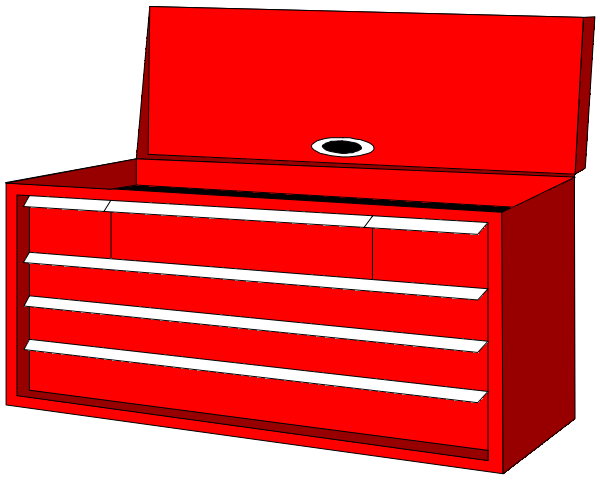
Industrial Musculoskeletal Injury Reduction Program

Common Industry Jobs (CIJs)

Horizontal/Vertical Resaw Tool Kit



IMIRP program coordinated by:

Council of Forest Industries

Industrial Wood & Allied Workers of Canada

Advanced Ergonomics Inc.

In cooperation with the Workers' Compensation Board of British Columbia

HORIZONTAL/VERTICAL RESAW TOOL KIT
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Overview

Horizontal/Vertical Resaw Operator

Job Summary

A Horizontal/Vertical Resaw Operator is responsible for ensuring the smooth operation of a horizontal or vertical bandsaw to produce the best recovery of grades and volume. A Horizontal/Vertical Resaw Operator advances lumber on an infeed chain, guides lumber onto rollers or conveyors, inspects and orients lumber, feeds lumber into the saw, and monitors the outfeed from the saw. The Horizontal/Vertical Resaw Operator also clears cross-ups in the work area. Refer to the Physical Demands Analysis for more detail.

Physical Demands

The physical demands of the Horizontal/Vertical Resaw job may include:

a) Forceful movements of the shoulder, elbow/wrist, wrist, and hip
b) Repetitive movements of the neck, shoulder, elbow/wrist, wrist, back, and ankle
c) Awkward postures of the neck, neck/shoulder, shoulder, elbow/wrist, wrist, back, and ankle
d) Static postures of the neck/shoulder and hip
e) Walking to clear cross-ups and change saws
f) Standing during all tasks
g) Climbing stairs to clear cross-ups and change saws
h) Balancing when advancing the lumber using foot pedals
i) Pushing, pulling, and/or lifting of lumber when guiding lumber onto the infeed, trimming lengths, and clearing cross-ups

Mental Demands

A Horizontal/Vertical Resaw Operator must be mentally alert and have a good knowledge of lumber grades and remanufacturing procedures. The Operator must quickly recognise grades and sizes of lumber, and make decisions as to the cut required to maximise recovery. The recognition and decision making process occurs 4 to 12 times per minute.

Major Variations

With different mills, the following major variations may be found:

1) The Horizontal/Vertical Resaw job may be:
   a) A manual job
   b) A booth job*

   * If the Horizontal/Vertical Resaw job at your mill is a booth job, please see the Tool Kit for Booth Operators.

2) In addition to the tasks mentioned in the job summary, the Horizontal/Vertical Resaw Operator may:
   a) Control saw widths
   b) Help with saw changes
   c) Trim lengths

Minor Variations

With different mills, the following minor variations may be found:

1) A Horizontal/Vertical Resaw Operator may be located:
   a) To the right of the bandsaw
   b) To the left of the bandsaw

Physical Demands Analysis
Horizontal/Vertical Resaw Operator

PDA General Instructions: Horizontal/Vertical Resaw Operator

This Physical Demands Analysis (PDA) identifies the physical demands of the Horizontal/Vertical Resaw job as assessed by IMIRP ergonomists. The information reported was collected from a sample of Horizontal/Vertical Resaw Operators in the BC Sawmill Industry. Where possible, state-of-the-art equipment and techniques were used in data collection and analysis to increase accuracy. However, some information is based on third party comments that are often subjective and not subject to verification.

Subsequent changes to the work process may reduce the validity of any pre-existing physical demands analysis. The IMIRP Society accepts no responsibility for the use or misuse of the Physical Demands Analysis, or for the accuracy of the PDA as it applies to any specific workplace.

To make the PDA specific to your workplace, determine which of the tasks identified are present in your mill. For each section, check off the items (e.g., tasks, tools, etc.) listed that reflect the Horizontal/Vertical Resaw job at your mill.

Rehabilitation professionals are encouraged to verify and update critical information through the client and through workplace sources to ensure that the content (e.g., tasks, weights of objects handled, etc.) accurately reflects the job.

Disclaimer

The BC sawmill IMIRP documents were developed by Advanced Ergonomics Inc. (AEI) based on analyses conducted in a number of voluntary, participating sawmills in British Columbia and should be considered applicable only to the BC sawmill industry. Modification to these documents may reduce their usefulness and/or lead to hazardous situations. Individuals or committees wishing to make Physical Demands Analyses (PDAs) site-specific, or wishing to implement options from the Work Manuals, are advised to first complete the two-day OHSC and Supervisor Ergonomics Training Session. Modifications to a PDA must be within the scope of competence of those individuals making the changes and must be reported to any rehabilitation professional using the PDA. Neither AEI nor the IMIRP Society accepts any responsibility for the use or misuse of these documents.

PDA Table of Contents

Physical Demands Analysis

Horizontal/Vertical Resaw Operator

Task List

For each of the tasks listed below, please indicate whether it occurs at your mill.

Advance lumber

A Horizontal/Vertical Resaw Operator advances lumber on the infeed deck. The infeed deck is usually controlled with foot pedals.

Does this task occur at your mill?

☐ Yes ☐ No

Guide lumber

A Horizontal/Vertical Resaw Operator guides lumber from the chain onto the rollers/ conveyor.

Does this task occur at your mill?

☐ Yes ☐ No

Inspect and orient lumber

A Horizontal/Vertical Resaw Operator inspects lumber and determines how to orient it before sending it into the saws. This may involve manually flipping the lumber.

Does this task occur at your mill?

☐ Yes ☐ No

Select widths and speeds

Once the lumber is oriented properly, a Horizontal/Vertical Resaw Operator selects a saw or press roll width to maximise recovery. The operator adjusts the roller or conveyor speed. This involves the manipulation of controls located on a control panel.

Does this task occur at your mill?

☐ Yes ☐ No

Feed lumber

A Horizontal/Vertical Resaw Operator ensures lumber smoothly enters the saw. This may involve holding and/or guiding lumber on rollers/conveyor.

Does this task occur at your mill?

☐ Yes ☐ No

Monitor outfeed

A Horizontal/Vertical Resaw Operator monitors the outfeed from the resaw by viewing monitors.

Does this task occur at your mill?

☐ Yes ☐ No

Clear cross-ups

A Horizontal/Vertical Resaw Operator clears any cross-ups that occur on the decks around the workstation. This may also involve removing waste lumber from the production flow.

Does this task occur at your mill?

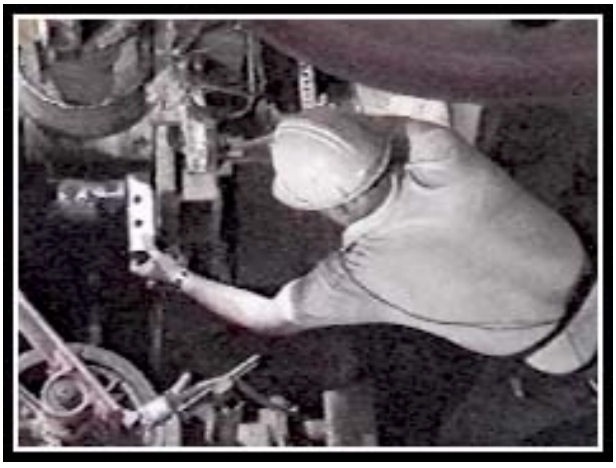
☐ Yes ☐ No

Change saws

A Horizontal/Vertical Resaw Operator assists in changing band saws.

Does this task occur at your mill?

☐ Yes ☐ No



Trim lengths

A Horizontal/Vertical Resaw Operator trims lengths of lumber using a skill or chop saw.

Does this task occur at your mill?

☐ Yes ☐ No

Company Profile

Company Name:_____ Division:_____

Number of Employees: _____ Turnover in last 12 months: +/- _____ or ____ %

Is a Return-to-Work (RTW) strategy in place? ☐ Yes ☐ No

If yes, check all that apply: ☐ Modified Job ☐ Modified Worksite ☐ Graduated RTW

Work Organisation

Task Description

The table below contains a list of tasks performed on an everyday basis by a Horizontal/Vertical Resaw Operator.

Indicate each of the tasks performed by placing a check mark (✓) in the far left column.

Check marks (✓) in the Percent of Shift columns correspond to percentages found during the ergonomic investigation. Multiple checkmarks indicate a frequency range observed across sample worksites. The Comments section may be used to elaborate on the task description (e.g., variations between mills, frequencies, cycle times, etc.).

	Task	Percent of Shift				Comments	
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%		
	Advance lumber		✓			• *Cycle time = 1 to 10 seconds*	• *Cumulative cycle time = 5 to 14 seconds* • *Cycle time is longer when infeed decks are not full due to the increase in time necessary to advance lumber*
	Guide lumber		✓			• *Cycle time = 1 second*	
	Inspect and orient lumber		✓			• *Cycle time = 1 second*	
	Select widths and speeds		✓			• *Cycle time = 1 second*	
	Feed lumber		✓			• *Cycle time = 1 second*	
	Monitor outfeed	✓	✓			• *Cycle time = 1 to 2 seconds*	
	Clear cross-ups	✓				• *The time required to clear a cross-up will vary depending on the severity*	
	Change saws	✓				• *Cycle time = 5 to 30 minutes*	
	Trim lengths	✓				• *Cycle time = 1 to 5 seconds* • *A higher quality of wood requires less trimming*	
	Other:						

Organisational Factors

The table below contains a list of organisational factors for a Horizontal/Vertical Resaw Operator. For each of the items input the necessary information to reflect the situation at your mill.

For the last item, if the job has scheduled job rotation (i.e., rotate from one job to another during a shift) check 'Yes' and then write in the jobs the worker rotates to and how often these rotations occur. If you do not have job rotation for this job, check 'No'.

Length of shift	☐ *8 hours* ☐
Formal breaks	☐ *Two 10 minute coffee breaks* ☐ *One 30 minute lunch break* ☐
Informal breaks	☐ *Yes – amount of time varies depending on production flow* ☐
Work pace	☐ *4000 to 5000 pieces per shift* ☐
Work pace control	☐ *Self paced* ☐ *Machine paced* ☐ *Dwell area (employee can pause without stopping others)* ☐ *Pace depends on performance or pace of the process before* ☐
Job rotation ☐ Yes *(Check one)* ☐ No	If **Yes:** Rotation with what job(s):_____ _____ How often: (e.g., every 2 hours)_____

Workstation Characteristics

Dimensions & Layout

Indicate the specified dimensions of the workstation to the nearest centimetre. Please refer to Figure 1 for the measurement locations.

Workstation Dimensions	
(A) Height of control panel	cm
(B) Height of rollers/conveyor	cm
(C) Height of infeed	cm

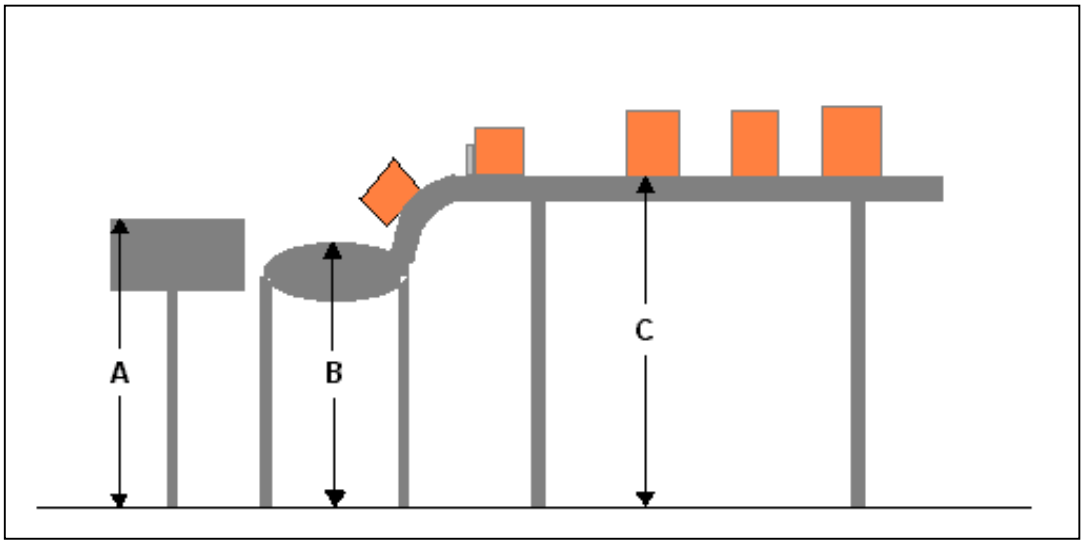


Figure 1: Horizontal/Vertical Resaw Workstation (right side view)

Flooring, Displays, and Seating

The table below lists several components of a workstation. For Flooring and Displays there are several options provided. Please indicate all of the options that apply to the workstation at your mill.

For the Seating section, first indicate whether seating is present at the workstation and then continue by elaborating on the features of the seating.

Workstation Characteristics	
Flooring	*Check all that apply* ☐ Cement ☐ Wood ☐ Rubber Matting ☐ Metal ☐ Other (e.g., tile, carpet) _____
Displays	*Check all that apply* ☐ Lights on Console ☐ Mirrors ☐ Video Monitors ☐ Computer Monitors ☐ None ☐ Scrolling Display ☐ Signal Lights ☐ Other _____
Seating: ☐ Yes *(Check one)* ☐ No	☐ Sit/stand ☐ Office Height of seat: _____ cm ☐ Industrial ☐ In-house Design Depth of seat: _____ cm Width of seat: _____ cm
	Check all that apply ☐ Armrests ☐ Backrest ☐ Swivel Seat ☐ Slide track ☐ Foot rest ☐ Lumbar support ☐ Castors # _____ Covering type: _____ Seat adjustable? ☐ Yes ☐ No If yes, adjustable: ☐ Height ☐ Armrests ☐ Backrest ☐ Forward tilt

Equipment & Machinery Controls

The table below contains a list of the types of controls used by a Horizontal/Vertical Resaw Operator.

Indicate the controls which are present at your mill by placing a check mark (✓) in the far left column.

