

Manufacturing Ergonomic Risk Evaluation Tool - MERET

USER GUIDE

May, 2019, Version 1.0

Developed by: A. Dolhy Ergonomics Inc. and Motor Coach Industries

www.dolhyergonomics.com or www.wcb.mb.ca

supported from a grant by the Research and Workplace Innovation Program
of the Workers Compensation Board of Manitoba



Assessment # 1			
Access to Work	Body Position	Motion, Speed, Static Work	Manipulation Force
1.0 - front, work table	1.0 - standing	1.0 - Smooth Motion, moderate pace and regular pauses in	0.5 - < 2lb, Light, Barely noticeable or relaxed effort
Duration of the Process	Process Repetition	Vibration	Contact Stress
1.5 - >8hrs	0.5 - 1-2 times	1.0 - None	1.0 - None
Pinch Grip	Vision	Temperature Issues	Time Pressure
1.0 - None	1.0 - None	1.0 - None	1.0 - None
Evaluation Scores			
	Cumulative Score ≥ 15	1.8	
	High Force Score ≥ 5	0.3	
	Force and Body Position Score ≥ 8	1.3	

Introduction

The Manufacturing Ergonomic Risk Evaluation Tool (MERET) was developed as a method to evaluate the musculoskeletal risk for both pre-production and existing tasks. The MERET was designed for a manufacturing facility and validated for common physical demands. The MERET quantitatively assigns three scores based on 12 categories that provide an evaluation of risk. The three outcomes include a Cumulative Score, High Force Score and a Force and Body Position Score.

The MERET was created to address the situations found within an industrial manufacturing environment mainly the need to review workstations and tasks that are only in the development or pre-production stage. Those in charge of designing or putting together workstations, tools and equipment can use this evaluation tool to determine if a musculoskeletal issue potentially exists. This tool can then be used to provide direction on corrective actions and to estimate the impact of controls.

The MERET includes an Evaluation Program in which drop down menus are chosen based on the task plans or observation of an existing task and documentation which includes information for evaluating each category with references and guidelines.

The following is a quick guide on how to perform an analysis using the MERET. The outcomes of the MERET include a Cumulative Score, a High Risk Score and a High Force/Body Posture Score. The outcomes of the MERET were validated for 75 manufacturing tasks with a positive predictive value of 86%, a negative predictive value of 83%, a sensitivity of 92% and a specificity of 74%. The outcomes were compared to a

full ergonomic assessment conducted by a certified professional ergonomist. The reliability study found an Intraclass Correlation Coefficient of 0.64 or moderate for this evaluation tool.

Collect Information about the Task

The first step in the evaluation process is to familiarize yourself with the task. The two pathways of using this evaluation tool is by observing a task that is currently in production or to review documentation of any planned changes to existing tasks or completely new tasks. Identify in the evaluation tool if documentation is an estimate or actual measurement. A brief task analysis, background information about the task and interviews with those performing or will be performing the task can be inputted into the Task Information and Description text box.

Become Familiar with the 12 Risk Categories

There are 12 risk categories that make up the content of the MERET. The assessor may use a printed version of the Worksheet and later input data into the evaluation tool or the excel program can be used directly. In focus groups, it was better to print a hard copy or the Worksheet especially when first learning to use the MERET. The Worksheet contains detailed information regarding the 12 Risk categories, the options for picking the input for each category and specific ergonomic guidelines to help the assessor make a decision.

Access to Work				
Front/ Work Table	- around waist height and within 22" reach			
Extended Side Reach	- the arm is almost fully extended, reach more than 24".			
Overhead	- above head height, > 68"			
At Floor Level	- or below knee height, <18"			
Underneath/Blind	- body is in an awkward position to see			
<i>The design of the workstation which dictates the worker's ability to perform or conduct the task.</i>				
				
Front/Work Table	Extended Reach	Overhead	Floor Level	Underneath/Blind

Perform the Evaluation

The MERET was set up to evaluate a task from different perspectives. The Evaluation program includes three separate calculations. This allows for flexibility in conducting an ergonomic assessment. The first assessment method is to view the task in its whole or complete form. That is, from beginning to end with averaging forces, frequency of motions and postures over the length of the process. The second assessment step is to focus on one ergonomic issue, a specific body area that is a concern or a sub-task that is the most concerning. For example, a task is conducted at a worktable for most of the process cycle, however a smaller percentage of time, the task is performed overhead. Assessment #2 allows the assessor to pick 'Overhead' even though it may only make up 10% of the whole task. The assessor will also adjust the repetition and duration inputs. In another example, the Manipulation Force has an average force of 20lbs over the entirety of the task. In Assessment # 2, the assessor can pick the highest Manipulation Force, say >50lbs even though it occurs rarely, and adjust the duration, repetition, body position etc., accordingly. A third Assessment #3 calculation allows for an additional issue to be evaluated or how a potential corrective action can change the outcome. The assessor can verify hypothetically, if a solution to

the problem will have a small or large effect on any of the three evaluation outcome scores. See Example 1: Existing Assembly Work -Hand-Arm complaints and Example 2: New Welding Task -Evaluation from Drawings for additional guidance.

