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Ergonomic Checklist for Forest Machines

Editors: R. Almqvist, Swedish University of Agricultural Sciences, Uppsala, Sweden
S. Gellerstedt, Swedish University of Agricultural Sciences, Uppsala, Sweden
R. Tobish, Kuratorium für Waldarbeit und Forsttechnik, Germany

Foreword

The Ergonomic Checklist for Forest Machines is for checking if a machine fulfils ergonomic and safety requirements. You can use it at inspection of your machine, or before buying a new one. This checklist is a simplified edition of the European Ergonomic and safety Guidelines for Forest Machines, which is mainly for use by the machine manufacturers.

The Ergonomic Checklist is a result of the EU project ErgoWood (2002-2005) with partners from France, Germany, Norway, Poland, Sweden and United Kingdom as well as a reference group in Finland.

This checklist as well as the European Ergonomic and Safety Guidelines for Forest Machines can be downloaded from http://www2.spm.slu.se/ergowood.

Publisher, responsible under Swedish law:
Mats Nylinder, Department of forest products and markets, Swedish University of Agricultural Sciences, Uppsala, Sweden.

Illustrations: Abbonland Illustration and Hans Fryk

Contents

Ergonomic profile

The Ergonomic Checklist leads you step by step through the most relevant ergonomic and safety features of the machine. In order to gain an overview it is appropriate to compile an ergonomic and safety profile of the machine.

When checking the machine, write the number of green, yellow and red assessment for each item in this profile!

Ergonomic profile			
	Number of marks		
Section	**Green**	**Yellow**	**Red**
Cab access			
Working posture			
Cab			
Visibility			
Operator's seat			
Controls			
Operating			
Winch			
Noise			
Vibration			
Cab climate			
Lighting			
Instructions and training			
Maintenance			

Green [1)]	Yellow	Red
Acceptable working conditions for full time work regarding health and safety.	There is a risk for health problems and injury. Need for changes, but not urgent.	Risk for health problems, illness and injury is obvious. The checked detail cannot be accepted without changes.

Except from familiarity with the machine operations, the only things you need are a pen, a piece of paper, a measuring-tape and a watch showing seconds. You answer the item asked for in the checklist and judge if it is in the green, yellow or red zone. Consider that a red valued point for one factor can be of much higher risk than a red valued point for another. Working posture, operation and vibration are the most important factors influencing health.

[1] Green is based on level 1 or 2, yellow on level 2, 3 or 4 and red on level 4 or 5 in the European Ergonomic and safety Guidelines for Forest Machines.

Basic data

Machine: **Date:**

Model, make/brand: .....

.....

Year of manufacture: ..... Total operating hours (meter reading): .....

Equipment (e.g. winch, remote control): .....

.....

Manual (edition): .....

Interactive software (version): .....

Special arrangements or equipment differing from the normal type: .....

.....

Operator involved in the testing:

Size (approximate length and weight): .....

Age and experience .....

Testing personnel:

Name: .....

Name: .....

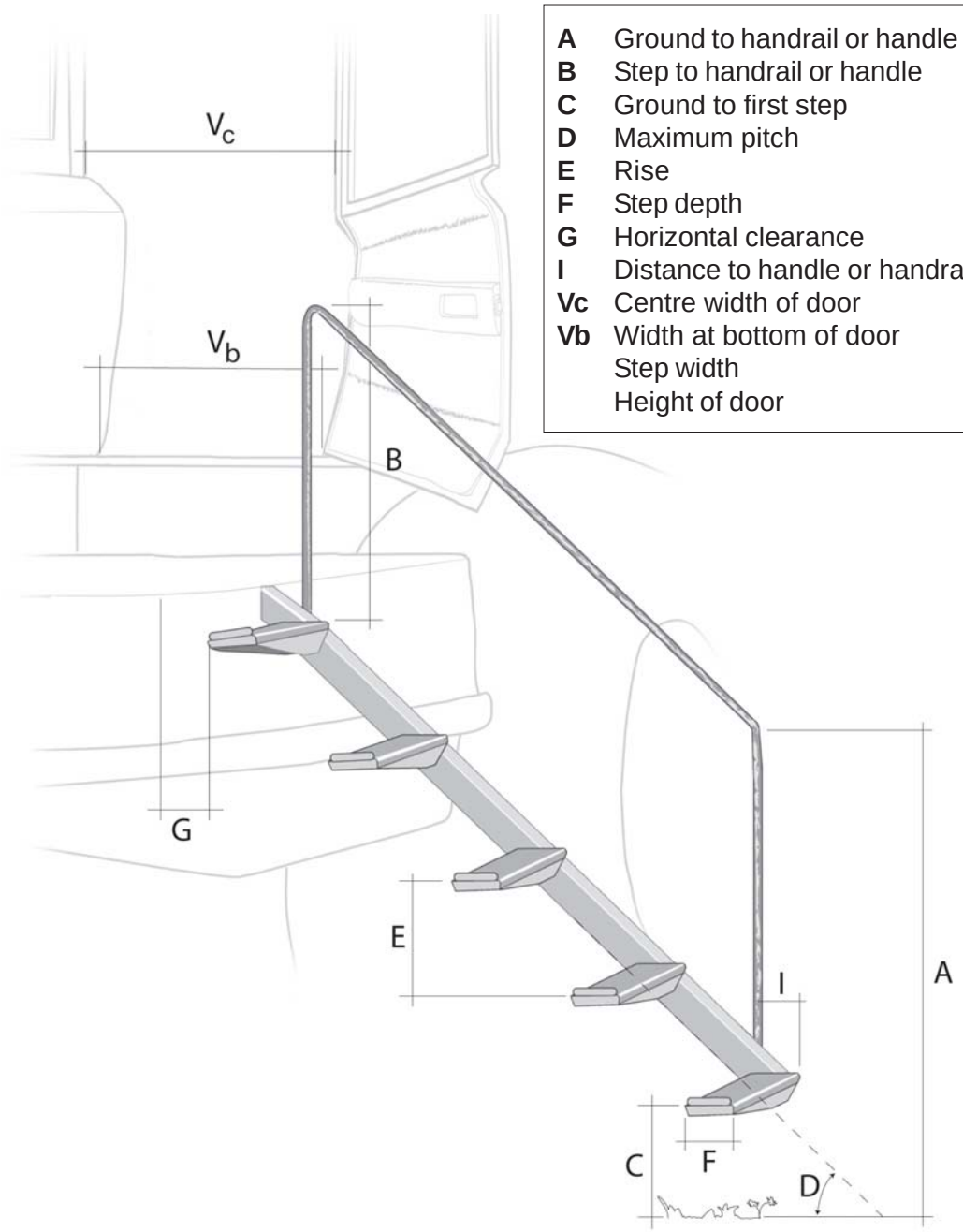
Name: .....

