as piecework, can lead to employees using a work technique and a work rate that can increase the risk of musculoskeletal disorders.

Adequate variation of movement means that the various parts of the body are loaded in a favourable manner during the working day. Alternating between different tasks that load different parts of the body affords the musculoskeletal system variation and recovery. The same is true when the parts of the body are given different forms of load, i.e. sometimes a little more and sometimes a little less.

Guidance on Section 9 Knowledge and information

One of the prerequisites for avoiding musculoskeletal disorders is that employees know how to perform their work in a suitable manner. In order to comply with this, employers need to have competence in assessing and providing information on the risks of musculoskeletal disorders and how to minimise them, either themselves or through access to such competence in other ways. Here, occupational health services or other external work environment expertise can be very helpful.

It is important for employees to know the approximate weight of a burden in order to adapt their input of force when handling it. Both unexpectedly light and unexpectedly heavy burdens can cause problems. At workplaces that regularly perform manual handling, the acquisition of a system for marking the weight of burdens should be considered.

It is also important to provide training in work technique when introducing new employees and changing working practices. Adequate time should be set aside for this so that employees have the opportunity to train suitable work postures and working movements, to learn to handle equipment and aids and how they can help each other to manage tasks that are difficult to carry out independently. Instructions on the use of controls and technical aids may be

necessary. Simple checklists can be useful to ensure that nothing is forgotten.

Employees should be sufficiently knowledgeable to take early signs of overloading seriously. It is easy to take no notice of muscles beginning to hurt. This is especially true under stress. If the feeling of fatigue and pain in muscles and joints recurs often, the condition of pain may, in the long term, increase in intensity and become more or less permanent.

Instructions and information should be repeated at regular intervals. Employers need to follow up that current procedures for these instructions are relevant and adequate, and that the instructions are being followed. This can be done as part of the follow-up that employers must perform under the Provisions of the Swedish Work Environment Authority on Systematic Work Environment Management.

Models for assessing risks of musculoskeletal disorders in work postures, manual handling and repetitive work according to the guidance on Section 4

There is a need for practical, systematic and simple methods for identifying and assessing jobs or situations that present risks from the perspective of ergonomics. Employers need such aids for their ongoing assessment of the risks in their activities according to the provisions on systematic work environment management and these provisions. Using these models, it should be possible to gain an initial indication of the load dose that a particular job or operation entails in order to assess whether or not the physical loads are health-endangering, and thus an initial basis for measures.

The models can also be used to analyse the ergonomics by the personnel who make decisions about working methods and workplaces in the activities, such as production planners, construction planners and design engineers.

Principles of the models

The relationships between work and the risk of musculoskeletal disorders are often difficult to detect. The models have been simplified to enable them to be used in actual practice. They only assess a few aspects of one load type at a time and so they cannot be used as exact limit values for loads. But they do provide sufficiently sound guidance on which to base a practical process of change at existing workplaces, when moving to new premises and when planning new workplaces.

Due to this simplification, applying the models uncritically may entail both overestimating and underestimating the actual risks. Comprehensive assessments will require the consideration of more factors and the use of more accurate models, which calls for a sound knowledge of ergonomics. Knowledge is also required for activities where a risk of vocal cord disorders can arise.

The models are designed according to a system with three zones (red–yellow–green) that give a clear indication of working conditions where the risk is great or negligible.

The colours in the models have the following meanings:

Red area = unsuitable
The loads in the work are of such a magnitude and character that all or most of the employees risk being affected by musculoskeletal disorders in the short or long term.

Rectify the conditions immediately in order to eliminate or reduce the risk, unless there are special reasons to postpone measures. Such reasons might include very great practical difficulties to quickly rectify the deficiencies entailing risks or specially chosen employees have received specific knowledge of the risks and skill in avoiding them.

Yellow area = evaluate more closely
The loads in the work are of such a magnitude and character that several employees risk being affected by musculoskeletal disorders in the short or long term. Carry out more precise investigations and assessments in order to determine the degree of risk. Above all, time factors (tempo, frequencies, duration etc.) need to be investigated in more detail.

Green area = acceptable
The loads in the work are of such a magnitude and character that no or a few employees risk being affected by musculoskeletal disorders.