The Comments section may contain information that describes variations between mills.

	Type of Control	Function	Frequency	Comments
	Foot pedal	• *Control infeed chains* • *Control press rolls* • *Control line bar* • *Control waterfall distance* • *Operate skill or chop saw* • *Operate pin stops or kicker*	• *Continuously* • *20 to 30 times per minute* • *10 to 20 times per minute*	• *Frequency of foot pedal use will depend on the number of foot pedals and functions*
	Joystick	• *Control rollers/conveyor* • *Control side lifts*	• *Continuously* • *6 to 10 times per minute* • *12 times per hour* • *Few times per shift*	• *Frequency of joystick use will depend largely on the work technique, and the availability of side lifts*
	Push button	• *Control saw width* • *Control press rolls* • *Control line bar width* • *Start/stop machinery*	• *30 to 40 times per minute* • *15 to 20 times per minute* • *6 to 12 times per minute* • *4 times per shift*	• *Frequency of push button use will vary depending on functions* • *Workstations with permanently set saw widths will use push buttons less*
	Rotary selector switch	• *Control pin stops* • *Start/stop control*	• *3 to 6 times per minute* • *4 times per shift*	• *Frequency of rotary selector switch use will depend largely on the work technique, and the availability of pin stops*
	Dial	• *Control infeed speed*	• *3 to 6 times per minute*	
	Lever	• *Control infeed speed* • *Dead man switch*	• *Rarely*	
	Knee bar	• *Control chains*	• *Rarely*	
	Other:			

Physical Demands

Whole Body Physical Demands

Identify each of the physical demands required by a Horizontal/Vertical Resaw Operator by placing a check mark (✓) in the far left column.

Check marks (✓) in the Percent of SHIFT columns correspond to percentages found during the ergonomic investigation. Multiple checkmarks indicate a frequency range observed across sample worksites. The Comments section may contain information relating to duration, frequencies and other variations in the physical demands.

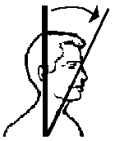
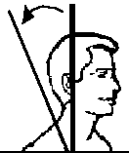
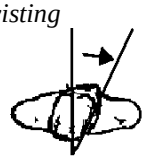
Physical Demands		Tasks or Activity	Percent of SHIFT				Comments
			Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Walking	• *Clear cross-ups* • *Change saws*	✓		✓		• *Percentage of shift spent walking varies depending on the tasks performed* • *If many cross-ups must be cleared, the percentage will be higher*
	Sitting						*Not Applicable*
	Standing	• *Advance lumber* • *Guide lumber* • *Inspect and orient lumber* • *Select widths and speeds* • *Feed lumber* • *Monitor outfeed* • *Clear cross-ups* • *Change saws* • *Trim lengths*			✓	✓	• *Percentage of shift spent standing will vary depending on the tasks performed*
	Climbing (stairs)	• *Clear cross-ups* • *Change saws*	✓				
	Climbing (other)						*Not Applicable*
	Balancing	• *Advance lumber*				✓	• *Operator may balance on their heels when operating foot pedals*
	Kneeling/ Crouching						*Not Applicable*
	Other:						

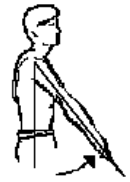
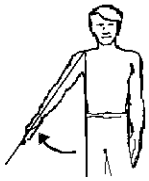
Body Postures

The table below outlines the body postures held or repeated throughout the shift by a Horizontal/Vertical Resaw Operator.

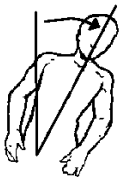
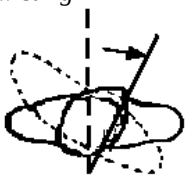
For each of the postures identified, indicate whether it occurs by placing a check mark (✓) in the far left column.

Check marks (✓) in the Percent of TASK columns correspond to percentages found during the ergonomic investigation. Multiple checkmarks indicate a frequency range observes across sample worksites. The Comments section may contain information relating to duration, frequencies, and other variations in posture.

Body Posture	Task(s)	Percent of TASK				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Neck						
	Flexion 	• *Guide lumber*			✓		• *Frequency = 4 to 12 times per minute*
		• *Inspect and orient lumber*		✓			• *Frequency = 4 to 12 times per minute*
		• *Select widths and speeds*		✓			
		• *Clear cross-ups*			✓		
	Extension 	• *Clear cross-ups*			✓		
	Twisting 	• *Advance lumber*		✓			
		• *Select widths and speeds*		✓			
		• *Feed saws*			✓		• *Frequency = 4 to 12 times per minute* • *Posture may be held when feeding saws*
		• *Monitor outfeed*			✓		
		• *Clear cross-ups*		✓			

Body Posture	Task(s)	Percent of TASK				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Shoulder						
	Flexion 	• *Guide lumber*			✓		• *Frequency = 4 to 12 times per minute* • *Flexion may occur with force when guiding lumber*
		• *Inspect and orient lumber*		✓			• *Frequency = 4 to 12 times per minute* • *Flexion may occur with force when orienting lumber*
		• *Select widths and speeds*			✓		• *Posture may be held*
		• *Clear cross-ups*			✓		
	Abduction 	• *Guide lumber*			✓		• *Frequency = 4 to 12 times per minute* • *Abduction may occur with force when guiding lumber*
		• *Inspect and orient lumber*		✓			• *Frequency = 4 to 12 times per minute* • *Abduction may occur with force when orienting lumber*
		• *Select widths and speeds*			✓		• *Posture may be held*
	Extension 	• *Clear cross-ups*		✓			
		• *Select widths and speeds*		✓			• *Posture may be held*

Body Posture	Task(s)	Percent of TASK				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Forearm						
Rotation 						*Not Applicable*
Wrist						
Flexion 	• *Guide lumber*		✓			• *Frequency = 4 to 12 times per minute*
Extension 	• *Guide lumber*		✓			• *Frequency = 4 to 12 times per minute*
	• *Select widths and speeds*			✓		• *Wrist may be flexed as the operator uses controls*
	• *Feed lumber*		✓			• *Frequency = 4 to 12 times per minute*
Ulnar Deviation 	• *Clear cross-ups*		✓			• *Ulnar deviation may occur when the operator uses tools such as a pike pole or picaroon*
Radial Deviation 						*Not Applicable*
Back						
Flexion 	• *Guide lumber*		✓	✓		• *Frequency = 4 to 12 times per minute* • *Percentage of task spent in back flexion will vary depending on operator height and workstation design* • *Back flexion may occur with force*
	• *Clear cross-ups*		✓			• *Operator may lean forward to pick up lumber or to pull on tools* • *Frequency will vary depending on the number and severity of cross-ups*

Body Posture	Task(s)	Percent of TASK				Comments
		Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
Back						
	Lateral Flexion 	• *Guide lumber*		✓	✓		• *Lateral flexion may or may not occur when guiding lumber, depending on workstation design* • *Frequency = 4 to 12 times per minute when it does occur* • *Lateral flexion may occur with force*
	Twisting 	• *Select widths and speeds*		✓			• *Operator may have to twist the trunk when reaching for the control panel*
	Extension 						*Not Applicable*
Other:						

Hand Grips

The table below contains a list of the common types of hand grips (i.e., how objects are held) used by a Horizontal/Vertical Resaw Operator.

For each of the hand grips, indicate which types of grips are used at your mill by placing a check mark (✓) in the far left column.

Check marks (✓) in the Percent of TASK columns correspond to percentages found during the ergonomic investigation. Multiple checkmarks indicate a frequency range observed across sample worksites. The Comments section may contain information relating to duration, frequencies, hand used, etc.

	Type	Task(s)	Percent of TASK				Comments
			Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Power 	• *Clear cross-ups*			✓		• *Operator may need to hold a tool continuously when clearing cross-ups*
	Pinch 	• *Inspect and orient lumber*		✓			• *Depending on lumber size, the operator may use a pinch grip when orienting the lumber*
	Hook 	• *Guide lumber*			✓		• *Depending on lumber size, the operator may use a hook grip when orienting the lumber*
	Precision 	• *Select widths and speeds*		✓			• *Operator may use a precision grip when operating controls*
	Other:						

Manual Material Handling

The table below contains a list of manual material handling tasks (e.g., pushing, pulling, lifting, lowering, and carrying) performed by a Horizontal/Vertical Resaw Operator.

Indicate which tasks are performed by placing a check mark (✓) in the far left column. Fill in the weight (or force) required to move the objects (may have to estimate).

Check marks (✓) in the Percent of TASK columns correspond to percentages found during the ergonomic investigation. Multiple checkmarks indicate a frequency range observed across sample worksites. The Comments section may contain information relating to duration, frequencies, and details regarding characteristics of the object handled.

	Handling Description	Weight (kg)	Percent of TASK				Comments
			Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Guide lumber	*Varies depending on size and species of lumber* ** See Appendix A*			✓		• *Operator must pull lumber from the infeed to the rollers/conveyor* • *Depending on the workstation design, one arm may be used more frequently* • *An average piece of lumber may require 7 to 10 kg of force to pull it off the infeed chain*
	Guide lumber	*Varies depending on size and species of lumber* ** See Appendix A*		✓			• *Operator may need to lift lumber onto the roller/ conveyor if it misses the rollers/conveyor as it is being guided down from the infeed*
	Trim lengths	*Varies depending on size and species of lumber* ** See Appendix A*		✓			• *Operator must lift and lower lumber from the rollers/conveyor to the skill or chop saw platform*
	Clear cross-ups	*Varies depending on size and species of lumber* ** See Appendix A*		✓			• *The operator may be required to push, pull, lift, or lower lumber when clearing cross-ups*
	Other:						

Hand Tools

Indicate the hand tools used by a Horizontal/Vertical Resaw Operator at your mill by placing a check mark (✓) in the far left column. Determine the weight of the hand tool and enter it in the appropriate column.

Check marks (✓) in the Percent of TASK columns correspond to percentages found during the ergonomic investigation. Multiple checkmarks indicate a frequency range observed across sample worksites. The Comments section may contain information relating to duration and frequencies of use.

	Type of Tool	Task(s)	Weight (kg)	Percent of TASK				Comments
				Rarely 0 to 5%	Occasionally 6 to 33%	Frequently 34 to 66%	Constantly 67 to 100%	
	Pike pole	• *Clear cross-ups*	*1.1 to 1.9*		✓			• *Frequency and duration of use depends on the frequency and severity of cross-ups*
	Picaroon	• *Clear cross-ups*	*0.9 to 1.2*		✓			
	Peevee	• *Clear cross-ups*	*3.5*		✓			
	Air hose	• *Saw change*	*1.1 to 1.4*		✓			
	Other:							

Environmental Conditions

Work Environment

The table below contains a list of environmental conditions that may be of concern at the Horizontal/Vertical Resaw job.

Vibration occurs when the body is in contact with a vibrating object or surface such as a tool, a seat, or the floor. If vibration occurs at this job, check 'Yes' and then mark whether the vibration is whole body and/or hand transmitted and the path through the body by which the vibration is transmitted. If vibration does not occur at this job, check 'No'.

If possible, indicate the appropriate value for the noise and lighting levels at your mill for the Horizontal /Vertical Resaw. For the lighting level, include the location of the measurements within the workstation.

Factor	
Vibration ☐ Yes *(Check one)* ☐ No	☐ Whole body ☐ Seat ☐ Floor
	☐ Hand transmitted ☐ Tool ☐ Other: _____

Noise level (dB)	*Range found: 95.3 to 98.1* *Mill Specific:*
Lighting level (lux)	*Range found: 246 to 667 on console* *361 to 497 over rollers* *Mill Specific:*
Temperature (^{0}C)	*See Regional Temperatures on the next page*

Location of Workstation

The table below contains a list of the type of work environments a workstation may be located in.

For the workstation, indicate which of the following types of work environments apply with a check mark (✓) in the left column.

For example, the workstation may be inside the main building but exposed to the outside via a doorway that is always open and has both a fan and a heater. In this situation all three, 'Inside exposed', 'Fan' and 'Heater', would be checked for this workstation.

	Work Environment
	Outside uncovered
	Outside covered
	Inside enclosed
	Inside exposed
	Heater present
	Fan present

Temperature

The table below contains a list of the geographical regions of British Columbia.

For your mill, indicate the appropriate region with a check mark (✓) in the left column.

Refer to the regional map in Appendix B of the PDA.

	Region	Avg. Max July/Aug	Avg. Min Dec/Jan	Extreme Max.	Extreme Min.
	Vancouver Island	22.5 °C	-0.6 °C	36.1 °C	-18.8 °C
	Southwestern BC	22.9 °C	0.4 °C	35.6 °C	-18.3 °C
	Cariboo Chilcotin Coast	22.2 °C	-11.6 °C	36.4 °C	-42.5 °C
	High Country	26.3 °C	-9.9 °C	39.6 °C	-39.7 °C
	Okanagan Similkameen	26.5 °C	-8.4 °C	36.0 °C	-36.3 °C
	Kootenay Country	26.2 °C	-6.7 °C	38.5 °C	-32.0 °C
	British Columbia Rockies	24.7 °C	-12.3 °C	37.5 °C	-42.2 °C
	North by Northwest	19.5 °C	-11.7 °C	32.9 °C	-38.1 °C
	Peace River Alaska Highway	20.0 °C	-20.2 °C	34.6 °C	-47.7 °C

Personal Protective Equipment

The table below contains a list of the personal protective equipment (PPE).

For the Horizontal/Vertical Resaw job at your mill, indicate which of the PPE items are required with a check mark (✓).

	Gloves Type:		Hard Hat		Leather Apron
	Glove Liners		Steel-toed Boots		Dust Mask
	Eye Protection		Hearing Protection		Seat Belt
	Face Shield/Helmet		Life Jacket		Harness
	Knee Pads		Other:		Other:

Appendix A – Weight of Wood Equation

1. Type of Wood Handled

The table below contains a list of the types of wood processed in British Columbia. The weight per board foot wet and dry is given for each species. This information will be used in the table in *Section 4* to calculate the weight of the wood handled. Please indicate all of the types of wood processed at your mill.

Wood Handled		Wet lb./ Board Foot	Dry lb./ Board Foot	Wood Handled		Wet lb./ Board Foot	Dry lb./ Board Foot
	Douglas Fir	3.60	2.83		Larch	3.48	N/A
	Hemlock	3.42	2.49		Spruce/Pine/Fir*	2.95	2.18
	Red Cedar	2.42	2.00		Alpine Fir	2.67	2.00
	Yellow Cedar	3.01	2.49		Lodge Pole Pine	3.26	2.41
	Sitka Spruce	2.76	2.23		White Spruce	2.93	2.15

*The Spruce/Pine/Fir values are an average of White Spruce, Lodge Pole Pine, and Alpine Fir.