Notes:

Cab access

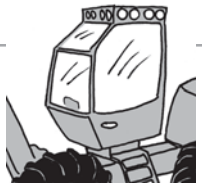
Many accidents among forest machine operators occur when they are mounting or alighting from the machine. Such accidents are usually caused by the operators missing their footing, falling, slipping, or jumping down from the machine. Climbing onto a wheel or track incurs an additional risk of slipping.

If the means of access is inconvenient, the operators are tempted to jump down, which in time can result in damaged hips, knees, or feet. Poorly designed access may also constitute a hindrance to older operators. Poor access conditions may deter the operator from leaving the cab for necessary rests or outdoor work duties.



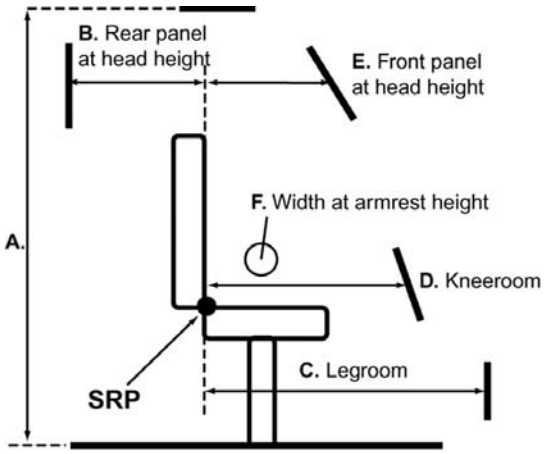
A	Ground to handrail or handle	85-130 cm
B	Step to handrail or handle	85-100 cm
C	Ground to first step	≤ 40 cm
D	Maximum pitch	≤ 50°
E	Rise	20-30 cm
F	Step depth	≥ 24 cm
G	Horizontal clearance	≥ 15 cm
I	Distance to handle or handrail	≤ 63 cm
Vc	Centre width of door	≥ 65 cm
Vb	Width at bottom of door	≥ 45 cm
	Step width	≥ 40 cm
	Height of door	≥ 170 cm

Green	Yellow	Red
☐ **1 Foot steps** The distances and dimensions of the footsteps are according to the figure. Allows alighting from the machine forwards.	☐ Slight divergence from recommended measures. The operator has to enter/exit the machine with some undesirable body movements.	☐ The operator can enter/exit the machine only with great difficulties.
☐ **2 Handrail or handle** Placed according to the figure. Has a comfortable grip and hand clearance. Allows alighting stepping down forwards.	☐ Handrail or handle available but with shortcomings in construction. They can be used but with some difficulties.	☐ Handrail or handle lacking or can be used only with great difficulties.
☐ **3 Risk of slipping** Self cleaning steps and platforms with a good grip and minimum risk of slipping.	☐ Some difficulties in keeping steps clean. Slip protection available.	☐ Difficult to keep steps clean and/or slip protection lacking. Wheel or track used.
☐ **4 Cabin entrance** Main door opening;height ≥ 170 cm, width, in the centre part ≥ 65 cm, width at bottom ≥ 45 cm.	☐ Shortcomings concerning recommended measures.	☐ Too narrow opening; height < 130 cm or centre width < 45 cm or bottom width < 25 cm
☐ **5 Cab door** Cab door is easy to handle and remains open when machine is tilted or in wind.	☐ Cab door is not sufficiently easy to handle or cannot always stay open when needed. No risk for pinching.	☐ Cab door heavy and difficult to handle, does not remain open when needed.
☐ **6 Emergency exit** In addition to the main cab entrance there is at least one functional emergency exit with sufficient space provided.	—	☐ Emergency exit with limited space or no emergency exit provided.
Number of green marks:	**Yellow marks:**	**Red marks:**



Cab

The size and design of the cab have a critical influence on whether the operator can work efficiently. A cramped or poorly designed cab forces the operator to work in a fixed posture that is both tiring and, in time, detrimental to health. The volume of the cab must also be adequate for a satisfactory climate to be achieved.



