



ERGONOMIC DESIGN



Association
paritaire
du textile

Volume 20, Number 1
June 2003

The Sewing Machine Workstation

The ergonomic design of sewing machine workstations aims to encourage adequate body position and reduce movement constraints to a minimum. The layout is not the only factor in the prevention of professional injuries, and the way work and working methods are organized must also be examined. Elements to consider include the adjustment of workstation components and the selection and maintenance of equipment. This information bulletin is limited to basic notions of ergonomic planning for sewing machine workstations.

In what order should components be adjusted?

The components located nearer the floor should generally be adjusted first, in the following order:

- 1 lateral position of the pedal, and footrest if any;
- 2 height of seat and position of backrest;
- 3 front/back position of footrest;
- 4 second pedal if any;
- 5 height of table or level of machine in case of free-standing machine;
- 6 material pick up and delivery areas.

ADJUSTMENTS TO THE WORKSTATION

When should the workstation components be adjusted ?

Adjustments should be made or reviewed every time:

- operators change workstations;
- a sewing operation is modified;
- the equipment is modified;
- pain or discomfort is signaled;
- a new working station is set-up;
- preventive maintenance is done.



SOURCE

Le poste d'opératrice de machine à coudre: un guide pour aider à prévenir les lésions professionnelles, ASP Habillement, 1996

ADAPTED BY

Stéphane Patenaude, ergonomist

VALIDATED BY

René Dufresne, ergonomist, Appareil ASP

REMEMBER...

- Making compromise adjustments, for example in cases where several operators share one machine, may cause problems for all operators.
- Adjustments should be made even for short periods of work, i.e. under one hour. Discomfort can appear very rapidly when equipment is not properly adjusted.



ADJUSTMENT OF PEDALS

Types of pedals

There are two different types of pedal, with different potential types of constraints:

- **The sewing pedal** is pressed during the entire sewing operation.
- The on/off pedal is pressed down to start the machine and released immediately. It is found as an **additional pedal**, beside the sewing pedal, or as an **on/off pedal** on automatic machines.

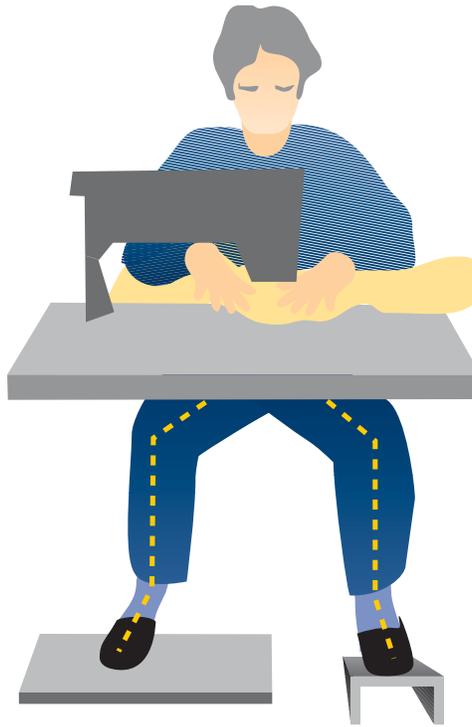
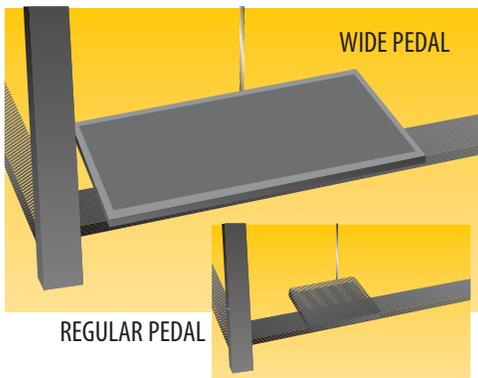
The sewing pedal

WIDTH OF PEDAL

When operators activate the sewing pedal with two feet, the pedal should be wide enough to allow simultaneous activation with both feet. When it is not wide enough, operators have to push their knees together to activate the pedal with their two feet, a movement causing discomfort in the hips and back. Wider pedals encourage better posture and allow proper spacing between feet.