2. Size of Wood*

The table below contains a list of different sizes or dimensions of wood. The percentage next to the size of the wood is the multiple used to compare the size of the board to a board foot (1" by 12" by 12"). This multiple will be used in the table in *Section 4* to calculate the weight of wood handled. Please indicate all of the applicable sizes of wood handled at the workstation. Add any other sizes to the bottom of the table if your particular size of wood is not listed.

1" Sizes		Multiple	2" Sizes		Multiple	4" Sizes		Multiple	6" Sizes		Multiple	8" Sizes		Multiple
	1 by 4	0.33		2 by 4	0.67		4 by 4	1.33		6 by 6	3.00		8 by 8	5.33
	1 by 6	0.50		2 by 6	1.00		4 by 6	2.00		6 by 8	4.00		8 by 10	6.67
	1 by 8	0.67		2 by 8	1.33		4 by 8	2.67		6 by 10	5.00		8 by 12	8.00
	1 by 10	0.83		2 by 10	1.67		4 by 10	3.33		6 by 12	6.00			
	1 by 12	1.00		2 by 12	2.00		4 by 12	4.00						

* Conservative estimates of actual wood dimensions

If the size of the board is different from those in this table, use this equation to find out the multiple value.

[(Dimensions of wood) x 12] / 144 = Multiple
For example: For a 5 by 5 piece of wood [(5x5) x 12]/144 = 2.08

3. Length of Wood

The table below contains a list of the common lengths of wood. Please indicate which of these lengths are being handled at this particular workstation. Add additional lengths to the table if necessary. This information will be used in the table in *Section 4*.

Length of Wood							
	6 foot		12 foot		18 foot		22 foot
	8 foot		14 foot		20 foot		24 foot
	10 foot		16 foot		Other:		Other:

4. Weight of Wood Equation*

The table below is used to calculate the weight of the boards being handled. The weight is calculated by multiplying the species weight/board foot (*Section 1 value*) by the size of wood multiple (*Section 2 value*) and by the length of wood (*Section 3 value*).

Example: For a run of wet Spruce/Pine/Fir, 2" x 4", 16 feet long

2.95 *(wet lb./ board foot)* x **0.67** *(size of wood multiple for 2" x 4")* x **16** *(length of board in feet)* = **32 lbs**.

For the heaviest species handled, enter the lb./board foot value, the multiple for the largest size of this wood, and the largest length of this wood. Multiply these values together to determine the weight of the board in pounds.

For the most common species handled, enter the lb./board foot value, the multiple for the most common size of wood, and the most common length of this wood. Multiply these values together to determine the weight of the board in pounds.

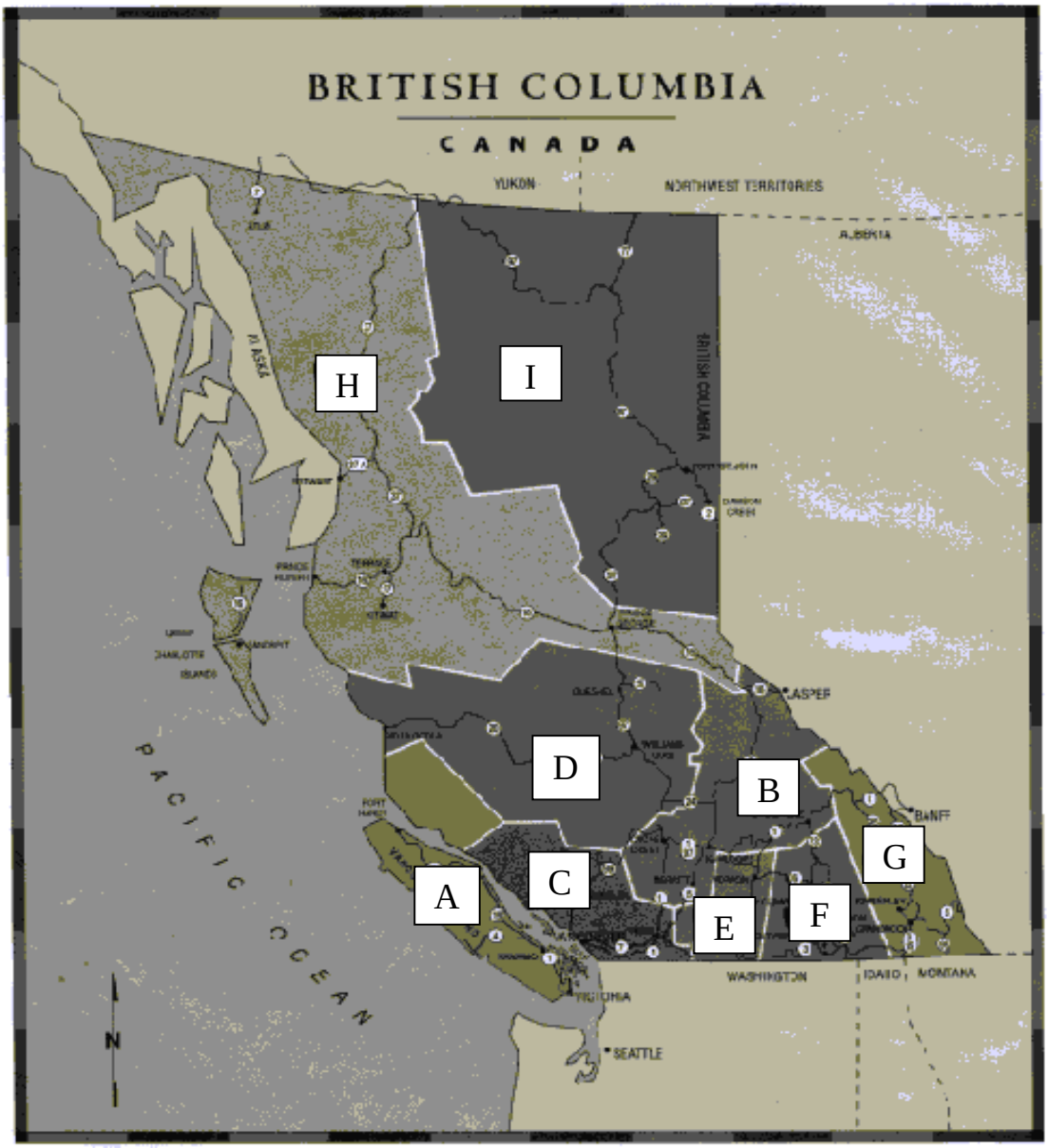
For the lightest species handled, enter the lb./board foot value, the multiple for the smallest size of wood, and the shortest length of this wood. Multiply these values together to determine the weight of the board in pounds.

If required, divide the pound value by 2.2 to obtain the weight of the board in kilograms.

Type of Wood Handled (lb./ board foot) *From Section 1*		**x**	**Multiple (size of wood)** *From Section 2*	**x**	**Length of Wood** *From Section 3*	**=**	**Weight of the Board in pounds**	**Divide by 2.2 to calculate value in kilograms**
Heaviest Species Handled		x		x		=		
Most Common Species Handled		x		x		=		
Lightest Species Handled		x		x		=		

* Weight may vary from the above calculation depending on the cell moisture content of the wood, actual wood dimensions, and wood density.

Appendix B – Regional Map



A - Vancouver Island	**F** - Kootenay Country
B - High Country	**G** - British Columbia Rockies
C - Southwestern BC	**H** - North by Northwest
D - Cariboo Chilcotin Coast	**I** - Peace River Alaska Highway
E - Okanagan Similkameen	

Risk Factor Identification Checklist
Horizontal/Vertical Resaw Operator

Purpose

The Risk Factor Identification Checklist for a Horizontal/Vertical Resaw Operator is used to **identify** potential ergonomic risk factors. Keep in mind that the purpose of this checklist is only to **identify** potential ergonomic risk factors, **not** to assess them.

The checklist can be used as part of your ergonomic intervention process, when workers express concerns about their work environment, during regular workplace inspections and observations, or when conducting an accident or injury investigation. Ideally, management and worker representatives who have completed the IMIRP Occupational Health & Safety Committee and Supervisor Ergonomic Training Session should complete this checklist. Try to view different workers in the same occupation when completing the checklist. Some specific examples are given to help answer the questions.

Instructions

General

Except for the first two questions, all remaining questions will require an answer with an implied frequency. For appropriate questions indicate with a check mark (✓) whether the answer to the question is 'No' or **'**Yes'. This way you will have a record indicating that all risk factors have been considered in the identification process.

If you indicate 'No', please continue to the next question. If the question refers to a situation which does not exist (e.g., there is no seating available), please indicate 'No' in the appropriate box and continue to the next question.

If your answer is 'Yes', please check the appropriate box and then circle the frequency ('S' for 'Sometimes' or 'O' for 'Often'). If you answer 'Yes – Sometimes', then this risk factor **may be** a potential area of concern. If you answer 'Yes – Often' then there is an increased likelihood that this risk factor **is** an issue. Each mill will be responsible for defining what 'Sometimes' and 'Often' will mean to them. It is important that all people who complete the checklist are consistent in how they determine if a risk factor occurs 'Sometimes' or 'Often'. Use the 'Comments' section to indicate specific tasks, or to make other notes about the direct risk factors.

Since ergonomic risk factors frequently occur in combinations, you may find similar questions in different sections. Answering all questions will ensure that the situations that involve combinations of ergonomic risk factors are identified. It is very important to recognise all risk factors that occur in the work area.

Please note that for some of the questions it will be beneficial to ask the worker for their input. Please take the opportunity to include the operator in the risk factor identification process as much as possible. Videotaping the job of interest and reviewing the checklist in a quiet area with the worker may allow for more discussion.

Summary Tables

At the end of each body part section, summarise your findings in the table provided. If any of the direct risk factor sections contain a 'Yes', indicate 'Yes' in the appropriate section of the summary table. Answer the questions referring to injury statistics and discomfort survey findings. If there are only 'No' answers in a direct risk factor section, indicate 'No' in the summary table for that section. Use the summary information to determine how you will use the Work Manual.

Risk Factor Identification Checklist – Horizontal/Vertical Resaw Operator

Management Representative _____

Worker Representative _____

Date _____

Risk Identification completed:

☐ Before implementation of solutions

☐ After implementation of solutions

Job History		No	Yes	Comments
1	Are there records of musculoskeletal injuries or accidents to indicate a risk of musculoskeletal injury? (refer to Worksheet 1 in Implementation Guide)			
2	Are there worker comments to indicate a risk of musculoskeletal injuries? (refer to Worksheet 2 in Implementation Guide)			

Definitions

Force: Force is the amount of physical effort required by the person to do a task and/or maintain control of tools and equipment. The effort depends on the type of grip, object weight and dimensions, body posture, type of activity, surface of the object, temperature, vibration, duration of the task, and number of repetitions.

Repetition: Repetition is defined as similar or the same motions performed repeatedly. The severity of risk depends on the frequency of repetition, speed of the movement or action, the number of muscle groups involved, and the required force. Repetition is influenced by machine or line pacing, incentive programs, piecework, and deadlines.

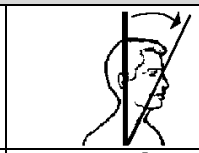
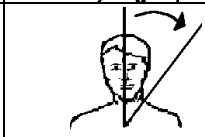
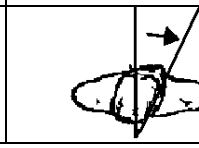
Static Postures: Static loading (sustained exertions) is physical effort (body postures) that is held, requiring muscle contraction for more than a short time.

Contact Stress: Contact stress is the contact of the body with a hard surface or edge. Contact stress can also result when using a part of the body as a hammer or striking instrument.

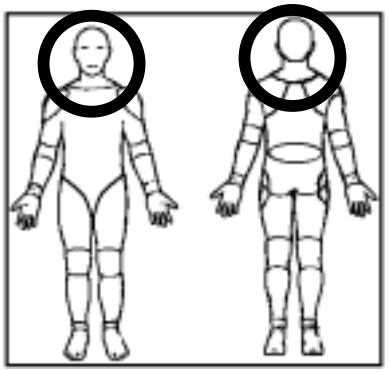
Awkward Postures: Awkward postures occur when there is a deviation from a power working posture. Some examples of awkward postures typically include reaching behind, twisting, working overhead, and forward or backward bending.

Vibration: Vibration is oscillation of a tool or surface. Vibration can be transmitted through the arm or through the whole body.

NECK

Repetition	N	Y		Comments:
Are identical or similar motions performed over and over again? (e.g., looking side to side)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., turning lumber)			S O	
Static Posture				
Ask the worker: Do tasks require your neck or shoulders to be maintained in a fixed or static posture? (e.g., bending the head forward to view lumber)			S O	
Awkward Posture				
Flexion 			S O	
Extension 			S O	
Lateral Bending 			S O	
Rotation 			S O	

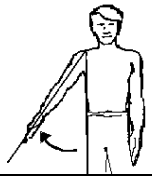
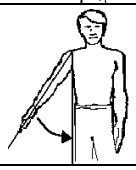
Please indicate whether the following direct risk factors were identified at the **NECK**.		
Direct Risk Factors	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Neck or Head/Eye or Upper Back? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Neck or Head/Eye or Upper Back? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No



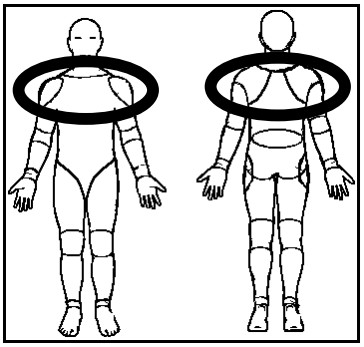
Body parts within the circled area will be classified as NECK issues.

SHOULDER

Force	N	Y		Comments:
Is forceful physical handling performed? Such as: Lifting			S O	
Lowering			S O	
Pushing			S O	
Pulling			S O	
Carrying			S O	
Repetition				
Are identical or similar motions performed over and over again? (e.g., guiding lumber down infeed)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., turning lumber)			S O	
Static Posture				
Ask the worker: Do tasks require your shoulders to be maintained in a fixed or static posture?			S O	
Ask the worker: Do you hold parts, tools, or objects for long periods?			S O	

Awkward Posture		N	Y		Comments:
Flexion				S O	
Extension				S O	
Abduction				S O	
Adduction				S O	

Please indicate whether the following direct risk factors were identified at the **SHOULDER**.		
Direct Risk Factors	Force	☐Yes ☐No
	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Shoulder or Neck or Upper Back? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Shoulder or Neck or Upper Back? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No



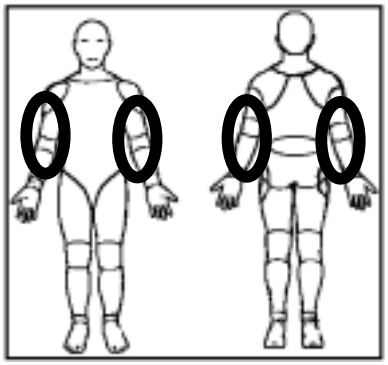
Body parts within the circled area will be classified as SHOULDER issues.