Recommended value (cm)		Measured value
A 180	Head room	A _____
B 55 [1)]	Seat in rear position	B _____
C 115	Seat in rear position, measured at toes	C _____
D 83 [2)]	Seat in forward position and at mid-height	D _____
E 65	Seat in forward and highest position	E _____
F 100 [3), 4)]	Cab width measured at armrest height	F _____

1) 70 cm is needed for a seat that tilts forwards and backwards
2) Measurement from SRP to inside limit (wall, steering wheel, computer screen, etc.).
3) With both forward and reverse machine operation, 65 cm of clearance from the SRP is needed for rotation.
4) A machine not equipped with levelling may be fitted with a laterally tilt-able seat requiring greater cab width.

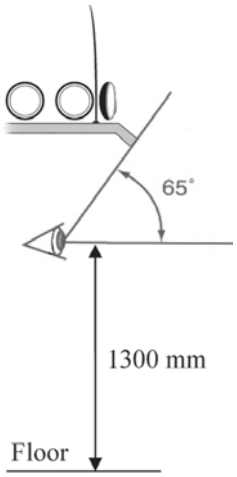
Green	Yellow	Red
☐ **1 Cab space** Cab space fulfils the recommended measurements in the figure.	☐ Maximum two of the measurements are slightly shorter than the recommended.	☐ One or more of the measurements do not reach the following figures: A 151, B 44, C 60, D 73, E 55 and F 92.
☐ **2 Operator's protection** The operator is protected against objects which could penetrate the cab or its windows, such as flying links from a broken chain.	—	☐ Sufficient protection lacking.
☐ **3 Stowage space** There is sufficient stowage space for first aid kit, manuals and personal items.	☐ Not fully adequate.	☐ Lack of stowage space or major shortcomings.
Number of green marks:	**Yellow marks:**	**Red marks:**

Visibility

Poor visibility increases the risk of accidents, reduces productivity and forces the operator to assume poor working posture. The problem of poor visibility is aggravated if the operator has to follow the boom movement from a fixed cab.

The need for good visibility conflicts with suitable placing of the boom, thick cab pillars, sturdy rollover protection (ROPS), and protective grilles. A large, spacious cab affords the operator a poorer view of the ground.

Assessment of vertical angle:
Eye should be positioned 1,3 m above floor. The seat should be vertical and in middle position of legroom adjustment range, see figure.



Green	Yellow	Red
1 Visibility of the ground ☐ In the working envelope of the boom, the operator can see the ground at least 2 m from the side of the machine (wheel). In driving direction the ground can be seen at least 5 m in front of the machine (from SRP).	☐ The operator can see the ground at least 4 m from the side and at least 7 m in front of the machine.	☐ The operator can not see the ground 4 m from the side or 7 m in front of the machine.
2 Vertical view ☐ In working position the operator's view upwards is 65° or more in harvesters and 50° or more in forwarders and skidders, see figure.	☐ Limited area of vertical view (harvester 40° - 65°, forwarder 30° - 50°).	☐ The operator has obvious problems with the vertical view (harvester <40°, forwarder <30°).
3 Operating view ☐ Free view in all used directions is not obstructed by boom posts, cab stays or equipment. Operator need not shift sitting position to obtain view of working area.	☐ View obstructions force the operator to use unfavourable postures occasionally.	☐ The operator frequently uses unfavourable body postures to be able to view the working area.
4 Window cleaning ☐ All windows are equipped with a wipe-wash system and de-icing nozzles which have the capacity to keep the windows clean and dry at all weather conditions.	☐ Wiped area is limited or de-icing and other cleaning possibilities have short-comings.	☐ Wipers or de-icing system lacking or with very poor function. Shortcomings regarding manual cleaning.
Number of green marks:	**Yellow marks:**	**Red marks:**

Operator's seat

The operator's seat on a forest machine should provide adequate support for the legs, thighs and back and generally support the body for comfortable and convenient operation of the controls. One of the prime causes of back problem is sitting in the same position for long periods. Armrests and controls should be positioned conveniently regardless of the operator's posture.