When operators activate the sewing pedal with one foot, it is recommended to install a footrest beside the sewing pedal which should be:

- the same height and at the same angle and front/back position as the pedal;
- wide enough;
- solidly fixed with a non-skid surface.



LATERAL POSITION OF PEDALS

The pedal should be adjusted when the operator is facing the work zone, not necessarily in front of the needle. The pedal should be laterally positioned so that the thigh, leg and foot are in line.

FRONT/BACK POSITION OF PEDALS

The front/back position of pedals should be adjusted when the operator is sitting at the machine in a position that provides a clear view of the work at hand and does not impede movements. The front/back location of the pedal partly depends on the height of the chair.

The front/back adjustment is correct when:

- thighs are approximately horizontal (with a horizontal seat);
- knees are at an angle of approximately 120 degrees.

Adjustment of sewing pedal for work in upright position

Activating sewing pedals while in an upright position causes an unbalance that can result in injuries to the legs, hips and back. These constraints can be eliminated by:

- using thinner pedals so part of the foot remains on the floor;
- linking pedals to a flexible cable so the operator can position the pedals as desired;
- electric pedals embedded in anti-fatigue rugs.

In addition:

- ensure that pedals adhere to floor surface so they will not move when activated;
- if possible, cover floor surface with shock-absorbing material to reduce leg fatigue or provide shoes with ergonomic soles.

To posture constraints is added the fatigue caused by working in an upright position. There are several ways to reduce fatigue.

If operators change machines regularly

When work conditions allow, provide a seat rest even if the operator uses it only for short periods such as when waiting for next batch of material.

If operators work continuously with one machine, including for short periods of time (one hour or two)

Additional fatigue is caused by working in an upright position while continuously remaining in the same location. A higher chair should be provided, including a second raised position for pedals.

Additional pedal

A second, very thin pedal is sometimes located beside the sewing pedal. This pedal activates the sewing machine's presser foot. It is recommended to eliminate the second pedal since operators have to lift and move their foot to press it, causing additional strain to the legs and hips. The second pedal should be replaced with a foot control integrated to the sewing pedal.

If it is impossible to remove the second pedal, position it:

- as close as possible to the sewing pedal to reduce the foot movement;
- at the same height, angle and front/back distance as the sewing pedal.

On/off pedals

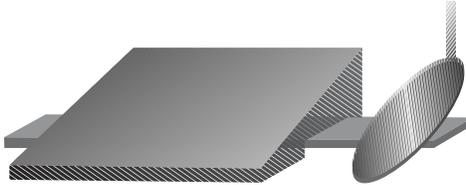
On/off pedals are found on automatic machines such as lockstitch machines, buttonhole and button machines, rivet machines and robot machines. They are generally very thin.

If operators work sitting down, pressing the pedal with only one foot will not lead to fatigue or discomfort as long as the workstation design follows certain rules:

- place the pedal under the foot used to press on it, off center from the operator;
- adjust the front/back position of the pedal;
- place a footrest under the inactive foot to balance posture and prevent numbness in the inactive leg.

If operators work standing up, applying pressure to pedals is an important source of strain to the legs and back, especially if the operator always remains in the same location. Even on automatic machines, it is much preferable to work in a sitting position if the job design allows it.

If it is not possible to work sitting down, the pedals should be replaced with other types of command mechanisms such as hand controls or foot forward commands.



ADJUSTMENT OF CHAIRS

In order to maintain adequate body position when working in a sitting position, operators should be provided with the right chair. The chair should be adjusted according to the size of the operator and the type of operation performed.

Features

Chairs for sewing machine operators must be of solid construction and include the following features:

SEAT:

- easy and rapid height adjustment;
- pivoting mechanism (particularly if operators need to turn sideways to pick up and deposit material);
- smooth surface to avoid compressing underside of thighs and adequate width to accommodate larger persons;
- not too deep.

BACKREST:

- adjustable height, low enough to support lower back of smaller individuals;
- adjustable front/back position, advancing enough to support back of operators of all sizes;
- relatively small size, to avoid blocking movements of the shoulder blades and elbows.