ELBOW

Force	N	Y		Comments:
Is forceful physical handling performed? Such as: Lifting			S O	
Lowering			S O	
Pushing			S O	
Pulling			S O	
Carrying			S O	
Turning materials			S O	
Are objects handled in a power grip? (e.g., pike pole) 			S O	
Are objects handled in a pinch grip? (e.g., lumber) 			S O	
Are objects handled in a hook grip? (e.g., grip used to guide lumber down infeed) 			S O	
Ask the worker: Do you wear gloves while performing your job? If the answer is **No**, check the **No** box and go to next section.		*	S O	
*If the answer to the above question is **Yes**, ask the worker: Are the gloves too large/small?			S O	
Does the thickness of the gloves cause problems with gripping?			S O	
Repetition				
Are identical or similar motions performed over and over again? (e.g., turning lumber)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., guiding lumber down infeed)			S O	

Static Posture	N	Y		Comments:
Ask the worker: Do tasks require your hand and arm to be maintained in a fixed or static posture?			S O	
Ask the worker: Do you apply constant pressure on controls/objects with your hand?			S O	
Ask the worker: Do you hold parts, tools, or objects for long periods? (e.g., pike pole)			S O	
Contact Stress				
Ask the worker: Do **any** objects, tools or parts of the workstation put pressure on **any** parts of your hand or arm, such as the backs or sides of fingers, palm or base of the hand, forearm, elbow? (e.g., metal edges of consoles or workstation digging into elbow)			S O	
Vibration				
Ask the worker: Is vibration transmitted to your hand through a tool or piece of equipment?			S O	

Please indicate whether the following direct risk factors were identified at the **ELBOW**.		
Direct Risk Factors	Force	☐Yes ☐No
	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Contact Stress	☐Yes ☐No
	Vibration	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Elbow or Forearm? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Elbow or Forearm? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No



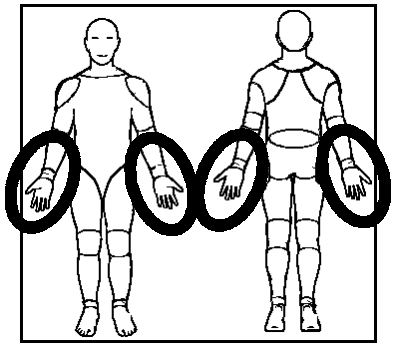
Body parts within the circled area will be classified as ELBOW issues.

WRIST/HAND

Force	N	Y		Comments:
Is forceful physical handling performed? Such as: Lifting			S O	
Lowering			S O	
Pushing			S O	
Pulling			S O	
Carrying			S O	
Turning materials			S O	
Are objects handled in a power grip? (e.g., pike pole) 			S O	
Are objects handled in a pinch grip? (e.g., lumber) 			S O	
Are objects handled in a hook grip? (e.g., grip used to guide lumber down infeed) 			S O	
Ask the worker: Do you wear gloves while performing your job? If the answer is **No**, check the **No** box and go to next section.		*	S O	
*If the answer to the above question is **Yes**, ask the worker: Are the gloves too large/small?			S O	
Does the thickness of the gloves cause problems with gripping?			S O	
Repetition				
Are identical or similar motions performed over and over again? (e.g., turning lumber)			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., guiding lumber down infeed)			S O	

Static Posture	N	Y		Comments:
Ask the worker: Do tasks require any part of your arm or hand to be maintained in a fixed or static posture?			S O	
Ask the worker: Do you apply constant pressure on controls/objects with your hand?			S O	
Ask the worker: Do you hold parts, tools, or objects for long periods? (e.g., pike pole)			S O	
Contact Stress				
Ask the worker: Do **any** objects, tools or parts of the workstation put pressure on **any** parts of your hand or arm, such as the backs or sides of fingers, palm or base of the hand, forearm? (e.g., hand tools that dig into the palm of the hand)			S O	
Ask the worker: Do you use your hand like a hammer for striking?			S O	
Awkward Posture				
Flexion 			S O	
Extension 			S O	
Ulnar Deviation 			S O	
Radial Deviation 			S O	
Vibration				
Ask the worker: Is vibration transmitted to your hand through a tool or piece of equipment?			S O	

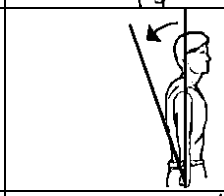
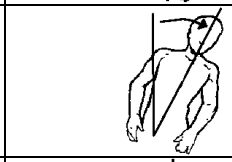
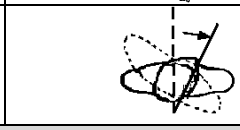
Please indicate whether the following direct risk factors were identified at the **WRIST/HAND**.		
Direct Risk Factors	Force	☐Yes ☐No
	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Contact Stress	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
	Vibration	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Wrist or Hand/Finger or Forearm? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Wrist or Hand/Finger or Forearm? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No



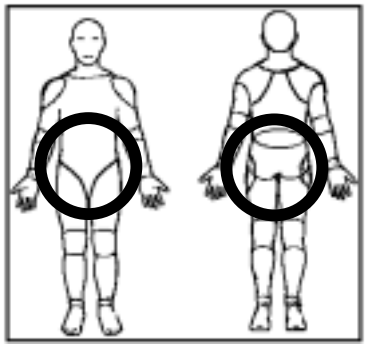
Body parts within the circled area will be classified as WRIST issues.

LOW BACK OR HIP/THIGH

Force	N	Y		Comments:
Is forceful physical handling performed? Such as: Lifting			S O	
Lowering			S O	
Pushing			S O	
Pulling			S O	
Carrying			S O	
Repetition				
Are identical or similar motions performed over and over again?			S O	
Ask the worker: Do you spend a large percentage of the day performing one action or task? (e.g., turning lumber)			S O	
Static Posture				
Ask the worker: Do tasks require your trunk and upper body to be maintained in a fixed or static posture? (e.g., bending forward to handle lumber)			S O	
Are workers required to sit or stand in a stationary position for long periods of time during the shift?			S O	
Contact Stress				
Ask the worker: Do **<u>any</u>** objects, tools or parts of the workstation put pressure on **<u>any</u>** parts of your hip/thigh? (e.g., machinery that digs into the hip or thigh)			S O	

Awkward Posture		N	Y		Comments:
Flexion				S O	
Extension				S O	
Lateral Bending				S O	
Twisting				S O	
Vibration					
Ask the worker: Is your whole body exposed to vibration for significant portions of the work shift? (e.g., standing on vibrating surface)				S O	

Please indicate whether the following direct risk factors were identified at the **LOW BACK or HIP/THIGH**.		
Direct Risk Factors	Force	☐Yes ☐No
	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Contact Stress	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
	Vibration	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Low Back or Hip/Thigh? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Low Back or Hip/Thigh? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No

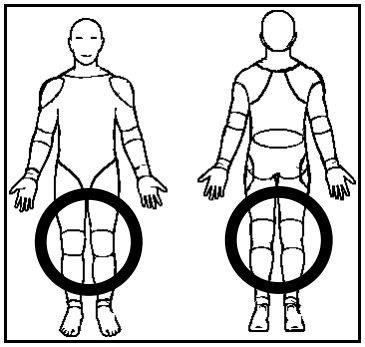


Body parts within the circled area will be classified as LOW BACK issues.

KNEE

Repetition	N	Y		Comments:
Are identical or similar motions performed over and over again?			S O	
Static Posture				
Ask the worker: Do tasks require you to maintain your knee(s) in a fixed or static posture? (e.g., kneeling)			S O	
Are workers required to sit or stand in a stationary position for long periods of time during the shift?			S O	
Do workers kneel (with one or both knees)?			S O	
Contact Stress				
Ask the worker: Do **any** objects or parts of the workstation put pressure on your knee(s)?			S O	
Awkward Posture				
Extreme Flexion 			S O	

Please indicate whether the following direct risk factors were identified at the **KNEE**.		
Direct Risk Factors	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Contact Stress	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Knee or Hip/Thigh? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Knee or Hip/Thigh? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No

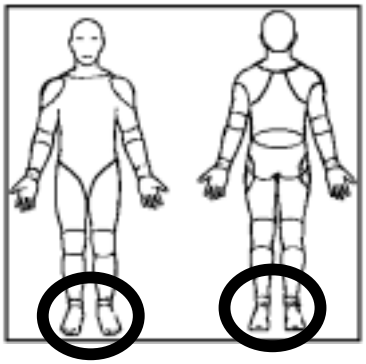


Body parts within the circled area will be classified as KNEE issues.

ANKLE/FOOT

Repetition	N	Y		Comments:
Are identical or similar motions performed over and over again? (e.g., walking on uneven surfaces)			S O	
Static Posture				
Are workers required to stand in a stationary position for long periods of time during the shift?			S O	
Awkward Posture				
Flexion 			S O	
Extension 			S O	
Vibration				
Ask the worker: Is your whole body exposed to vibration for significant portions of the work shift? (e.g., standing on vibrating surface)			S O	

Please indicate whether the following direct risk factors were identified at the **ANKLE/FOOT**.		
Direct Risk Factors	Repetition	☐Yes ☐No
	Static Posture	☐Yes ☐No
	Awkward Posture	☐Yes ☐No
	Vibration	☐Yes ☐No
In the **Injury Statistics** investigation, were there injury reports for the Ankle or Foot? (see Worksheet 1 in the Implementation Guide)		☐Yes ☐No
In the **Discomfort Survey** investigation, were there reports of discomfort for the Ankle or Foot? (see Worksheet 2 in the Implementation Guide)		☐Yes ☐No



Body parts within the circled area will be classified as ANKLE/FOOT issues.

CHARACTERISTICS OF OBJECTS BEING HANDLED

	N	Y		Comments:
Are there problems handling a load due to its size or shape?			S O	
Are there problems handling a load due to its fragile, unbalanced, or non-rigid conditions?			S O	
Ask the worker: Do you experience situations where mechanical aids or equipment are not readily available to assist with manipulating an object? (e.g., hoists)			S O	
Are handles for tools and equipment inappropriate in terms of size or shape? (e.g., hand tools)			S O	
Ask the worker: Do any objects that you work with (other than tools or equipment) have handles? If the answer is **No**, check the **No** box and go to the next section.			S O	
If the answer to the above question is **Yes**, ask the worker: Are the handles an inappropriate size or shape for the characteristics of the object?			S O	

ENVIRONMENTAL CONDITIONS

Temperature				
Ask the worker: Are your hands or arms exposed to cold from exhaust air, cold liquids or solids?			S O	
Ask the worker: Are you exposed directly to temperature extremes that may cause you to use more force or cause you to fatigue quicker than normal? (e.g., hot or cold, either by equipment or natural environment)			S O	
Lighting				
Ask the worker: Do you assume awkward postures to overcome problems associated with glare, inadequate lighting, or poor visibility?			S O	

ENVIRONMENTAL CONDITIONS [CONTINUED]

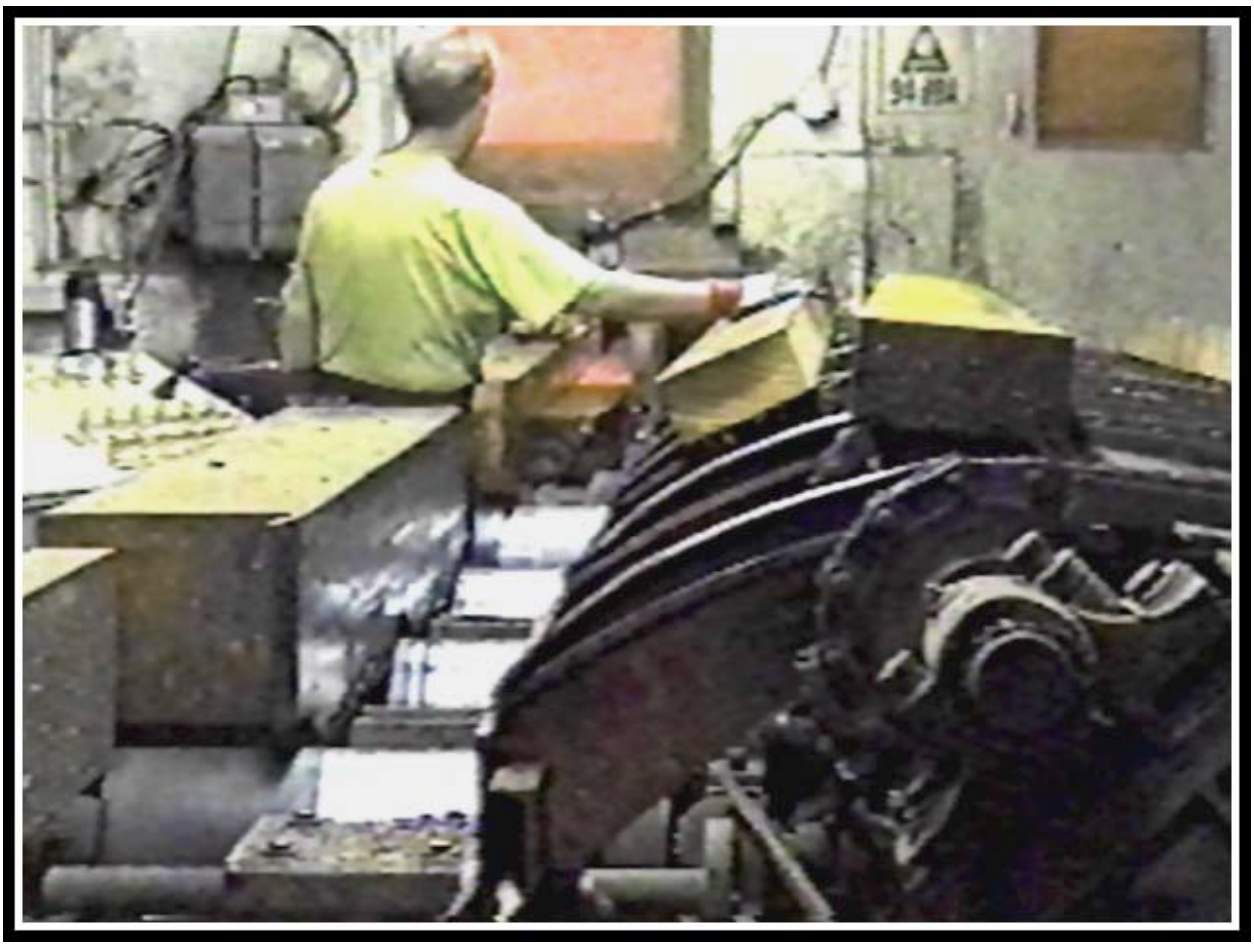
Noise	N	Y		Comments:
Have there been complaints on the level of noise in the work area?			S O	
Ask the worker: Are there any distracting or annoying noises at the workstation?			S O	

WORK ORGANISATION

	N	Y		Comments:
Is the work externally-paced or controlled by a machine or the process?			S O	
Do peak workloads or sudden increases in pace occur with the tasks?			S O	
Ask the worker: Are there indications of excessive fatigue or pain, or symptoms of adverse health effects due to extended work days or overtime?			S O	
Ask the worker: Are there indications of excessive fatigue or adverse health effects due to shiftwork?			S O	
Ask the worker: Are rest periods or task variety insufficient to prevent the build-up of fatigue or the risk of adverse health effects?			S O	
Ask the worker: Are tasks in a job rotation program similar to one another, and therefore not providing a variation in movements?			S O	

Work Manual

Industrial
Musculoskeletal
Injury
Reduction
Program



Horizontal/Vertical Resaw Operator

This Work Manual contains information about the body parts found to be at risk of musculoskeletal injury (MSI) for the Horizontal/Vertical Resaw job (Injury Education), and how to reduce the risk of MSIs using various control measures (Injury Prevention). Each Work Manual is intended to help Occupational Health and Safety Committee members establish effective solutions to reduce MSIs, and as a resource for workers to understand the MSI risks that they may encounter on the job.