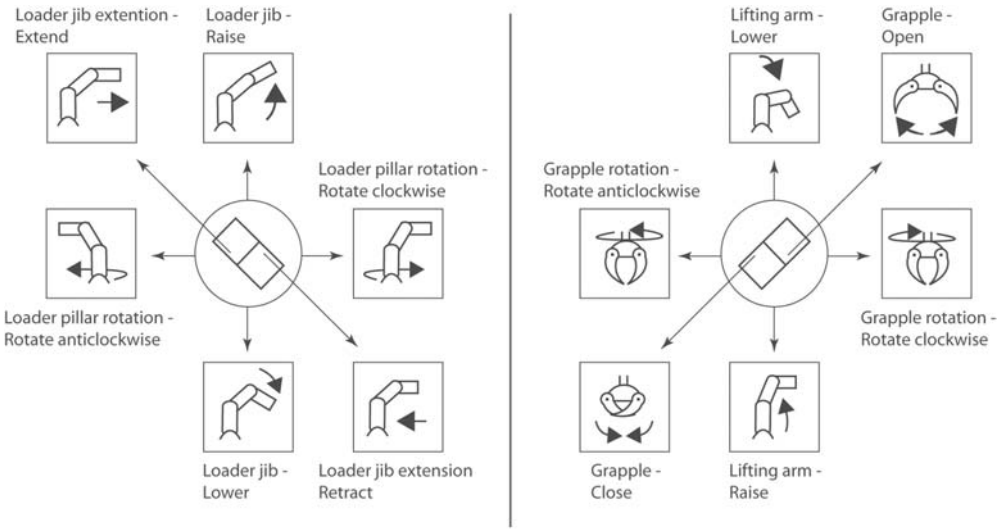
Legroom	Height	Lateral tilt 2)	Fore-aft tilt 2)	Backrest angle	Seat pitch
≥ 24 cm	40-55 1) cm	±10-15°	> ± 20°	- 5-30°	Up 8° Down15°

Distance between armrests	Armrest swivel	Armrest height	Armrest pitch	Armrest length	Pitch sideways
42-52 cm	In 30° Out 15°	12-27 cm	< - 30-0°	20-30 cm	± 10°

1) Measured with a medium sized person in the seat.
2) Depending on whether the operator's seat or cab can be levelled

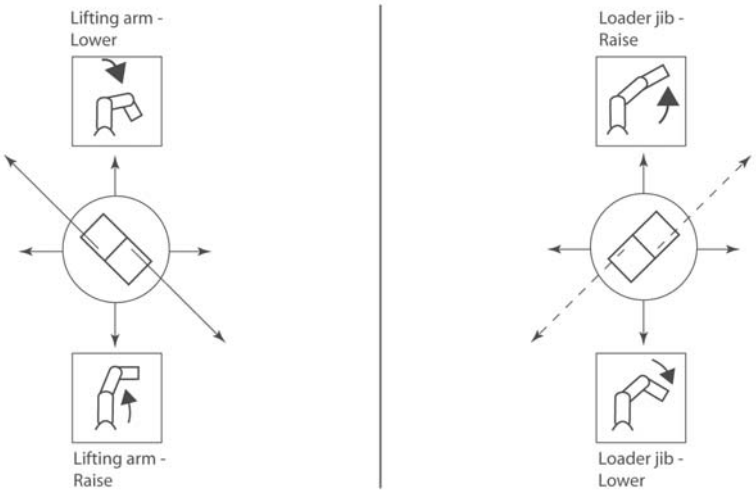
Green	Yellow	Red
1 Adjustment possibilities ☐ The operator can adjust the seat according the figure.	☐ Minor shortcomings regarding the possibility to gain a comfortable sitting position or to change it at full range.	☐ Legroom; less then 10 cm or lowest height; more than 54 cm or height range; less then 7,5 cm.
2 Seat stability ☐ The seat is well sited, anchored and easy to maintain.	☐ Minor shortcomings.	☐ Major shortcomings.
3 Suspension and damping ☐ Good damping vertically and horizontally, protecting from vibrations as well as shocks. These qualities are valid also with the seat in its lowest position.	☐ Shortcomings in damping for light and heavy persons.	☐ Poor damping.
4 Seat tilt ☐ For and aft tilt and lateral tilt in accordance with the figure.	☐ Minor shortcomings.	☐ No tilting possibilities or for and aft tilt less then ± 10°, lateral tilt missing.
5 Space under the seat ☐ Feet have enough space under the front of the seat, when knees are bent 60° or less.	☐ Knees can be bent 60 - 80°.	☐ There is no room for feet under the seat.
6 Backrest ☐ The backrest is comfortable regarding width and height. It is adjustable within an angle range of - 5° to +30°.	☐ Minor shortcomings concerning adjustability.	☐ Shortcomings concerning height and width. Backrest fixed or adjustable less then +5° to +15°.
7 Armrests ☐ All dimensions and possible adjustments are equal to the recommendations in the figure.	☐ Minor shortcomings referring to the dimensions. Only one of the adjustment possibilities lacking.	☐ Major shortcomings or armrests not provided.
8 Settings ☐ Individual settings of all seat and armrests functions can easy be done in less than 1 minute, automatically or manually. Graded scales are available.	☐ All setting possibilities are available, takes less than 2 minutes to perform.	☐ Some settings missing, settings are done manually with some difficulty or tools needed.
9 Armrests/seat ☐ Armrests follow seat movements automatically.	—	☐ Shortcomings.
Number of green marks:	**Yellow marks:**	**Red marks:**

Controls



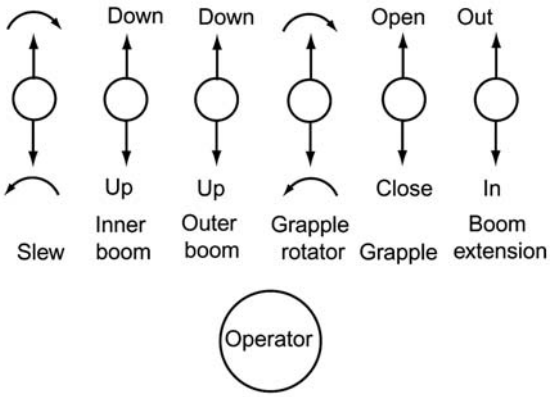
System A

Log loader controls, two lever system operational pattern (from ISO 15078). For system B only the differences from system A are illustrated.