Thus, for most employees, the loads present no risk of injury. But be cautious with regard to specific risk groups (e.g., pregnant women, minors or employees who have recently been ill). General measures do not normally need to be taken, but individual ones where necessary.

Models for the assessment of sitting, standing and walking work postures

It is impossible to determine the degree of harmfulness in each individual work posture because it is often difficult to distinguish them from each other. But usually, there are one or a few predominant work postures that influence the load more than others, e.g. those occurring most often during the working day or those involving extreme positions, even if these only occur for short periods. It is these work postures that are assessed in the model. First of all comes a determination of which work postures are involved. The model is then used to see if the work postures can be classified as red, yellow or green for one or more parts of the body.

In principle, only one indent in a box needs to be true in order for that box to be considered red or yellow. The more assessments that come in a red area,

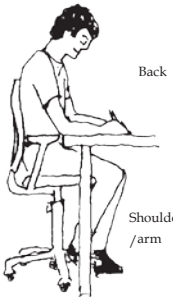
the greater the need for measures.

The body parts mentioned in the model are observation points and not necessarily those that are injured. For example, *unstable surface* in the model means the risk of back disorders rather than the risk of leg disorders.

The model assumes a full shift. A shift normally consists of 7–8 hours per day. The term *a substantial part of the shift* here means that the work posture occurs without interruption, or with very short interruptions, for more than half the shift. *Periodically* means alternation of the work posture with other work postures to such an extent that the total duration of the work posture does not exceed half the shift.

Note that the model does not take into account whether the work requires great or little application of force. Where there are high force requirements, any of the yellow and green jobs can become red.

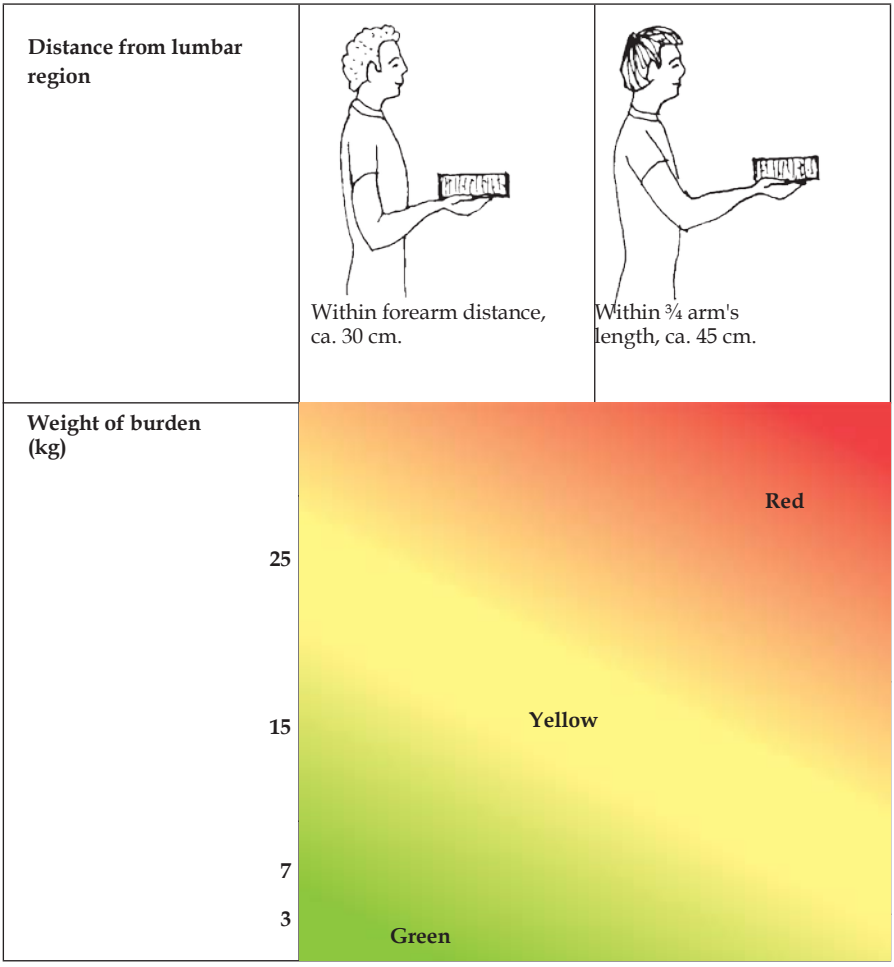
The time aspect is always important; no work posture that can be assumed naturally is health-endangering in itself. The risks arise if it is assumed too often or too long.