The Body Manual, referenced throughout the Work Manual, is a separate document that contains information on how to prevent common MSIs through exercise. Please note exercises described in the Body Manual should only be used after consulting a healthcare practitioner.

The General Risk Factor Solutions Manual, referenced throughout the Work Manual, is a separate document that contains general, preventative information on Environmental Conditions and Work Organisation issues.

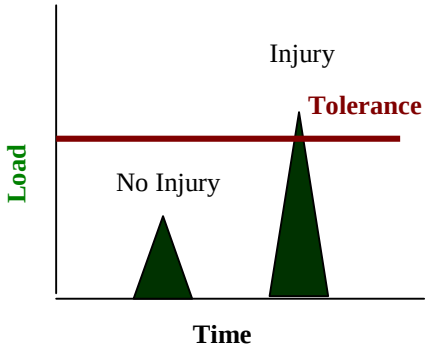
Work Manual

Horizontal/Vertical Resaw Operator

WM Table of Contents

Injury Education

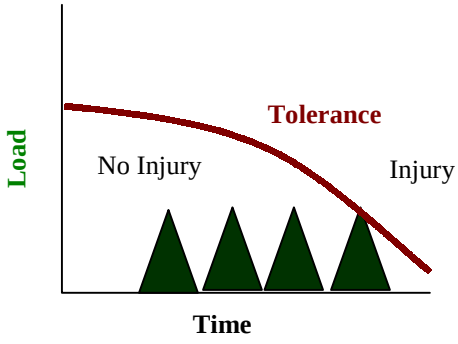
Injuries occur when …
Loads exceed tissue tolerances



Excessive Force

This type of injury occurs from a single event, where the loads or forces are so great they exceed tissue tolerances and cause an immediate injury. This type of injury is more common with trips and falls.

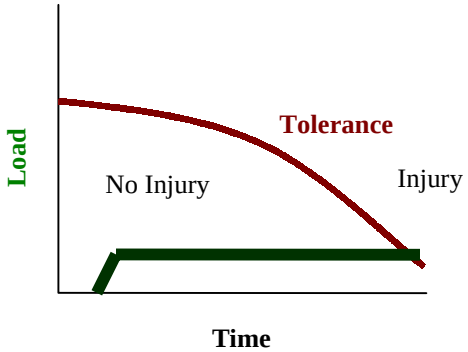
Example – a worker going over on their ankle and spraining it.



Excessive Repetition

This type of injury occurs from repeated loading weakening tissue to the point of failure. It progresses slowly to the point where a subfailure load can cause an injury. This type of injury is more common with repetitive tasks.

Example – a worker pulling lumber off a chain developing a herniated disc.



Excessive Duration

This type of injury occurs from constant loading weakening tissue to the point of failure. This type of injury is more common with tasks that require workers to adopt static or awkward postures for extended periods.

Example – a Grader developing neck tension.

Body Parts at Risk

The previous page on injury education explains how injuries can occur. The Injury Education section of this Work Manual expands on these principles, relating them to the specific body parts at risk of being injured.

After all of the appropriate information is collected during the investigation of the Horizontal/Vertical Resaw job (i.e., injury statistics, discomfort surveys, results from the Identification Checklist), the next steps are to:

1. Match the body parts of concern from your investigation to those described in this section of the Work Manual.

2. Note the direct risk factors associated with each body part of concern.

3. Read the information on the page and try to understand why a body part, in combination with each of the direct risk factors, is of concern.

4. Discover which indirect risk factors are associated with a particular body part problem and the headings under which they are found in the Injury Prevention section of the Work Manual.

5. Note the consequences of the direct risk factor relative to a body part.

6. Note where the potential solutions can be found within the Injury Prevention section of the Work Manual. In addition, for many of the body parts, a reference may be provided to refer to specific sections of the Body Manual.

At the end of the Body Parts at Risk Section, there is a summary page of all the body parts of concern for the Horizontal/Vertical Resaw job. In addition, a reference table, with a summary of the direct and indirect risk factors by body part, is provided.

In the last section on Injury Prevention, the Work Manual discusses specific solution options for each of the body parts at risk.

NECK

Direct Risk Factors:
Awkward Postures
Repetition

A Horizontal/Vertical Resaw Operator looks to the side and/or down in order to view the control panel, infeed, and rollers/conveyor.

BACKGROUND INFORMATION

- A number of smaller muscles around the neck produce the forces necessary to support and move the head. These muscles remain relatively relaxed when the head is balanced over the spine (neutral posture). The neutral posture occurs when the head is upright and the ears and shoulders are aligned.

DIRECT RISK FACTORS

Awkward Postures

- Neck muscles are required to turn the head to the side. The further the head is turned to the side, the greater the load on the muscles and tendons.
- Neck muscles must support the weight of the head while in a bent or twisted position. The more the neck bends or twists, the greater the load on the muscles and tendons.

Repetition

- When the head is repeatedly turned to the side or bent forward, the muscles of the neck are subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues can fatigue to the point of injury.

INDIRECT RISK FACTORS

Workstation Design

Additional Workstation Design Options

- Loading to the neck muscles is increased because the orientation of the worker, with respect to the infeed and outfeed, requires the operator to repeatedly bend and/or twist the neck in order to monitor the work area and view the control panel.

CONSEQUENCES

- When the head is held to the side or in a forward bent and/or twisted posture, muscles and soft tissues of the neck may fatigue. Fatigue leads to an accumulation of waste products and/or a decrease in the ability to tolerate additional stress.
- Signs and symptoms include pain, tenderness, muscle spasm in the neck area, and headaches.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Neck, please see the column labelled “Neck” in the Summary of Solutions on pages 90 & 91.
- For exercises that can help to prevent ***neck*** injuries, see the ***Neck section of the Body Manual.***

NECK/SHOULDER

Direct Risk Factors:
Awkward Postures
Static Postures

A Horizontal/Vertical Resaw Operator reaches to the side or behind in order to reach the control panel.

A Horizontal/Vertical Resaw Operator reaches behind when operating a trim or chop saw.

BACKGROUND INFORMATION

- The neck and shoulder regions work together to produce certain movements, or to hold certain postures. The larger muscles of the neck and upper back (e.g., trapezius) elevate the shoulders, and the larger muscles of the shoulders (e.g., deltoids) raise the arms.

DIRECT RISK FACTORS

Awkward Postures

- Neck and shoulder muscles must support the weight of the arms when they are away from the body. The farther away the arms are from the body, the greater the load on the muscles and tendons.

Static Postures

- When the arms are held away from the body, the muscles of the neck and shoulder must remain tense to support the weight. If the duration of constant tension is excessive, and recovery is not adequate, the tissues may fatigue to the point of injury.

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

- Loading to the neck and shoulder muscles is increased because the console is located in a position that requires the operator to reach away from the body for the controls.
- Loading to the neck and shoulder muscles is increased because the trim/chop saw is located in an area that requires the operator to reach to the side or behind in order to guide the lumber to the cutting area.

CONSEQUENCES

- When the arms are held away from the body, muscles and soft tissues of the neck and shoulder may fatigue. Fatigue leads to an accumulation of waste products and/or a decrease in the ability to tolerate additional stress.
- Signs and symptoms include pain, tenderness, muscle spasm in the neck and shoulder area, and headaches.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Neck/Shoulder, please see the column labelled “Neck/Shoulder” in the Summary of Solutions on pages 90 & 91.
- For exercises that can help to prevent ***neck*** and ***shoulder*** injuries, see the ***Neck*** and ***Shoulder sections of the Body Manual.***

SHOULDER

Direct Risk Factors:
Force
Awkward Postures
Repetition

A Horizontal/Vertical Resaw Operator guides lumber down the infeed in order to inspect and orient it properly.

BACKGROUND INFORMATION

- The shoulder joint is designed for mobility. The joint is held together by muscles and soft tissues. The larger muscle groups around the shoulder are responsible for producing movement (e.g., deltoids). The deeper muscles stabilise the shoulder joint as well as produce movement. These deeper muscles and their tendons are referred to as the rotator cuff.

DIRECT RISK FACTORS

Force

- The rotator cuff stabilises the shoulder joint when objects are manipulated. The heavier the object, or the larger the force required, the greater the load on the rotator cuff.
- If the force placed on the rotator cuff exceeds the tissue tolerances, injury may occur.

Awkward Postures

- The rotator cuff stabilises the shoulder joint when the arms are away from the body. The farther away the arms are from the body, the greater the load on the rotator cuff.

Repetition

- When the arms are repeatedly raised, the rotator cuff is subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues may fatigue to the point of injury.

INDIRECT RISK FACTORS

Workstation Design

Working Heights

- Loading to the rotator cuff is increased because the height of the infeed chain requires the operator to lift the arms upward in order to reach the lumber.

Additional Workstation Design Options

- Loading to the rotator cuff is increased because the design of the workstation encourages the operator to reach and forcefully pull lumber down from the infeed.

Work Organisation

Task Variability

- Loading to the rotator cuff is increased because the lack of variability in the operator's tasks leads to excessive repetition of the same shoulder movements.

CONSEQUENCES

- When using the arms to pull and/or manipulate lumber, the rotator cuff may fatigue. Fatigue leads to an accumulation of waste products and/or a decrease in the ability to tolerate additional stress.
- Stressing a fatigued shoulder may lead to degeneration or injury in the rotator cuff muscles of the shoulder joint.
- Signs and symptoms include pain, tenderness, and decreased range of motion and strength in the shoulder joint.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Shoulder, please see the column labelled "Shoulder" in the Summary of Solutions on pages 90 & 91.
- For exercises that can help to prevent ***shoulde****r* injuries, see the ***Shoulder section of the Body Manual.***

ELBOW/WRIST

Direct Risk Factors:
Force
Awkward Postures
Repetition

A Horizontal/Vertical Resaw Operator grips lumber as they guide and orient it for the saws.

A Horizontal/Vertical Resaw Operator grips tools when clearing cross-ups.

BACKGROUND INFORMATION

- Muscles used for gripping are found in the forearm. The tendons of these muscles cross over the elbow and the wrist joints before connecting to bones. The elbow area may be affected by tension generated in the forearm muscles.

DIRECT RISK FACTORS

Force

- Gripping an object requires activation of the forearm muscles, which generates tension at the tendon/bone connection of the elbow. The harder that an object must be gripped, the greater the load on the tendon/bone connection.

Awkward Postures

- The width of an object affects how much muscle tension needs to be generated. There is an optimal grip width where the forearm muscles work efficiently. Outside this width, muscles have to work harder to generate equivalent tension. Consequently, objects that are too large (e.g., large cuts of wood) or too small (e.g., narrow tool handles) could increase the tension generated by muscles, and lead to tissue fatigue at the tendon/bone connection.
- The position of the wrist also affects how much muscle tension needs to be generated. There is an optimal wrist position where the forearm muscles work efficiently. This occurs when the wrist is in its natural relaxed (neutral)

position. Bending the wrist forward or backward deviates from this position, and the forearm muscles have to work harder to maintain the grip. Consequently, gripping objects with the wrist bent increases the tension generated by muscles, and could lead to tissue fatigue at the tendon/bone connection.

Repetition

- Repeated stress to the elbow without adequate rest could slowly fatigue tissues to the point of injury.

INDIRECT RISK FACTORS

Characteristics of Objects Being Handled

Size and Shape

- Loading to the elbow is increased because orienting the lumber requires a wide, and at times forceful, grip.

Container, Tool, and Equipment Handles

- Loading to the elbow is increased when the operator must grip tool handles with slippery surfaces. The lack of friction between the gloves and the handle, and the narrow handle width, could increase the grip forces necessary to maintain control of the tool.

Work Organisation

Task Variability

- Loading to the elbow/wrist is increased because the lack of variability in the operator's tasks leads to excessive repetition of the same arm movements.

CONSEQUENCES

- Repeated forceful gripping may lead to fatigue at the tendon/bone connection near the elbow.
- Signs and symptoms include pain in the elbow area and decreased grip strength.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Elbow/Wrist, please see the column labelled "Elbow/Wrist" in the Summary of Solutions on pages 90 & 91.
- For exercises that can help to prevent ***elbow*** injuries, see the ***Elbow section of the Body Manual.***

WRIST

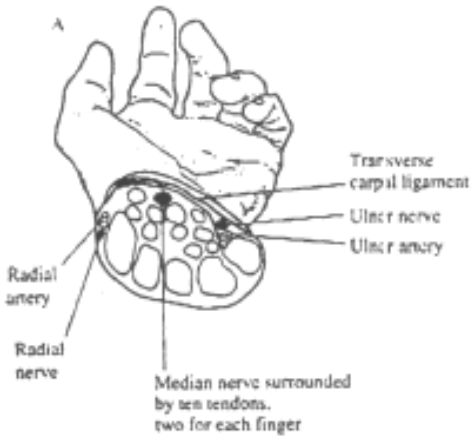
Direct Risk Factors:
Force
Awkward Postures
Repetition

A Horizontal/Vertical Resaw Operator must grip lumber and controls with the wrists bent in order to guide, inspect, and orient it for the saws.

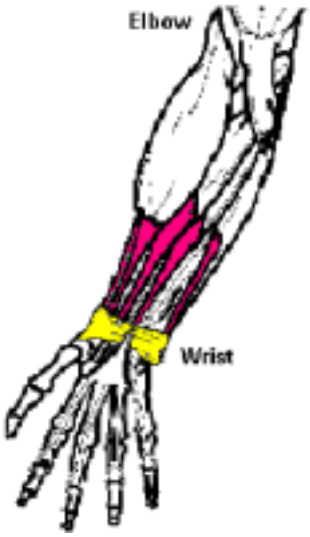
A Horizontal/Vertical Resaw Operator must grip tool handles with the wrists bent when clearing croos-ups.