System B

Lever sequence and function controls for booms, primarily log loaders, that are manoeuvred with six hand levers (RTG 6907).



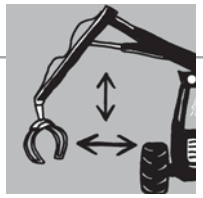
The choice of controls and pushbuttons together with their location and design has a great bearing on the precision and speed of the work and on the strain imposed on hands, arms, shoulders and neck.

Green	Yellow	Red
1 Lever functions ☐ Lever moves activate functions according to the figure.	—	☐ There are divergences from the standards.
2 Primary control location ☐ All primary controls[1] within the zone of comfort.	☐ One or two controls outside the zone of comfort.	☐ More than two controls outside the zone of comfort.
3 Secondary control location ☐ All secondary controls[2] within the zone of comfort or the zone of reach (without leaving the seat).	☐ Only the very seldom used controls outside the zone of reach.	☐ Important controls are outside the zone of reach.
4 Accidental activation ☐ Accidental activation of controls when leaving or entering cabin is prevented.	—	☐ Accidental activation not prevented.
5 Adjustment possibility ☐ The position of levers and control panels are possible to adjust to suit different operators. Scales provided.	☐ Moderate shortcomings, e.g. adjustable but with slight difficulties.	☐ Not possible to adjust or with major shortcomings.

Remote controls

6 Remote control function ☐ Remote control has an emergency stop and machine function returns to neutral when the machine looses contact with the remote control.	—	☐ Emergency stop missing or the machine functions do not return to neutral when the emergency switch is activated.
7 Alarm signals ☐ Alarm signals are clearly perceptible from outside the machine. All warnings are displayed on the remote control unit.	☐ Central alarm on the remote control unit or central acoustic alarm.	☐ Alarm cannot be registered from outside the machine.
8 Protection ☐ The transmitter and the receiver of the remote control are well protected.	☐ Protection is not sufficient.	☐ Very poor protection or protection is missing.
Number of green marks:	**Yellow marks:**	**Red marks:**

[1]Primary controls: used frequently or constantly by the operator such as boom, grapple, harvester head, processor, brakes, steering, throttle, etc.
[2]Secondary controls: used infrequently by the operator such as switches for the lamps, wipe-wash system, lighting, starter, heating unit, air-conditioning etc.



Operating the machine

Functions of a forest machine should be straightforward and sequential, and always behave in the same way. Different functions requiring high attention should not be concurrently with other manually operated functions. Poorly designed and presented information on displays cause fatigue and may contribute to pain in neck and shoulders and head ache.

The operator's repetitive and exact movement of hands, arms and head during machine work means that the same muscles and joints are being used all the time. This gives a high risk for pain and ache in neck, shoulders and arms. To avoid this risk, control of the boom and its tool needs to involve frequent natural breaks during each work sequence, e.g. a boom cycle.

Green	Yellow	Red
☐ **1 Functions and processes** Operator has full control over automated functions, can take over immediately. Automated processes stops when the operator leaves the cab and have to be restarted by the operator.	—	☐ Discrepancy.
☐ **2 Protection against movements** Neither the machine nor its components can move spontaneously. The machine can only be moved if the operator is on the operators stand.	☐ Protection against spontaneous movements, but can easily be manipulated.	☐ No protection against spontaneous movements.
☐ **3 Correcting boom path** When handling trees/logs, the boom follows the path without any need of corrections, only on full reach may it be need of some correction.	☐ Corrections are needed during the path when handling heavy trees.	☐ Corrections are needed for a boom without load on full reach.
☐ **4 Control activations** Only three control activations are needed to reach a given point above the ground with the boom.	☐ Four control activations are needed.	☐ More than four control activations are needed.
☐ **5 Brake condition** With foot-brake engaged, the machine cannot move when an attempt to pull away in the lowest gear is made.	☐ The machine cannot move when an attempt to pull away in the second gear is made.	☐ With foot-brake engaged, the machine moves when trying to pull away in the second gear.
☐ **6 Displays** The visual displays for operator control are close to the operator's field of view (within ± 30°).	☐ Displays within ±45° horizontal view.	☐ Displays more than ±45° horizontal view.
☐ **7 Displays legible** Text, symbols, and colours on displays are clearly legible in all day-light and darkness conditions.	☐ Parts not legible in sunshine. Light intensity of the displays not adjustable.	☐ All displays not legible in sunshine. No illumination in darkness.
Number of green marks:	**Yellow marks:**	**Red marks:**

Working posture

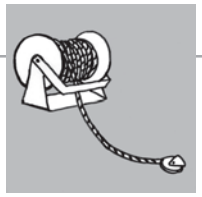
The operator's body posture and movements in the cab are influenced by the cab, seat and controls, and by visibility and operation of the controls. The working posture is also affected by machine vibration and jolting.

The joints of the operator's body when seated in the cab should be at a comfortable angle and not fully straightened. Accordingly, the shoulders should be relaxed, the upper arms parallel to the body and the forearms at an angle of 105° or more to the upper arms. The operator should be able to shift his position freely from this basic posture, being able to straighten the body and stretch the legs. He should also be able to bend his knees and place his feet under the seat, and to vary his position, e.g. by sitting higher up.