Work posture	Red	Yellow	Green
Sitting	One of the following occurs **during a significant part** of the shift.	One of the following occurs **periodically** during the shift.	The following applies to **a significant part** of the shift.
Neck  Back Shoulder /arm Legs	– flexed – twisted – simultaneously flexed and twisted – heavily restricted freedom of movement	– flexed – twisted – simultaneously flexed and twisted – heavily restricted freedom of movement	– in a central position – opportunity for free movements
	– flexed – twisted – simultaneously flexed and twisted – heavily restricted freedom of movement – no backrest	– flexed – twisted – simultaneously flexed and twisted – heavily restricted freedom of movement	– opportunities for free movements – well-designed backrest - opportunity to change to standing position
	– hand at or above shoulder height – hand beyond forearm distance, unsupported	– hand at or above shoulder height – hand beyond forearm distance, unsupported	– working height and reach adapted to task and individual – good arm support
	– inadequate legroom – no support for the feet – heavily restricted freedom of movement – leg- or foot-operated pedal work*)	– inadequate legroom – no support for the feet – heavily restricted freedom of movement – leg- or foot-operated pedal work*)	– free legroom – good footrest – seldom leg- or foot-operated pedal work*) – opportunity to change to standing position
Standing/walking			
Neck  Back Shoulder/ arm Legs	– flexed – twisted – simultaneously flexed and twisted – heavily restricted freedom of movement	– flexed – twisted – simultaneously flexed and twisted – heavily restricted freedom of movement	– upright posture – opportunity for free movements
	– flexed – twisted – simultaneously flexed and twisted – heavily restricted freedom of movement – unstable or inclined surface	– flexed – twisted – simultaneously flexed and twisted – heavily restricted freedom of movement – unstable or inclined surface	– upright posture – opportunity for free movements – opportunity to change to sitting position
	– hand at or above shoulder height – hand at or below knee level – hand beyond ¾ arm's length from the body	– hand at or above shoulder height – hand at or below knee level – hand beyond ¾ arm's length from the body – inadequate room for legs and feet	– working height and reach adapted to task and individual – freedom of movement on stable, non-slip even and level surface
	– inadequate room for legs and feet – unstable surface – inclined surface – leg- or foot-operated pedal work*)	– unstable surface – inclined surface – leg- or foot-operated pedal work*)	– no leg-operated and seldom foot-operated pedal work*) – opportunity to change to sitting position

*) Leg-operated pedal work = the brake or clutch pedal of a car,
Foot-operated pedal = the accelerator pedal of a car

AFS
Model for the assessment of lifting

The model for the assessment of lifting concentrates on two main factors: the weight of the burden and how far in front of the body the burden's centre of gravity is. Thus the model does not include important factors such as lifting frequency, the duration of lifting work, lifting heights and the ability of the load to be grasped. In order to include the effects of these and other factors in the analysis, supplementary assessments have to be made. The model is valid for both men and women.



Model for the assessment of a symmetrical lift with two hands, standing, under ideal conditions. Horizontal distance = the distance between the lumbar region and the burden's centre of gravity during the lift.

The model shows that it is unsuitable to handle burdens that are heavier than 25 kg in most cases.

Appendix A contains the most important of the many factors that should be taken into account in the risk assessment, especially if the first assessment comes in the yellow area. The greater the number of "aggravating" factors, the lower the recommended maximum weight compared with ideal lifting conditions.

Model for assessing pushing and pulling work

Force (N)	Red	Yello	Green
Starting	>300	300–150	<150
Continuously	>200	200–100	<100

The model for assessing pushing and pulling work relates to good ergonomic conditions, i.e. a symmetrical two-handed grip, well-designed handles positioned at a suitable height and good ambient conditions. If the object is moved far, the operation repeated frequently or for a prolonged period or if the grasping height deviates noticeably from about elbow height, the values in the model should be correspondingly reduced. This also applies if the work is being done using only one hand. Most of the influencing factors in the assessment model for lifting work (Appendix A) can also be used for pushing and pulling work.