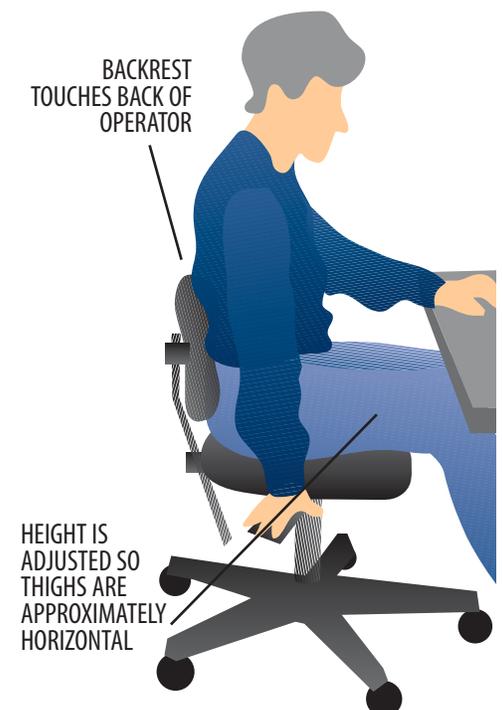
OTHER FEATURES:

- no rollers or blocking mechanism for roller feet, if applicable;
- padded cover for seat and backrest.

Chair adjustment

HEIGHT OF CHAIR

Adjustments should be made when the operator is sitting at a normal distance from the sewing area and feet are on the pedals. The chair height should be adjusted to make the seat and thighs approximately horizontal. If the chair is too high, the underside of thighs will be pressed against the front edge of the chair; if too low, the body weight will be tilted backward, which will cause discomfort in the buttocks area. If significant modifications to the adjustment are made, the height of the chair and the location of pedals will both need to be adjusted accordingly.



BACKREST ADJUSTMENT

The backrest should be adjusted when the operator is sitting at a normal distance from the sewing area. The backrest is moved forward until it comes in contact with the lower back of the operator. The operator should not need to back up in the chair in order to lay against the backrest, and the backrest should not push the operator forward either. The backrest should be positioned at the most appropriate height for the operator.

ADJUSTMENT OF SEWING TABLES

Most industrial sewing machines are mounted on sewing tables. Some types of machines such as ordinary and overcasting machines are built into the table while others are top-mounted, like most automatic machines and those with raised flatbed.

Features

TABLE SIZE

The table should be large enough to support material while sewing is being done.

Tables that are too small may:

- cause bunching around the needle, or
- force operators to push and pull material during the sewing operation.

A work surface of adequate size gives operators ample room to pick up and deposit material, and avoids the need for potentially harmful movements to lean sideways or backward.

WORK SURFACE

The surface should be completely smooth in order to make material handling easier.

In order to prevent visual fatigue:

- avoid severe light contrasts on the table, especially around the needle;
- remove any source of light reflection around the needle to prevent dazzling;

- select a surface with a matte finish in a neutral shade.

WORK LAMP

Adequate lighting of the work area helps prevent visual fatigue and promote proper body position. Lamps used for spot lighting should include the following features:

- adjustable components to accommodate different operators;
- swan neck or articulated arm to direct light as needed;
- a lamp shade completely covering the sides of light bulbs to avoid dazzling;
- blocked air holes (on operators' side only), also to avoid dazzling;
- light bulbs with adequate wattage and low heat diffusion. The desired light intensity varies according to factors such as the age of the operator, the level of precision of the work being done and the quality of the work surface.

Armrests

Tables should be equipped with supports for the forearms except where operators work with hands close to the body, as is the case with some automatic machines. In order to prevent back and shoulder injuries, proper forearm support should be provided in situations where operators have to work with hands above and in front of them, or with elbows raised sideways. If the table design does not include arm support, consider adding armrests, which can be installed on the table or the chair. They should be adjustable for height and for front to back position so that arms and elbows are supported without impeding the operator's movements or preventing operators from bringing their chair closer to the machine. If armrests cannot be installed, other solutions should be found.