BACKGROUND INFORMATION

- Most of the muscles involved in gripping and manoeuvring the hands are found in the forearms. These muscles attach at the elbow and their tendons (surrounded by a protective sheath) run down the forearm into the hand. At the wrist, the tendons and a nerve run under a thick band (see pictures below), which forms the roof of the carpal tunnel.



The Carpal Tunnel



DIRECT RISK FACTORS

Force

- Gripping an object requires activation of the forearm muscles, which generates tension in the tendons and tendon sheaths running through the wrist. The harder an object is gripped, the greater the tension in the tendons. As tension increases, the pressure within the carpal tunnel may also increase.

Awkward Postures

- As the wrist is bent, the tendon sheaths will rub up against the walls of the carpal tunnel. The further the wrist is bent, the more friction experienced in the tendon sheaths.

Repetition

- Repeated gripping and/or repeated bending of the wrist causes stress to the tendon sheaths. If the repetitive stress is excessive, and recovery is not adequate, the tendon sheaths may fatigue to the point of injury.

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

- Loading to the tendon sheaths in the wrist is increased because the worker must adopt awkward wrist postures when reaching inappropriately placed controls.

Characteristics of Objects Being Handled

Size and Shape

- Loading to the tendon sheaths in the wrist is increased because the size and shape of the lumber requires the operator to put their wrists into an awkward posture in order to manipulate it. Larger cuts of lumber may also require a more forceful grip in order to manipulate them.

Container, Tool, and Equipment Handles

- Loading to the tendon sheaths in the wrist is increased when straight handled tools are used to clear cross-ups, as the use of straight handled tools can cause awkward wrist postures.

Work Organisation

Task Variability

- Loading to the wrist is increased because the lack of variability in the operator's tasks leads to excessive repetition of the same hand and wrist movements.

CONSEQUENCES

- Repeatedly gripping objects with the wrist bent may lead to irritation and damage in the tendon sheaths.
- Signs and symptoms include pain, tenderness, and inflammation in the wrist area.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Wrist, please see the column labelled “Wrist” in the Summary of Solutions on pages 90 & 91.

LOW BACK

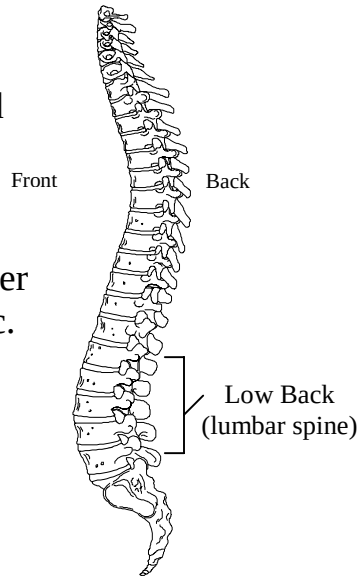
Direct Risk Factors:
Awkward Postures
Repetition

A Horizontal/Vertical Resaw Operator frequently bends forward or to the side, or twists the back, in order to guide lumber onto the rollers/conveyor, and to reach the controls.

BACKGROUND INFORMATION

- The spine is made up of 33 bones called vertebrae. Each of these vertebrae is specially designed to protect the spinal cord and provide support for the back. Between each of the vertebrae are discs. Discs have tough elastic walls that are filled with a watery gel-like substance. These discs are like jelly donuts; when they are pressed down on one side, the other side bulges and puts increased pressure on the wall of the disc. To maintain an even distribution of pressure across the discs, the spine has to be kept in the neutral posture.

Neutral Spine



DIRECT RISK FACTORS

Awkward Postures

- Back muscles must support the weight of the upper body when leaning forward or to the side. Increased bending of the back increases the loading on the spine and increases the pressure on the walls of the discs.

Repetition

- Repeated forward and/or side bending can gradually fatigue the structures of the low back. If the repetitive stress is excessive, and recovery is not adequate, the disc walls may fatigue to the point of injury.

INDIRECT RISK FACTORS

Workstation Design

Working Reaches

- Loading to the back muscles is increased because the location of the infeed requires the operator to reach over the rollers/conveyor to the lumber.
- Loading to the back muscles is increased because the location of the control panel or saw with respect to the worker requires the operator to twist the back in order to see the panel or the saw.

Working Heights

- Loading on the back muscles is increased because the height of the rollers/conveyor is low. This low height requires the operator to bend the back to reach the lumber when orienting it.

Work Organisation

Task Variability

- Loading to the back muscles is increased because the lack of variability in the operator's tasks leads to excessive repetition of the same low back movements.

CONSEQUENCES

- Repeatedly bending forward/to the side or twisting the back may lead to damage in the disc walls.
- Signs and symptoms may include muscle spasm and sharp or radiating pain in the back and/or lower extremities.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Back, please see the column labelled "Back" in the Summary of Solutions on pages 90 & 91.
- For exercises that could help to prevent ***back*** injuries, see the ***Back section of the Body Manual.***

HIP

Direct Risk Factors:
Force
Static Postures

A Horizontal/Vertical Resaw Operator balances on one leg in order to operate foot pedals.

BACKGROUND INFORMATION

- The hip is designed for stability, as a result of the architecture of the bones. Muscles also contribute to the stability of the hip joint. Range of motion in the hip joint is primarily determined by the flexibility of muscles and soft tissues in this region.

DIRECT RISK FACTORS

Force

- Muscles surrounding the hip are used to stabilise the body when standing.
- Balancing on one leg requires the muscles surrounding the hip bearing the weight to contract and stabilise the weight of the whole body. This leads to an increased force being placed on the load-bearing hip.

Static Postures

- Balancing on one leg for prolonged periods requires the muscles surrounding the hip bearing the load to remain tense. With no time allowed for recovery, the constant state of tension in the hip muscles may cause fatigue. If the constant stress is sufficient, and recovery is not adequate, the tissues may fatigue to the point of injury.

INDIRECT RISK FACTORS

Workstation Design

Seating

- Loading on the hip is increased because of the lack of appropriate seating. This may result in an inability to relieve the lower extremities of the load of the upper body.

Floor Surfaces

- Loading on the hip is increased because the foot pedals used require constant activation by the operator. This lead to a need to balance on one leg.

CONSEQUENCES

- Balancing on one leg for prolonged periods can lead to muscle imbalance at the hip. This muscle imbalance may lead to excessive loading, which may cause degenerative changes in the hip, and possibly the knee and low back.
- Signs and symptoms include pain in the area around the hip joint and stiffness to one side. Muscle weakness in the affected side may also be noticed.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Hip, please see the column labelled “Hip” in the Summary of Solutions on pages 90 & 91.

ANKLE

Direct Risk Factors:
Awkward Postures
Repetition

A Horizontal/Vertical Resaw Operator frequently activates foot pedals in order to operate chains, saws, and/or kickers.

BACKGROUND INFORMATION

- The muscle responsible for pulling the foot upwards is found in the front of the shin. Its tendon runs beneath thick bands at the ankle before attaching to the foot bones.

DIRECT RISK FACTORS

Awkward Postures

- Lifting the foot to activate a foot pedal puts the ankle into an awkward posture, which increases the loading in the muscle on the front of the shin. The further away from the neutral posture the ankle is, the greater the loading to this muscle. If the shoes worn are rigid or heavy, the loading is also increased.

Repetition

- Repetitive use of foot pedals may gradually cause small tears in the muscle on the front of the shin. If the repetitive stress is excessive, and recovery is not adequate, the small tears in the muscle on the front of the shin may progress to a more significant problem.

INDIRECT RISK FACTORS

Workstation Design

Floor Surfaces

- Loading to the muscle of the shin is increased if the height of the foot pedal is increased. The higher the foot must be lifted to activate the foot pedal, the greater the loading on the shin muscle.

Work Organisation

Task Variability

- Loading to the shin is increased because the lack of variability in the operator's tasks leads to excessive repetition of the same ankle movements.

CONSEQUENCES

- Repeated use of foot pedals can cause damage to the tissues in the shin.
- Signs and symptoms include inflammation, and pain with walking.

SUGGESTED SOLUTIONS

- For specific solutions that may prevent injuries to the Ankle, please see the column labelled "Ankle" in the Summary of Solutions on pages 90 & 91.

Summary of Body Parts at Risk

NECK

- A Horizontal/Vertical Resaw Operator looks to the side and/or down in order to view the control panel, infeed, and rollers/conveyor.

NECK/SHOULDER

- A Horizontal/Vertical Resaw Operator reaches to the side or behind in order to reach the control panel.

- A Horizontal/Vertical Resaw Operator reaches behind when operating a trim or chop saw.

SHOULDER

- A Horizontal/Vertical Resaw Operator guides lumber down the infeed in order to inspect and orient it properly.

ELBOW/WRIST

- A Horizontal/Vertical Resaw Operator grips lumber as they guide and orient it for the saws.

- A Horizontal/Vertical Resaw Operator grips tools when clearing cross-ups.

WRIST

- A Horizontal/Vertical Resaw Operator must grip lumber and controls with the wrists bent in order to guide, inspect, and orient it for the saws.

- A Horizontal/Vertical Resaw Operator must grip tool handles with the wrists bent when clearing cross-ups.

LOW BACK

- A Horizontal/Vertical Resaw Operator frequently bends forward or to the side, or twists the back in order to guide lumber onto the rollers/conveyor and reach the controls.

HIP

- A Horizontal/Vertical Resaw Operator balances on one leg in order to operate foot pedals.

ANKLE

- A Horizontal/Vertical Resaw Operator frequently activates foot pedals in order to operate chains, saws, and/or kickers.

Risk Factors by Body Part

Direct Risk Factors	Neck	Neck/ Shoulder	Shoulder	Elbow/ Wrist	Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Force			✓	✓	✓			✓			
Repetition	✓		✓	✓	✓		✓			✓	
Awkward Postures	✓	✓	✓	✓	✓		✓			✓	
Static Postures		✓						✓			
Contact Stress											
Vibration – Whole body*											
Vibration – Hand Transmitted*											

Indirect Risk Factors		Neck	Neck/ Shoulder	Shoulder	Elbow/ Wrist	Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Duration**	Duration	✓	✓	✓	✓	✓		✓	✓		✓	
Workstation Design	Working Reaches		✓					✓				
	Working Heights			✓				✓				
	Seating								✓			
	Floor Surfaces								✓		✓	
Characteristics of Objects Being Handled	Size and Shape				✓	✓						
	Load Condition and Weight Distribution											
	Container, Tool and Equipment Handles				✓	✓						
Environmental Conditions	Heat Exposure	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
	Cold Exposure	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
	Lighting	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
	Noise	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
	Vibration*	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Work Organisation	Work-Recovery Cycles	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
	Task Variability	♦	♦	✓ ♦	✓ ♦	✓ ♦	♦	✓ ♦	♦	♦	✓ ♦	♦
	Work Rate	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦

** Vibration is categorised under both direct and indirect risk factors. Vibration can directly increase the likelihood of injury to the back and wrist as well as indirectly (environmental conditions) promote injuries in other parts of the body.*
*** Extended exposure to <u>any</u> risk factor can increase the likelihood of injury. For solutions designed to decrease the duration of exposure to any risk factor please refer to the Work Organisation section of the General Risk Factor Solutions Manual.*

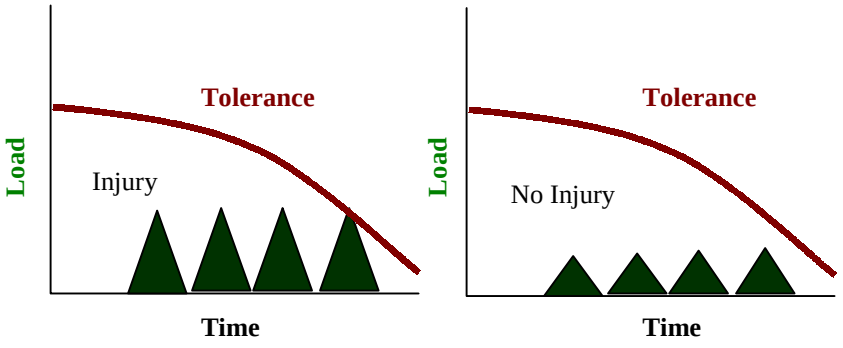
= Indicates that the risk factor was assessed and was not found to be a contributor to the body part problem.

♦ = Indicates that the risk factor assessed is commonly found in sawmills, and may need to be addressed at your mill. See the appropriate section of the General Risk Factor Solutions Manual for more information.

✓ = Indicates that the risk factor was assessed as a contributor to the body part problem. Please see the Summary of Solutions Table on pages 90 & 91 for specific problem/solution information. Additional information on some risk factors can be found in the General Risk Factor Solutions Manual.

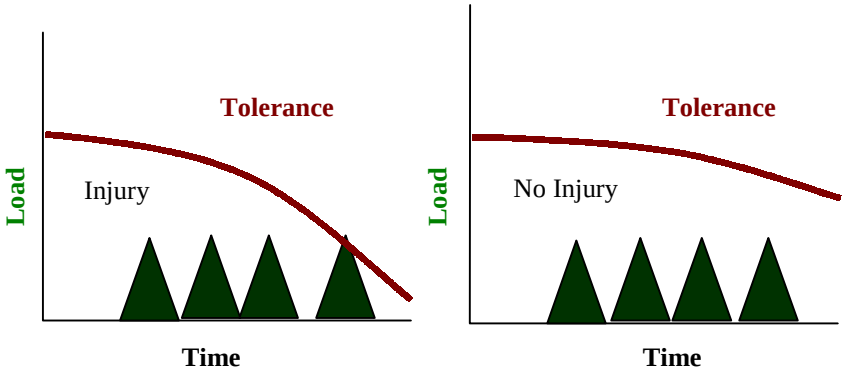
Injury Prevention

Injuries are prevented by …
Decreasing loads and increasing tissue tolerances



Injuries may be avoided by decreasing the size of the loads on the tissue.

Example – using a torque multiplier wrench to loosen bolts.



Injuries may be avoided by increasing tissue tolerances, and allowing the body to endure more loading.

Example – using maintenance exercises to strengthen tissues.

Suggested Solutions

The previous page explains how injuries may be prevented by decreasing the load on a tissue or by increasing the tissue tolerances. The Injury Prevention section of the Work Manual provides possible solutions that can be implemented to decrease the size of the loads on the tissues.

Each of the solutions described in the Work Manual has a risk control icon. The Risk Control Key provides guidelines on how to distinguish between different types of risk controls. Generally, engineering, administrative, and work practice controls are considered more effective than the use of personal protective equipment to decrease the risk of musculoskeletal injuries.