Assessment # 1

Access to Work	Body Position	Motion, Speed, Static Work	Manipulation Force
1.0 - front, work table	1.0 - standing	3.0 - Rapid, Jerky Motions, moderate pace and regular pauses	5 - < 2lb, Light, Barely noticeable or relaxed effort
		1.0 - Smooth Motion, moderate pace and regular pauses in work	
		2.0 - Smooth Motion, quick pace and/or lack of variety in work	
Duration of the Process	Process Repetition	Contact Stress	
1.5 - >8hrs	0.5 - 1-2 times	3.0 - Rapid, Jerky Motions, moderate pace and regular pauses in work	0 - None
		4.0 - Rapid, Jerky Motions, quick pace and/or lack of variety in work	
		3.0 - Little Movement, hold > 30 seconds or long duration static postures	
Pinch Grip	Vision	Temperature Issues	Time Pressure
1.0 - None	1.0 - None	1.0 - None	1.0 - None
Evaluation Scores			
Cumulative Score ≥ 15		2.3	
High Force Score ≥ 5		0.8	
Force and Body Position Score ≥ 8		1.8	

Evaluation Scores

There are three evaluation scores for the MERET.

A Cumulative Score - **15 or greater**, then the task needs to be further assessed.

This involves the Access to Work, Body Position, (Motion, Speed and Static Work and Manipulation Force), (Duration of Process and Process Repetition), Vibration, Contact Stress, Pinch Grip, Vision Issues, Temperature Issues, and Time Pressure.

A High Force Score - **5 or greater**, then the task needs to be further assessed.

This involves the combined Motion, Speed and Static Work and Manipulation Force.

A Force and Body Position Score – **8 or greater**, then the task needs to be further assessed. This involves the sum of the Motion, Speed and Static Work and Manipulation Force score and the Body Position score.

Resources

Ergonomics: A Guide to Program Development and Implementation

- Contains information on 6 key elements of an effective ergonomics program

Small Workplace Ergonomics Resource Guide

- Questions and Answers, 20 Common Hazards, Forms and Checklists

Small Business Ergonomic Case Studies: Hazards, Assessments, Solutions, Costs and Benefits

- 32 case studies of before and after ergonomic problems

Workplace Job Accommodations: Solutions for Effective Return to Work

- Key principles and solution options for accommodating musculoskeletal injuries

Safe Work for an Aging Workforce

- 40 case studies of older worker issues arranged according to the Spot the Hazard, Assess the Risk, Find a Safer Way and Everyday model

These resources and many more can be found at www.dolhyergonomics.com, www.wcb.mb.ca and/or www.mflohc.mb.ca

Notes

The evaluation program is password protected.

Each evaluation needs to be saved as a different file or the organization can create their own spreadsheet and manually enter the outcome scores for each task.

Any program errors, software bugs or suggestions for improvement can be communicated to Andrew Dolhy CPE, A. Dolhy Ergonomics Inc., dolhy@mts.net, (204) 299-9132 www.dolhyergonomics.com.

Acknowledgements

This program is based on an original pre-production checklist developed by Motor Coach Industries, Winnipeg, MB. The validity and reliability study was conducted at Motor Coach Industries and sister companies, Frank Fair Industries and Carfair Composites. Mr. Gary Davies, Mr. Rob Down and Mr. Jeff Philpott of Motor Coach Industries are graciously thanked for their contributions to this project.

The material and guidance contained in the Manufacturing Ergonomic Risk Evaluation Tool is not intended as legal or professional advice and is intended as an initial review of a task. The adoption and/use of the information and outcomes may not meet the needs, requirements or obligations of workplace safety programs, individual ergonomic assessments or other preventative measures.



Supported from a grant by the Research and Workplace Innovation Program of the Workers Compensation Board of Manitoba.

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Manufacturing Ergonomic Risk Evaluation Tool version 1.0, 2019

Hard Copy Worksheet

refer to the MERET User Guide version 1.0 for instructions
www.dolhyergonomics.com or www.wcb.mb.ca

Task Information and Description:

Assessor and Date:

Is the evaluation for a pre-production task? _____
 or is it currently in production? _____

List Sub Tasks: _____ Task Production Information: Frequency, Duration, Time Pressures, etc.