A level seat is conducive to a relaxed posture, in contrast to one that is tilted, which is very tiring. If levelling can only be provided in one direction, priority should be given to lateral (side-ways) levelling.

Backward bending of the head should be avoided, as injuries can occur in this position, particularly if the machine is jolting. The operator should not have to turn his head frequently or for long periods. The cab shall be capable of swivelling freely within the working envelope and independently of the boom.

Before checking this section, assess Cab, Visibility, Seat and Controls.		
Green	**Yellow**	**Red**
☐ **1 Basic posture** Operators of different stature can assume a relaxed basic posture in which the controls are within optimum reach and good visibility is afforded.	☐ Some difficulty for operators of above or below average stature.	☐ Difficulty for most operators to assume a good posture.
☐ **2 Changing posture** The operator can easily change the sitting posture, straighten the body and stretch the legs.	☐ Limited possibilities to change sitting posture.	☐ Very little possibility for varying sitting posture.
☐ **3 Tilting for horizontal posture** The machine or cab can automatically be tilted through 10-15° laterally and 20° longitudinally for levelling.	☐ Minor limitations in levelling laterally or longitudinally. Tilting possibilities only by the seat.	☐ No levelling function other than by the influence of e.g. oscillating axle or bogie.
☐ **4 Swivelling** The cab on a harvester can be swivelled independently of the boom in any direction within the working envelope.	☐ Shortcomings referring to the swivelling function.	—
Number of green marks:	**Yellow marks:**	**Red marks:**



Winch

The highest accident risk when working with a winch occurs when the cable breaks under tension. A snapped cable may kill a person. In addition, there is a danger of chain links and other parts of the attachments suddenly breaking and being catapulted through the air.

A higher maximum line pull of the winch requires a thicker and therefore heavier wire. Unravelling a heavy wire is an arduous task for the operator. A spool out device can only provide a moderate amount of relief in this task. Remote control is commonly used for operating winches and is to be checked in section ”Controls”.

Green	Yellow	Red
☐ **1 Winch size** The machine is big enough in relation to the winch (approximately two times its weight in kg compared to the winch line cable pull in kN).	☐ The winch is a little bit too big in relation to the machine weight.	☐ The winch is oversized in relation to the machine (the same cable pull as the machine weight or more).
☐ **2 Winch wire durability** The cable pull power is limited to not be exceeded in relation to the dimension.	—	☐ The line pull power can be exceeded or the cable dimension is not sufficient.
☐ **3 Wire size** The quality and dimension of the wire is sufficient and weight not uncomfortably high for the operator.	☐ The weight is slightly to high for the operator.	☐ Not sufficient quality or dimension.
☐ **4 Size of drum, blocks etc.** The diameter of the drum and all blocks and pulleys exceed the wire diameter by a factor of at least 11.	☐ Ratio drum etc. and wire diameter less than 11 but more than 8.	☐ Ratio less than 8.
☐ **5 Winching speed** The winching speed is comfortable for the operator and is possible to adjust e.g. for different log sizes and terrain conditions.	☐ Winching speed is not adjustable but fairly comfortable.	☐ Fixed speed is too fast or too slow.
☐ **6 Brake system** The winch brake engages automatically and immediately after winching is stop. Brake force exceeds the maximum pull force of the winch.	—	☐ The brake system is too weak.
☐ **7 Guards** All cable inlets (to drum, blocks and pulleys) are well guarded against accidental pinching of hands or other parts of the body.	—	☐ One or more guards are missing.
Number of green marks:	**Yellow marks:**	**Red marks:**

Noise

The noise level in a forest machine seldom risks to damage hearing. However, that noise can be irritating, tiring and hiding acoustic signals, which can result in fatigue and lower productivity. It should be possible for the operator to have a telephone conversation without raised voice or increased sound in the loud speaker of the phone.

Green	Yellow	Red
1 Noise level in cab ☐ No problem to hear when speaking in a normal voice level or to hear acoustic machine signals (noise level below 70 dB).	☐ Some problems to hear when speaking in a normal voice. Radio has to be put on higher volume and machine signals could be difficult to hear properly.	☐ Speaking in a normal voice is not possible. Signals are difficult to hear (noise level probably exceeding 80 dB).
2 Other undesired sounds ☐ The cab has no irritating or tiring sounds such as irregular or shrill sounds, sudden changes in the sound or sounds transmitted through chassis or else.	☐ Undesired sounds exist, but only during minor parts of the operation.	☐ Undesired sounds exist during major parts of the operation.
Number of green marks:	**Yellow marks:**	**Red marks:**

Vibration

Whole-body vibrations and jolting are uncomfortable and fatiguing for the operator. In addition, precision work is made more difficult and the operator may have difficulty in keeping his eye on the work piece being handled. Many years of exposure to vibration can have a detrimental effect on the operator's health. The lower back is particularly prone to injury, most often caused by mechanical shocks. Neck and shoulders are vulnerable as well, especially in combination with frequent turning of the head and looking upwards.

The level of vibration and jolting is affected by driving speed, ground conditions, tires, springs/ damping in the chassis, cab and seat, and the operator's working technique. Usually, whole-body vibration is transmitted to the operator through the cab and seat. The condition of the cab and the seat in that respect will be treated in respective chapters.