The focus of the Injury Prevention section is on solutions developed following the ergonomic investigation of the Horizontal/Vertical Resaw job. The solutions are presented under the headings of Workstation Design, Characteristics of Objects Being Handled, Environmental Conditions, and Work Organisation.

The Summary of Solutions table provides a quick reference guide to solutions for specific body part problems.

Please note that the information provided in the Body Manual addresses the issue of injury prevention in terms of increasing tissue tolerances through exercise. This information is not provided in the Work Manual.

Risk Control Key

Risk control measures (solutions) are commonly grouped into four categories:

E

ENGINEERING CONTROLS
These include physical changes to workstations, equipment, materials, production facilities, or any other relevant aspect of the work environment, that reduce or prevent exposure to risk factors.

A

ADMINISTRATIVE CONTROLS
These include any change in procedure that significantly limits daily exposure to risk factors, by control or manipulation of the work schedule or manner in which work is performed. Administrative controls include, but are not limited to, job rotation, rest breaks, alternative tasks, job enlargement, redesign of work methods, and adjustment of work pace or output. Some models of risk control include work practice controls within this category.

WP

WORK PRACTICE CONTROLS
These include techniques used to perform the tasks of a job, such as reaching, gripping, using tools and equipment, or discarding objects, etc. Education and training are an integral part of work practice controls.

PPE

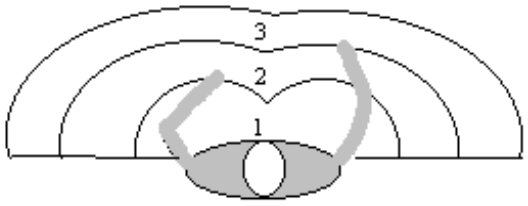
PERSONAL PROTECTIVE EQUIPMENT
These are devices worn by a worker to reduce the risk of injury, including gloves, knee pads, hearing protection, and leather aprons.

On the following pages, the icons next to the solution options indicate the type of risk control.

Workstation Design

WORKING REACHES

A working reach that is too far for the worker will require stressful shoulder, elbow, wrist, and back postures. Reaching to the side, behind, or too far in front of the body can put stress on the smaller muscles. Ideally, working reaches should be within a normal reach envelope, as laid out below, with the controls and materials that are handled most often closest to the body. It is also ideal to have controls that perform similar or combined functions grouped together to decrease awkward postures that may otherwise occur.



1 = Controls/items most frequently used
2 = Controls/items less frequently used
3 = Controls/items least frequently used

Generally, the most frequently used items should be placed within a forearm's reach, with less frequently used items placed within a comfortable arm's reach, and infrequently used items placed within a fully extended arm's reach. For more specific recommendations on working reaches, please consult anthropometric tables or an ergonomist.

Moveable console

E

In order to reduce awkward postures of the shoulder and back, the operator's control panel can be relocated to an area where excessive reaching would not be required. For example, a small vertically and horizontally adjustable console that contained the most frequently used controls (e.g., saw width controls) would be ideal. This would allow the operator to place the control panel in an area most accessible to them.

Multiple control joystick

E

In order to reduce awkward postures of the shoulder and back, a multiple control joystick can be installed in front of the operator. By placing the most frequently used controls on a joystick close to the operator, many awkward movements of the upper limbs could be eliminated.

Unscrambler and lugs

E

In order to reduce forceful and awkward postures of the shoulders and wrists, and awkward postures of the low back, a well functioning unscrambler could be added to the workstation to reduce the number of cross-ups. An infeed chain with lugs would also aid in decreasing the number of cross-ups.

Wait for lumber to drop

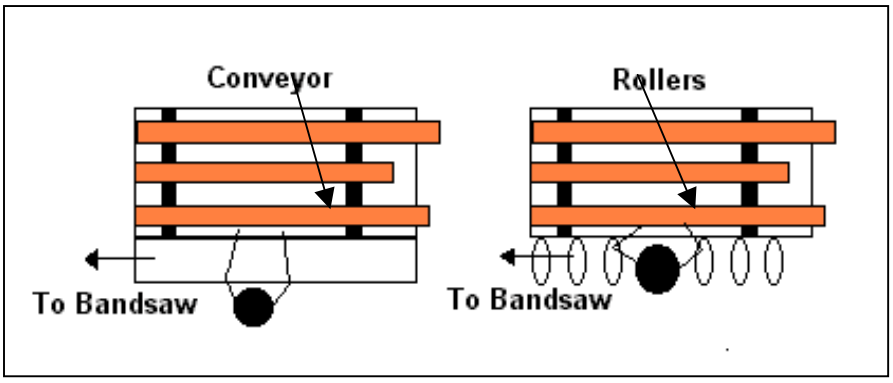
E

In order to reduce forceful and awkward movements of the shoulder, and awkward postures of the low back, while guiding boards down the infeed, the operators should be encouraged to wait for the lumber to drop to the rollers/conveyor before the lumber is inspected and oriented for the saws.

Rollers

E

In order to reduce awkward postures of the shoulder and back, rollers can be used instead of a conveyor for the bandsaw infeed. The operator would be allowed closer access to the lumber infeed by positioning the rollers so the operator can step toward the lumber infeed.



Control location

E

In order to reduce awkward postures of the wrist, ensure controls are located in an accessible location, and that awkward wrist postures are not required for their operation.

Trim/chop saw location

E

In order to reduce awkward and forceful movements of the shoulder, the trim/chop saw should be located in an area close to the operator, but in an area not requiring extension of the arm to reach. A platform slightly elevated from the main rollers/conveyor, with pin stops to lift the lumber, would be appropriate. A time delayed (or foot pedal activated) kicker to return the cut lumber to the main rollers/conveyor would also aid in reducing awkward and forceful postures of the arms.

WORKING HEIGHTS

A working height that is too high for the worker will require stressful shoulder and arm postures, while a height that is too low will require stressful bending of the neck and trunk. The height of a work surface should allow room to change position and move the legs and feet (WCB Draft Ergonomic Regulations, 1994).

The ideal workstation is height adjustable, allowing a large percentage of the population to adjust the work surface height to suit their dimensions

To determine the appropriate height specific for the Horizontal/Vertical Resaw Operator, identify the body part of most concern. If the main concern is the:

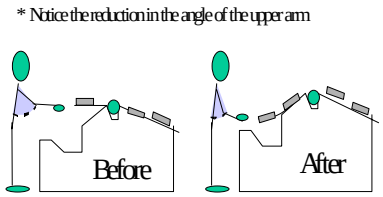
Neck - minimise forward bending of the neck by increasing working height.
Shoulders - minimise elevation of the arms by lowering working height.
Low Back - minimise forward bending of the back by increasing working height.

For more specific guidelines on matching the working heights with the tasks performed please consult anthropometric tables or an ergonomist.

Slant infeed

E

In order to eliminate awkward postures of the shoulder and low back while guiding lumber down the infeed, the infeed can be slanted down towards the operator (e.g., a "waterfall").



Infeed height

E

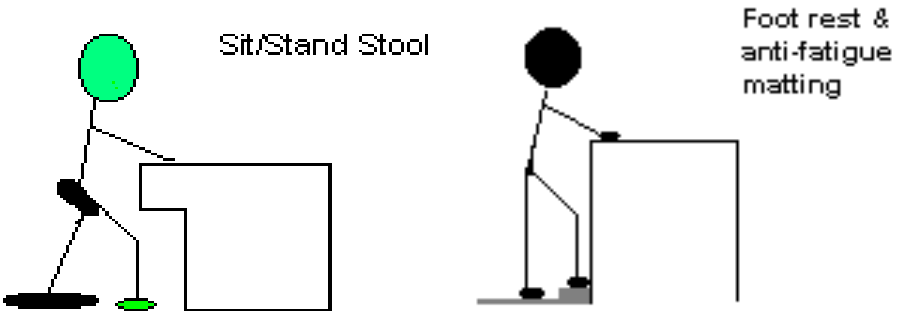
In order to reduce awkward postures of the shoulder while guiding boards down the infeed, the height of the infeed can be lowered and/or the worker raised (e.g., on a platform). This option would be most appropriate for those workstations, which do not require the operator to manually handle lumber (e.g., have kickers to turn the lumber). Keep in mind that lowering the infeed height and/or raising the worker may introduce additional stress to the low back and neck.

SEATING

Sit/stand stool

E
WP

In order to minimise fatigue in the lower extremities, sit/stand stools can be provided. Sit/stand stools are preferred over regular stools, as the design makes it easier to alternate between sitting and standing, and allows the larger muscles of the lower extremities to be recruited when handling objects. If sit/stand stools are not possible, foot rests or foot rails can be provided to encourage frequent changes in posture.



FLOOR SURFACES

Anti-fatigue matting

E

In order to minimise fatigue in the lower extremities, anti-fatigue matting can be installed. The use of anti-fatigue matting in the work area will help to increase comfort and reduce muscle fatigue. The cushioned surface encourages continuous micro-movements of the feet, which minimises blood pooling in the feet and legs and the associated discomfort.

Hip extensor stretch

WP

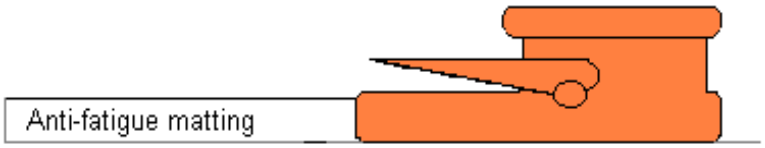
In order to alleviate strain in the hip region, perform the hip extensor stretch in the back section of the Body Manual.

Foot pedals

Recessed foot pedals

E

In order to minimise awkward postures of the ankle, recess foot pedals into anti-fatigue matting to decrease the height of the foot pedal base. To recess foot pedals, and provide a more comfortable standing surface in the process, position anti-fatigue matting as close as possible to the foot pedal base. If the pedals are stationary, cut the matting to surround the front of the foot pedal. For moveable foot pedals, place the matting as close to the base of the foot pedal as possible. The height of the matting should not exceed the base of the foot pedal (see diagram below). It is important to ensure pedals are kept clean of debris and are well maintained.



Moveable foot pedals

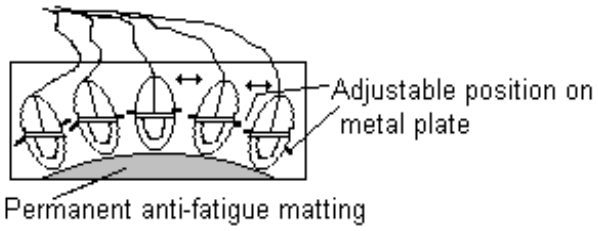
WP

In order to reduce awkward postures of the lower extremities; allow operators to choose the most appropriate position for the pedals, based on their body dimensions and the workstation design. Foot pedals should be placed in a position that does not require the operator to bend over them to reach lumber on the rollers/conveyor.

E
WP

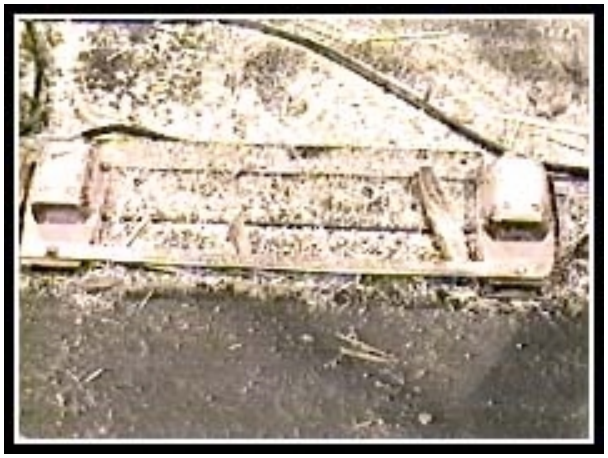
Securing the foot pedals may be required or desirable. Three solutions include:

1) Providing moveable foot pedals on a metal plate. The foot pedals are positioned in slide tracks cut into the metal, which allow pedals to move into the desired positions. The pedals are then fastened into place. The operator is able to move the set of foot pedals to any desired position in the workstation.



2) Providing several positions on the floor where clips or nails may be used to secure foot pedals. If this option is considered, make sure each possible position is highly visible to all operators, to prevent tripping or injuries.

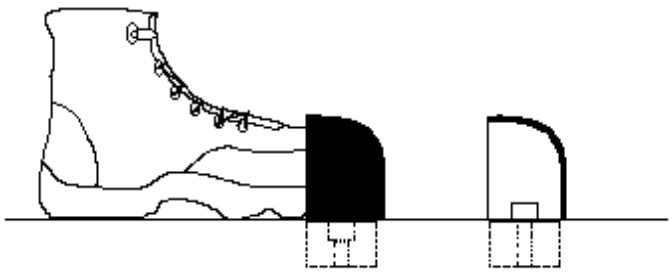
3) Provide a physical link (e.g., a metal bar) between two foot pedals with the same function. This solution is most appropriate where a worker may move to manipulate lumber but still needs to operate the foot pedals.



Foot push buttons

E

In order to eliminate awkward ankle postures, foot buttons can be chosen over foot pedals in certain circumstances. In general, foot controls leave the upper body free to manipulate or handle items, while still maintaining control over the process or equipment. For processes or equipment that require a control to produce a discrete action (e.g., on/off, start/stop) or maintain a continuous process (e.g., movement of a chain), a foot push button may be appropriate. The desired operation (e.g., chain running) is easily activated by the weight of the operator on the push button. When the foot is removed, the switch is deactivated, causing the process to stop. For safety reasons, a foot push button needs to be protected from accidental activation. A guard, similar to those used on foot pedals, may be appropriate.

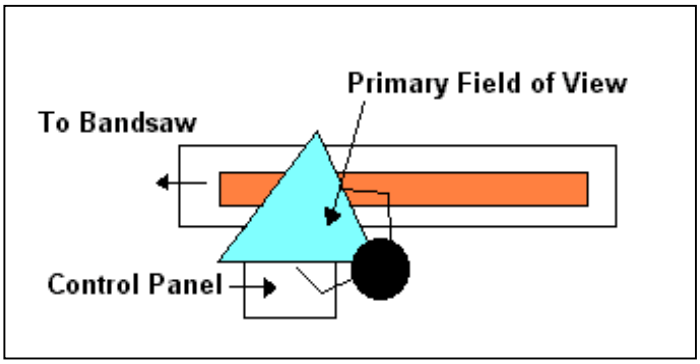


ADDITIONAL WORKSTATION DESIGN OPTIONS

Orientation of operator

E

In order to reduce awkward postures of the neck, the operator and console can be oriented to minimise the degree of neck twisting required to view the infeed and outfeed. For example, orienting the worker on a 45 degree angle to the infeed, facing the bandsaw, would reduce the degree of neck twisting required. The controls used most frequently, and any monitors or displays that the operator must view, should be located within the primary field of view.