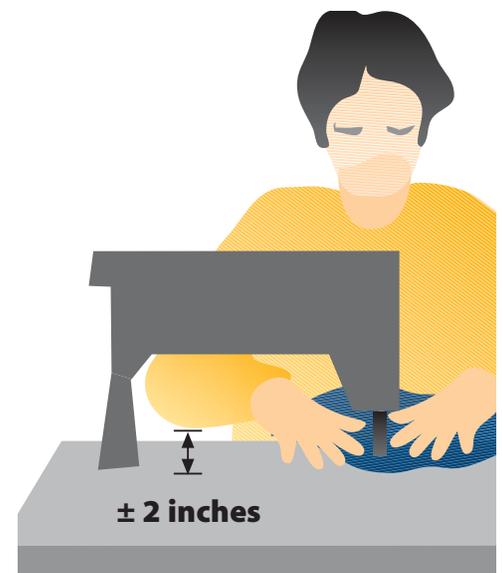
Space under the table

The space under the sewing table must be left uncluttered to leave ample leg room. Clutter under the table can force the operator to adopt an uncomfortable body position at the workstation. Remove motors, control boxes, drawers and any other equipment that may prevent proper positioning of the legs or obstruct pedal operation. For instance, chutes for cuttings of material at overcasting machines should not be located under the table: they can be placed higher up or replaced with aspirators.

Table adjustment

HEIGHT

Even if the operator remains the same, the proper table height can vary according to the work done and the size of the material handled. Therefore the right height is not always at elbow level. The proper height for the table can be determined by observing the operator's body position. If she needs to bend forward to work, the table is probably too low. If she needs to raise her shoulders, the table is too high. The table should be adjusted within ± 2 inches of the operator's elbow. An operator working at a well-adjusted table will not need to lean forward or raise her shoulders. Remember that adjustments to the table should be done after the pedals and chair have been adjusted.



TILT

The sewing table can be tilted forward to encourage operators to refrain from bending their heads. If tables with an integrated tilting mechanism are unavailable, the same result can be achieved with ordinary sewing tables by raising the back legs. The angle of tilt is adjusted once the table is at the proper height. However, this adjustment may cause problem to the lubrication system of certain models of sewing machines.

MATERIAL PICK UP AND DEPOSIT

Movements to pick up and deposit material can cause injuries to the back and shoulders. Risks result from the weight of material bundles and the location of handling areas in relation to the operator.

There are several ways to reduce risks of injuries:

- design pick up and deposit areas adequately;
- pack material in lighter bundles;
- install mechanical aids where possible.

Material handling areas

POSITION

Operators should be able to pick up and deposit material directly in front of them, never behind, to avoid potential back and shoulder injuries. Handling areas may be located:

- on the sewing table;
- on shelves installed over the table;
- on a retractable shelf over the operator's knees;
- on a retractable stalk.

If material handling areas cannot be positioned in front of the operator, they can be positioned slightly to the side as long as operators do not have to make movements that may lead to shoulder injury. Material is generally picked up and deposited on tables, carts, bins, stands or conveyors.

HEIGHT

Pick up and deposit areas should be located at waist level so operators are not required to bend down or reach up too far. Remember that the location of handling areas should be determined only once other components of the workstation have been adjusted. The workstation design should place handling areas:

- directly in front of operators;
- approximately at waist level.

Material bundles

Handling material bundles from a sitting position puts a greater strain on the back and shoulders. Handling operations should be performed standing up. If this is not possible, the following measures should be taken:

- reduce the size and weight of bundles to a minimum;
- stack bundles properly;
- use solid ties that are easy to put on and remove.

If material handling areas are located at waist level, prepare smaller bundles of material. Place larger and heavier bundles on work surfaces that can be lowered or raised by the operator.

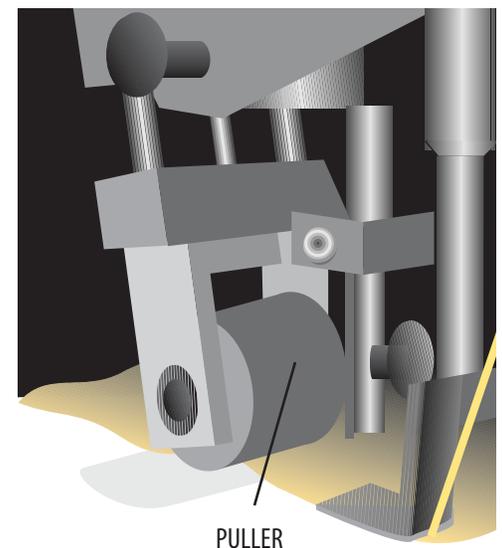
Mechanical aids to facilitate material handling such as automatic stackers or robot arms are available. They can help reduce back and shoulder strain. Handling aids should be installed only if no other ways to eliminate risks have been found.