The assessment of vibration level has to be based both on machine construction and by a driving test with an interview of the operator. The test shall preferably be done in a little bit tougher conditions than in normal work.

Assessment based on machine construction

Green	Yellow	Red
☐ **1 Cab siting** The cab is suspended, with special damping or other solution for minimising vibrations.	☐ At least one of the mentioned arrangements are made.	☐ No such arrangements are made.
☐ **2 Wheels and tracks** Vibrations are minimised by bogies or oscillating axles as well as by lenient tracks and wide tires or central tire inflation.	☐ Some reduction of vibrations by some of the arrangements as in the green level.	☐ No special arrangements for minimised vibrations.
☐ **3 Transmission** The machine has the ability to smoothly ride a ditch or a rock and the ground hugging ability allows very few slips.	☐ Slow driving is difficult when passing hindrance. The machine has a tendency to slip.	☐ The machine has a stiff transmission not allowing smooth driving.

Assessment based on perceived comfort

☐ **4 Whole-body vibration** The operator perceive discomfort (e.g. during fast driving) less than 10 % of a work cycle (e.g. a loading/unloading turn with a forwarder), otherwise very slight discomfort.	☐ The operator perceive discomfort less than 20% of a work cycle.	☐ The operator is subjected to discomfort more then 20% of a work cycle.
☐ **5 Shocks** The operator is subjected to almost any shocks during a working day.	☐ The operator is subjected to less then 5 – 10 shocks during a working day.	☐ The operator is subjected to more then 5 – 10 shocks during a working day.
Number of green marks:	**Yellow marks:**	**Red marks:**

Cab Climate

It is difficult to achieve a good climate for the operator's whole body in a forest machine cab. Solar radiation and drafts are serious problems. The operator's perception of drafts is often caused by heat from the body being transferred to adjacent cold surfaces or by the air vents. It is easier to achieve a good climate in a large cab than in a small one.

There is normally a very little risk for a forest machine operator to get health problems due to exposure of gas, particulates or oil mist. Although there is a danger if diesel fumes is getting into the cab. Dust or pollen may give rise to lung disorders or allergies for sensitive persons. The operator may also be exposed during the spraying of chemical and biological pesticides, and the spreading of artificial fertilizers or wood ash.

Green	Yellow	Red
☐ **1 Cab temperature** Convenient temperature (adjustable between 15°C and 22°C in winter, 20 and 25°C in summer) can be kept in the cab in all weather conditions.	☐ Difficulties to keep convenient temperature during a hot sunny summer day or a cold winter day.	☐ Difficulty to keep convenient cab temperature in many types of outdoor climate conditions.
☐ **2 Equal temperature** The temperature is evenly distributed from top to toe of the operator, e.g. the feet can be kept warm in winter and the chest kept comfortable a sunny summer day. The airflow is spread and do not cause draft.	☐ Differences in temperature for different body regions cause slight inconvenience, e.g. cold feet or chilled shoulders. Slight inconvenience with draft.	☐ Obvious difference in temperature for different body regions. Inconvenience with draft.
☐ **3 Sun protection** Sunlight is falling on a small area (up to 10%, e.g. hands and arms) of the operator.	☐ Sunlight is falling on a medium large area (up to 40%, e.g. chest, stomach or thighs) of the operator.	☐ Sunlight is falling on more than 40% of the operator.

Gases and particulates

☐ **4 Air filter** The filter system can remove dust, pollen and soot (filter quality at least F7 in accordance with EN 779). There is a clear indication when it is time to replace the filter.	☐ Filter system at least F5. The indication has shortcomings.	☐ No filter available or filter with poor function. Indication missing.
☐ **5 Filter replacement** Filter is easy to access and can be replaced (changed) without the use of tools.	☐ Easy to access, but tools required.	☐ Difficult to replace and tools required.
☐ **6 Operator's experience** The operator cannot smell any exhaust gas and has no problem with dust or particulates.	☐ Under special conditions there can be minor momentary influence from exhaust gas or dust.	☐ There are obvious problems with exhaust gas or dust.
Number of green marks:	**Yellow marks:**	**Red marks:**

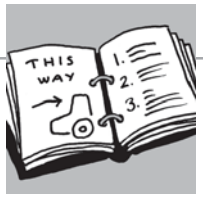
Lighting

Working after dark is more demanding and more tiring than in daylight and makes the operator more prone to making mistakes.

A large problem on forest machines is to provide adequate lighting in all areas of the operating envelope. For instance, the area adjacent to the boom tip is usually brightly lit, making the surrounding area pitch black.

Uneven lighting can cause headaches and eye fatigue. The reason is that the eye involuntarily adjusts to different levels of luminance. To achieve the same visual performance, a 40 years old person needs twice as much light as a person who is 20 years old.