Neck postural exercise

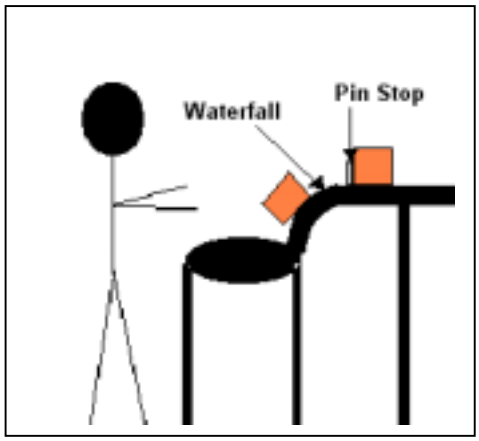
WP

In order to reduce stress on the neck, and ensure healthy spinal alignment, perform the neck postural exercise in the neck section of the Body Manual.

Design of infeed

E

In order to reduce the need for the operator to reach to the infeed to pull lumber down to the rollers/conveyor (forceful and awkward postures), pin stops could be installed at the end of the lumber infeed and a “waterfall” used to guide lumber from the infeed onto the rollers/conveyor.



Characteristics of Objects Being Handled

SIZE AND SHAPE

Pin stops/kickers

E

In order to reduce the force required to orient the lumber, pin stops or kickers could be added to the roller/conveyor infeed for the bandsaw. This would allow the operator to orient the lumber with mechanical aids.

CONTAINER, TOOL AND EQUIPMENT HANDLES

Wrap tool handles

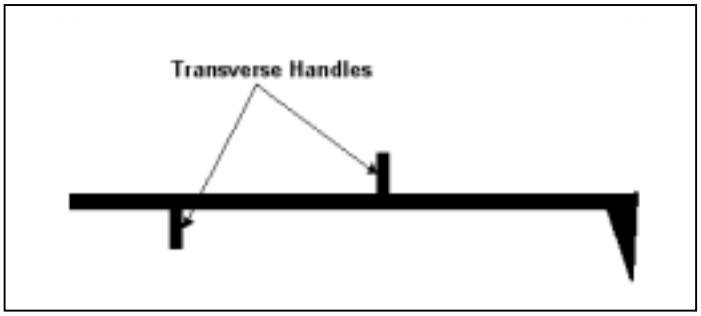
E

In order to reduce the force required to grip hand tools, increase the friction between the tool handles and the operator's glove. Due to the slippery surface of metal or wooden tool handles (e.g., pike pole, picaroon) a Horizontal/Vertical Resaw Operator must use a higher grip force in order to maintain control of the tool. This can put the elbow, and possibly the wrist and hand, at risk of injury. Wrapping the tool handles with foam, rubber, medical/athletic tape, or modifying the surface using other friction increasing material (e.g., gritty paint if plastic substances are not allowed) would increase the friction between the handle and the Horizontal/Vertical Resaw Operator's glove, and thus decrease the grip forces required.

Transverse tool handles

E

In order to reduce awkward postures while gripping tools, transverse handles could be added to the tools. This would allow the wrist to remain in a more neutral posture when the tools are being used.



Thin gloves

PPE

In order to reduce grip forces required by the Horizontal/Vertical Resaw Operator, the operator should wear thin, close fitting gloves with a "sticky" palm surface to increase the friction between the gloves and the lumber and tool handles.

Environmental Conditions

Please refer to the General Risk Factor Solutions Manual for solutions regarding environmental risk factors.

Work Organisation

Reducing the amount of reaching and handling involved in the Horizontal/Vertical Resaw job is the main concern for reducing ergonomic related injuries in this job. Evaluating task variability, job rotation, and other work organisation risk factors may reduce the exposure of the Horizontal/Vertical Resaw Operator to the continual reaching, guiding, and orienting of lumber.

Please refer to the General Risk Factor Solutions Manual for solutions regarding work organisation risk factors.

Summary of Solutions

Refer to the table below to help determine which solution alternatives will aid in addressing risk factors in the particular body parts of concern.

		Injury Prevention Potential										
SOLUTIONS	**Page**	Neck	Neck/ Shoulder	Shoulder	Elbow/Wrist	Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Moveable console	**81**		**A**					**A**				
Multiple control joystick	**81**		**A**					**A**				
Unscrambler and lugs	**82**		**F A**	**F A**		**F A**		**A**				
Wait for lumber to drop	**82**		**F A R**	**F A R**				**A**				
Rollers	**82**		**A**	**A**				**A**				
Control location	**82**					**A**						
Trim/chop saw location	**82**		**A**	**F A**								
Slant infeed	**83**		**A**	**A**				**A**				
Infeed height	**83**		**A**	**A**								
Sit/stand stool	**84**							**S**	**F S**	**S**		**S**
Anti-fatigue matting	**84**							**S**	**S**	**S**		**S**
Hip extensor stretch	**84**								**F S**			

Direct Risk Factors

F = *Force* **R** = *Repetition* **A** = *Awkward Postures*
S = *Static Postures* **C** = *Contact Stress* **V =** *Vibration*

Summary of Solutions

Refer to the table below to help determine which solution alternatives will aid in addressing risk factors in the particular body parts of concern.

		Injury Prevention Potential										
SOLUTIONS	**Page**	Neck	Neck/ Shoulder	Shoulder	Elbow/Wrist	Wrist	Wrist/ Hand	Low Back	Hip	Knee	Ankle	Foot
Foot pedals	**85**										**A**	
Orientation of operator	**87**	**A**	**A**									
Neck postural exercise	**87**	**A**	**A**									
Design of infeed	**87**		**F A**	**F A**				**A**				
Pin stops/kickers	**88**				**F A R**	**F A R**						
Wrap tool handles	**88**				**F**							
Transverse tool handles	**88**				**A**	**A**						
Thin gloves	**88**				**F**							
Heat Exposure	◆	indirectly reduces risk of injury to the body										
Cold Exposure	◆	indirectly reduces risk of injury to the body										
Lighting	◆	indirectly reduces risk of injury to the body										
Noise	◆	indirectly reduces risk of injury to the body										
Vibration	◆	directly reduces risk of injury to the back and wrist										
Rest breaks	◆	indirectly reduces risk of injury to the body										
Job Rotation	◆	indirectly reduces risk of injury to the body										
Task Rotation	◆	indirectly reduces risk of injury to the body										
Work Pace	◆	indirectly reduces risk of injury to the body										
Scheduling	◆	indirectly reduces risk of injury to the body										

Direct Risk Factors

F = *Force* **R** = *Repetition* **A** = *Awkward Postures*
S = *Static Postures* **C** = *Contact Stress* **V** = *Vibration*
◆ = *See General Risk Factor Solutions Manual*

HORIZONTAL/VERTICAL RESAW MSI SAFETY GUIDE

OBJECTIVE: To identify ergonomic risks involved in operating the Horizontal/Vertical Resaw and to reduce the potential for musculoskeletal injuries. More detailed information about risk reducing recommendations can be found in the Work Manual for the Horizontal/Vertical Resaw.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Neck A Horizontal/ Vertical Resaw Operator looks to the side and/or down in order to view the control panel, infeed, and rollers/conveyor.	**Awkward Postures** **Repetition**	• Neck muscles are required to turn the head to the side. The further the head is turned to the side, the greater the load on the muscles and tendons. • Neck muscles must support the weight of the head while in a bent or twisted position. The more the neck bends or twists, the greater the load on the muscles and tendons. • When the head is repeatedly turned to the side or bent forward, the muscles of the neck are subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues can fatigue to the point of injury.	• If twisting cannot be avoided, try to turn the head in both directions. • When twisting or bending the neck, keep the chin tucked in and the ears in alignment with the shoulders. • Turn the whole body, instead of just the neck, to view the control panel. • Exercise to improve endurance of neck muscles, improve posture, and to prevent ***neck*** discomfort, ***see the Neck section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Neck/Shoulder A Horizontal/ Vertical Resaw Operator reaches to the side or behind in order to reach the control panel or when operating a trim or chop saw.	**Awkward Postures** **Static Postures**	• Neck and shoulder muscles must support the weight of the arms when they are away from the body. The further away the arms are from the body, the greater the load on the muscles and tendons. • When the arms are held away from the body, the muscles of the neck and shoulder must remain tense to support the weight. If the duration of constant tension is excessive, and recovery is not adequate, the tissues may fatigue to the point of injury.	• Turn the whole body to view the control panel and when operating the chop/skill saw. • For exercises that can help prevent ***neck*** and ***shoulder*** injuries, ***see the Neck and Shoulder sections of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Shoulder A Horizontal/ Vertical Resaw Operator guides lumber down the infeed in order to inspect and orient it properly.	**Force** **Awkward Postures** **Repetition**	• The rotator cuff stabilises the shoulder joint when objects are manipulated. The heavier the object, or the larger the force required, the greater the load on the rotator cuff. • If the force placed on the rotator cuff exceeds the tissue tolerances, injury may occur. • The rotator cuff stabilises the shoulder joint when the arms are away from the body. The further away the arms are from the body, the greater the load on the rotator cuff. • When the arms are repeatedly raised, the rotator cuff is subjected to repeated stress with little time for recovery. If the repetitive stress is excessive, and recovery is not adequate, the tissues may fatigue to the point of injury.	• In order to reduce forceful and awkward movements of the shoulder while guiding boards down the infeed, wait for the lumber to drop to the rollers/conveyor before the lumber is inspected and oriented for the saws. • Avoid sudden forceful movements of the arms. Use smooth motions while keeping the arms close to the body. • For exercises that can help prevent ***shoulder*** injuries, ***see the Shoulder section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Elbow/Wrist A Horizontal/ Vertical Resaw Operator grips lumber as they guide and orient it for the saws. A Horizontal/ Vertical Resaw Operator grips tools when clearing cross-ups.	**Force** **Awkward Postures** **Repetition**	• Gripping an object requires activation of the forearm muscles, which generates tension at the tendon/bone connection of the elbow. The harder that an object must be gripped, the greater the load on the tendon/bone connection. • The width of an object and the position of the wrist also affect how much muscle tension needs to be generated. Bending the wrist forward or backward, or gripping an object that is too large or too small, deviates from the optimal position, and the forearm muscles have to work harder to maintain the grip. As muscles generate increased tension, tissue fatigue can occur at the tendon/bone connection. • Repeated stress to the elbow without adequate rest could slowly fatigue tissues to the point of injury.	• Use only as much gripping force as is necessary. • Maintain a straight wrist position. • Whenever possible, try using both hands. • To prevent injuries by increasing tissue tolerances, ***refer to the Elbow section of the Body Manual.*** Strengthening exercises should be used by new employees or employees who have been off work for extended periods.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Wrist A Horizontal/ Vertical Resaw Operator must grip lumber and controls with the wrists bent in order to guide, inspect, and orient it for the saws. A Horizontal/ Vertical Resaw Operator must grip tool handles with the wrists bent when clearing cross-ups.	**Force** **Awkward Postures** **Repetition**	• Gripping an object requires activation of the forearm muscles, which generates tension in the tendons and tendon sheaths running through the wrist. The harder an object is gripped, the greater the tension in the tendons. As tension increases, the pressure within the carpal tunnel may also increase. • As the wrist is bent, the tendon sheaths will rub up against the walls of the carpal tunnel. The further the wrist is bent, the more friction experienced in the tendon sheaths. • Repeated gripping and/or repeated bending of the wrist causes stress to the tendon sheaths. If the repetitive stress is excessive, and recovery is not adequate, the tendon sheaths may fatigue to the point of injury.	• Whenever possible, try using both hands to grip and manoeuvre the lumber. • Use only as much force as is necessary to grip and manoeuvre the lumber. • Avoid sudden forceful movement of the hands. Use smooth motions and keep the wrists straight. • Limit turning the board to once or twice. • To prevent injuries by increasing tissue tolerances, ***refer to the Wrist section of the Body Manual.*** Strengthening exercises should be used by new employees or employees who have been off work for extended periods.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Low Back A Horizontal/ Vertical Resaw Operator frequently bends forward or to the side, or twists the back in order to guide lumber onto the rollers/conveyor and reach the controls.	**Awkward Postures** **Repetition**	• Back muscles must support the weight of the upper body when leaning forward or to the side. Increased bending of the back increases the loading on the spine and increases the pressure on the walls of the discs. • Repeated forward and/or side bending can gradually fatigue the structures of the low back. If the repetitive stress is excessive, and recovery is not adequate, the disc walls may fatigue to the point of injury.	• In order to reduce awkward postures of the low back while guiding boards down the infeed, wait for the lumber to drop to the rollers/ conveyor before the lumber is inspected and oriented for the saws. • Try to keep the back in a neutral position (ears, shoulders, and hips aligned). • Position foot pedals in the working area so that you don't have to bend over them to reach lumber on the rollers/conveyor. • For exercises that can help prevent ***back*** injuries, ***see the Back section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Hip A Horizontal/ Vertical Resaw Operator balances on one leg in order to operate foot pedals.	**Force** **Static Postures**	• Muscles surrounding the hip are used to stabilise the body when standing. • Balancing on one leg requires the muscles surrounding the hip bearing the weight to contract and stabilise the weight of the whole body. This leads to an increased force being placed on the load-bearing hip. • Balancing on one leg for prolonged periods requires the muscles surrounding the hip bearing the load to remain tense. With no time allowed for recovery, the constant state of tension in the hip muscles may cause fatigue. If the constant stress is sufficient, and recovery is not adequate, the tissues may fatigue to the point of injury.	• Alternate the leg that bears the majority of the body weight on a regular basis. • Stretch to alleviate the strain in the hips – perform the hip extensor stretch in ***the Back section of the Body Manual***.

CHECK IF THIS APPLIES	ACTIVITY OF RISK	DIRECT RISK FACTOR(S)	POTENTIAL HAZARDS	SUGGESTED SOLUTIONS
	Ankle A Horizontal/ Vertical Resaw Operator frequently activates foot pedals in order to operate chains, saws, and/or kickers.	**Awkward Postures** **Repetition**	• Lifting the foot to activate a foot pedal puts the ankle into an awkward posture, which increases the loading in the muscle on the front of the shin. The further away from the neutral posture the ankle is, the greater the loading to this muscle. If the shoes worn are rigid or heavy, the loading is also increased. • Repetitive use of foot pedals may gradually cause small tears in the muscle on the front of the shin. If the repetitive stress is excessive, and recovery is not adequate, the small tears in the muscle on the front of the shin may progress to a more significant problem.	• Stretch the ankles before and during work to make sure the muscles and ligaments are loose. • Alternate using the toe of the foot and the heel of the foot to activate the foot pedals. This will use more muscles of the leg, increasing circulation in this area. • To prevent injuries by increasing tissue tolerances, ***refer to the Foot section of the Body Manual.*** Strengthening exercises should be used by new employees or employees who have been off work for extended periods.