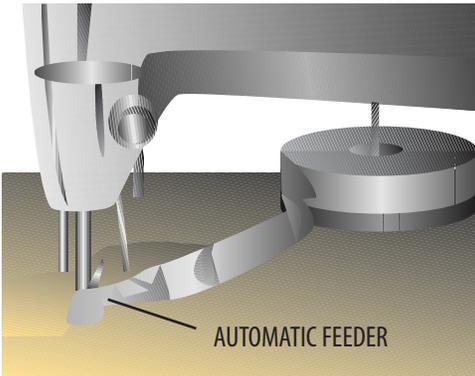
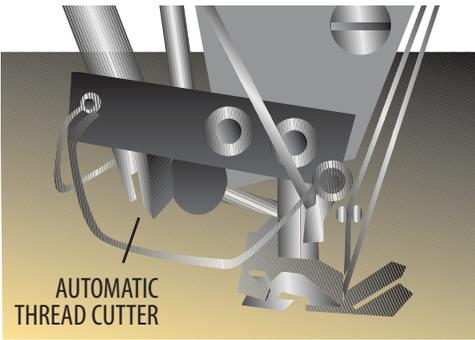
ACCESSORIES

Various accessories can be added to sewing machines in order to lower the work load and help reduce the risks of injuries to the back or upper limbs (hands, wrists and elbows). However, some accessories such as manual hemming machines will cause additional strain so all aspects of proposed attachments should be carefully examined.

Accessories to facilitate work

Accessories such as pullers, automatic thread cutters and automatic feeders for material strips and elastic material can all make the operators' work easier. They can also help eliminate movements presenting a potential risk of injury such as pulling and pushing material with the fingers, pressing down on material with the fingers or repeatedly stretching the arms forward (to cut thread by hand).





TOOLS

The tools most widely used by sewing machine operators are scissors and thread cutters. Using these tools can lead to hand and wrist strain. There is also a danger caused by dropping scissors.

When using scissors or thread cutters, avoid:

- making strenuous movements with the wrists (flexing or bending);
- applying excessive pressure on fingers or palm;
- rubbing the skin on rough or sharp parts of the tools.

To avoid strenuous movements of the wrists:

- choose scissors or cutters designed to keep wrists straight during use;
- perform cutting operations in an area with enough room to allow work with straight wrists.

To avoid excessive pressure on hands:

- adapt the size of the handle to the size of the operator's hand;
- provide a choice of left-handed and right-handed scissors;
- keep tools sharp.

To avoid injuries to the skin:

- choose models with a rounded, smooth design.

Finally, in order to avoid dropping scissors, secure them to the table with a solid elastic band or with Velcro.



The Préventex newsletter is published by

Préventex – Association paritaire du textile

2035, Victoria avenue, suite 203
Saint-Lambert QC J4S 1H1
Telephone: (450) 671-6925
Fax: (450) 671-9267
e-mail: info@preventex.qc.ca
www.preventex.qc.ca

General manager and newsletter editor

Jean-Marc Champoux

Co-chairman (Employers)

Jacques Hamel
Cavalier Textiles inc.

Co-chairman (Unions)

Pierre-Jean Olivier
TUAC/COUTA

Coordination

Lise Laplante

Copy editor

Pierre Bouchard
Indico Communication

Translation

Paule Champoux-Blair

Graphic design

Anne Brissette Graphiste

Printing

Imprimerie For inc.

Préventex, its managers and personnel, as well as authors of articles published in the Préventex newsletter make no guarantee as to the accuracy of the information contained therein nor as to the pertinent efficiency that may be inferred from this information, and therefore accept no responsibility. The information contained in the newsletter should not be considered professional advice. Mention of products or services by advertisers or in articles does not constitute an endorsement or recommendation of same.

The Préventex newsletter is distributed free of charge to members of the textile and knitting industries in the Province of Québec. Its contents may be duplicate provided prior authorisation is obtained from Préventex and the source is mentioned.

Legal deposit:

September 1st, 1994
ISSN 0825-4230

Printing: 2500 copies