Green	Yellow	Red
☐ **1 Distribution of light** The operator can see both the qualities of the handled trees/logs and for planning within 1,5 x the maximum boom reach. The operator is not dazzled by contrasts.	☐ The work area is somewhat narrowed by low light, inadequate distribution of light or glaring contrasts.	☐ Low light, poor distribution of light or dazzle renders work tiring and sometimes unsafe.
☐ **2 Lamps quality** Colour and quality of the light give good general visibility, do not cause eye strain and reproduce important colours faithfully.	☐ Somewhat insufficient lamp quality regarding colour quality.	☐ Highly poor lamps make the work tiring and sometimes unsafe.
☐ **3 Anti-glare facilities** The machine is constructed and painted for a minimum risk of glare caused by the sun or the illumination. Sun blinds installed.	☐ Limited protection against glare. No sun blinds.	☐ Risk of glare is obvious.
☐ **4 Regulation of lighting** Lights can be switched off individually or as a group.	☐ Some lights can be switched off individually or as a group.	☐ Regulation of lighting not possible.
☐ **5 Aiming of light** Lamps can be aimed precisely and readily returned to previous setting. Graded scales are provided.	☐ Somewhat limited aiming possibility.	☐ Very limited aiming possibility or cannot be aimed.
Number of green marks:	**Yellow marks:**	**Red marks:**



Instructions and training

This section deals with the oral and written instructions, manuals and briefing that should be given to the operator. Failure to provide the necessary information can result in accidents, severe stress, discomfort and low productivity for the operator. If the operator is to achieve a sound working technique, there must be a proper instruction and given a sufficient time for training before the machine is operated at full capacity.

Green	Yellow	Red
☐ **1 Language** Manuals and instructions are in a language which is fully comprehensive for the operators.	—	☐ The manual or other instructions are not fully understandable for the operator.
☐ **2 Operational instructions** All necessary instructions for starting, stopping, driving (including public roads) and operating the machine and its equipment are covered in the manual.	☐ Minor shortcomings or somewhat poor descriptions.	☐ Pieces of necessary instructions are missing.
☐ **3 Safe maintenance** All instructions necessary for safe maintenance are in the manual.	☐ Minor shortcomings or somewhat poor instructions.	☐ Pieces of necessary instructions are missing.
☐ **4 Training and oral instruction** Adequate instruction and practical training is offered in conjunction with the delivery. Opportunity exists for individual follow-up, additional training and consultations.	☐ Not fully adequate training is offered in conjunction with the delivery and there are limited opportunities offered for follow up and additional training.	☐ Inadequate or unacceptable instructions or training is offered.
Number of green marks:	**Yellow marks:**	**Red marks:**

Maintenance

This section deals with the scheduled maintenance specified in the manual and with unscheduled repair. Work involving the use of welding equipment, grinding machines etc. is not included.

Green	Yellow	Red
1 Access facilities ☐ For maintenance points that can not be reached from ground level there are ladders, ramps, non-slip steps, handles etc. fitted or provided with the machine[1].	☐ Safe, but not always comfortable access facilities.	☐ Shortcomings about safety.
2 Safe access at maintenance ☐ The machine have no sharp corners and sharp edges or they are safely covered.	☐ Some minor deficiencies on less frequent visited parts of the machine.	☐ Shortcomings.
3 Safe service ☐ All maintenance work can be performed without the engine running or if not, advice is given in the manual on how to work safely. Guards are provided.	☐ The engine has to be running in e.g. fault diagnosis. Guards are provided but there are some failure about secure advise in the manual.	☐ The engine has to be running. Guards missing or poor security instruction.
4 Disengaging power etc. ☐ Neither the machine nor its components can move spontaneously during maintenance work. Quick and safe disengaging of power sources and stored energy are possible.	☐ Safe facilities exist, but not quick or protection can easily be manipulated.	☐ Shortcomings.
5 Protective hoods, covers etc. ☐ Tiltable cab, protective hoods etc. can readily be handled by one person and are securely locked automatically when opened.	☐ The handling of protective means could be easier. The locking are fully secure but no always automatic.	☐ Deficiencies in easy handling or security.
6 Battery ☐ The battery is suitably located, anchored, protected and easy to maintain and replace.	☐ Minor shortcomings.	☐ Battery located inside the cab or other obvious short-comings.
7 Service conditions ☐ All service and maintenance can be performed with good and stable body postures. Components are readily accessible and easy to replace.	☐ A few service conditions can be better.	☐ Poor service conditions.
Number of green marks:	**Yellow marks:**	**Red marks:**

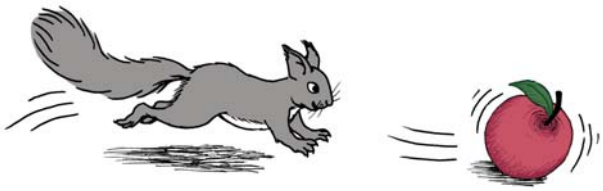
1) Compare with section ”Cab access”.

Ergonomic checklist for forest machines

This handbook is for checking if a forest machine fulfils ergonomic and safety requirements. You can use it at inspection of your machine, or before buying a new one. It is a simplified edition of the European Ergonomic and safety Guidelines for Forest Machines, which is mainly for use by the machine manufacturers.

The handbook is based on research and established practices of people using forest machines. Operators, machine owners, manufacturer, trade unions, contractor associations and forest companies, as well as health and safety authorities and researchers in seven European countries contributed with their experience.

The checklist is a result of the EU project ErgoWood (2002-2005) founded by the European Commission and the partners.



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This checklist and also the European Ergonomic and safety Guidelines for Forest Machines can be downloaded from http://www2.spm.slu.se/ergowood

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