The unit of force is the newton [N] and is measured using a dynamometer.

Model for identifying and assessing repetitive work

The model supports the identification and assessment of repetitive work. In the final assessment of risk, it is always important to weigh in the total time the work is performed and how it is distributed over the day.

	Red	Yellow	Green
Work cycle	The work cycle is repeated several times a minute for at least half the shift.	The work cycle is repeated several times a minute for at least one hour of the shift or many times an hour for at least half the shift.	The work cycle is repeated a few times every hour.
Work postures and working movements	Constrained or uncomfortable work postures and working movements.	Limited opportunities to change work postures and working movements.	Well-designed workplace. Good opportunities to vary work postures and working movements.
Job decision latitude	The work is completely controlled by other things or persons.	The work is partly controlled by other things or persons. Limited opportunities to influence how the task is performed.	Good opportunities to adapt the work to one's own ability. Influence over the planning and arrangement of the work.
Work content Training/ Competence requirements	The employee performs an isolated task in a production process. Short training.	The employee performs several tasks in a production process. Job rotation can occur. Training for several areas.	The employee participates in several tasks or in the entire production process, including planning and control. Continuous competence development.

Aggravating factors

Some factors that aggravate the risk of musculoskeletal injuries are

- if the work places high demands on the development of force, precision or speed of movement,
- if the work object is heavy and difficult to grasp,
- if a reward system is applied that puts a premium on quantity,
- if there are frequent unexpected disruptions in production over which the employee has no control, and
- if there are weak social relationships and social support at the workplace.

Assessment

The work cycle is the most important factor – if this is in a red area, the work is assessed to be repetitive. Such work is harmful, and it is very important to implement measures in the near future. The risk of adverse effects increases even more if one or more of the other factors are also in a red area. If the work cycle is in a yellow area, the conditions should be evaluated more closely. If one or more other factors are in a red or yellow area, the work is unsuitable and measures should be taken. If the work cycle is in a green area, the work is no longer repetitive. For other factors, the working conditions improve when these move towards a green area. The aggravating factors are always weighed into the total assessment.

Explanations concerning the model

The model assumes a full shift. A shift normally consists of 7–8 hours per day.

Work cycle: The time from beginning to process an object until the same operation recurs with the next object. It is not unusual for the same working movements to be repeated several times within such a work cycle. Fingers and wrists can manage a higher frequency of movement than elbows and shoulder joints without suffering injury. A more serious assessment should be made if large parts of the body are involved.

Work postures and working movements: Assessments of working movements should take into account the body parts that are used. Assessments of work postures should refer to the assessment model for taxing work postures and to the guidance on Section 5.

Job decision latitude: Job decision latitude can be limited by sitting at a conveyor belt, where the employee is unable to affect the speed of the machine. Long queues of customers may also lead to a mental stress that limits job decision latitude. Piecework entails a certain measure of autonomy in that employees can themselves decide how much is to be produced. But, in practice, it often has the opposite effect because there are always minimum requirements with respect to production volume. The concept of job decision latitude is treated in Section 8 and in the general recommendations.

Work content, training and competence requirements. Work content includes viewing the production process as a whole and how one's own work fits together with the whole. A good work content means that the work is made up of parts that are different in character, yet clearly fit together, e.g. by including planning, implementing and controlling operations. Employees have the opportunity to use all their skills and develop in their

work. A job with little work content means that it only consists of one simple task.

There are jobs with a markedly limited work content, whose sole stimulation consists in the amount the individual can produce or the incentive pay associated with this. The mental stimulation of feeling "competent" entails a risk to physical health since the load on the body increases with increased performance while time for breaks and recovery decreases.

Training and competence requirements are the induction, introduction and continuing training that employees need to perform the task. More complicated tasks give employees opportunity to use their physical, mental and creative abilities. Jobs with a varied work content usually require longer training and continuous competence development.