1) _____

2) _____

3) _____

4) _____

5) _____

Assessment # 1: Assess the task as a whole or complete job. Focus on average forces, production timing and usual process methods.

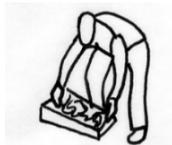
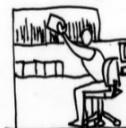
Assessment # 2: Assess the task by focusing on a specific sub-task, ergonomic issue or region of the body.

Assessment # 3: Assess additional issues or evaluate the changes a corrective action may achieve.

Access to Work

- Front/ Work Table - around waist height and within 22" reach
- Extended Side Reach - the arm is almost fully extended, reach more than 24".
- Overhead - above head height, > 68"
- At Floor Level - or below knee height, <18"
- Underneath/Blind - body is in an awkward position to see

The design of the workstation which dictates the worker's ability to perform or conduct the task.



Front/Work Table

Extended Reach

Overhead

Floor Level

Underneath/Blind

Assessment # 1 Overall Task

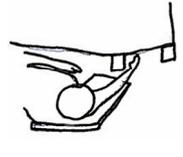
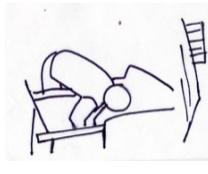
2 Specific Issue

Assessment # 3 Corrective Action

Body Position

- Stand - note footwear, no leg support, clearance issues, shrugging or stooping
- Sit - assume knowledge of how to adjust chair, good back support and foot support
- Bend/Reach - more than 20 degrees, forward reach more than 22"
- Crouch/Squat/Kneeling - more than 2/min or 50% of task cycle
- Laying on Back - for more than 5% of process time or longer than 3 minutes.

The body position to perform the task as dictated by the workstation for the majority of the time.



Stand with leg support

Sitting with back support

Bend/Stoop

Crouch/Squat

Kneeling

Laying on Back

Assessment # 1 Overall Task # 2 Specific Issue Assessment # 3 Corrective Action

Motion, Speed, Static Work

- Smooth Motion, moderate pace and regular pauses in work
 - Smooth Motion, quick pace and/or lack of variety in work
 - Rapid, Jerky Motions, moderate pace and regular pauses in work
 - Rapid, Jerky Motions, quick pace and/or lack of variety in work
 - Little Movement, hold > 30 seconds or long duration static postures
- Observe the worker or consider the tasks involved from labour standards.*
- Would/are workers performing the same motions for more than half the task cycle or duration of the process? What would the speed or pace of movement be/is?*
- Is there a lack of variety in the task which would change the worker's body positions?*

Assessment # 1 Overall Task # 2 Specific Issue Assessment # 3 Corrective Action

Manipulation Force

< 2lbs	Light	Barely noticeable or relaxed effort
2-10lbs	Somewhat Hard	Noticeable or definite effort
11-25lbs	Hard	Obvious effort; Unchanged expression
26-50lbs	Very Hard	Substantial effort; Changed expression
>50lbs	Near Maximal	Uses shoulder or trunk for force

The effort required to perform the task. Are the weights or force measurements known?
May include power grip, pinch grip, manipulation effort to accomplish a task.

Assessment # 1 Overall Task # 2 Specific Issue Assessment # 3 Corrective Action

Duration of the Process

>8hrs example 1: choose to look at the task over an entire shift
 4-8hrs example 2: choose a specific task cycle time, eg, 2 hours
 1-4hrs example 3: choose a duration for a specific sub-task or body motion, eg, overhead for <30min
 30min-1 hr
 <30min

*A process is a series of actions or steps taken in order to achieve a particular end.
 The rater is to choose a duration based on an entire shift or the actual cycle of each process.
 Must be consistent with how the rater chooses the Process Repetition category.*

Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action

Process Repetition

1-2 times example 1: I do this all shift, 21-50 times
 3-10 times example 2: I do this 1 hour, 11-20 5 times
 11-20 times example 3: I do this part for less than 10 minutes, with 3-10 efforts in that time
 21-50 times
 >50 times

The number of times a task repeats itself within the process time. Can be cyclic or the same body motions over repeated cycles. Tasks are usually performed without any rest break or substantial interruption by any other task.

Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action

Vibration

None
 Vibration <2hours with anti-vibration PPE
 Vibration <2hours
 Vibration >2hrs with anti-vibration PPE
 Vibration > 2hrs

Hand-Arm
 Vibration



Whole Body
 Vibration



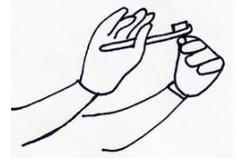
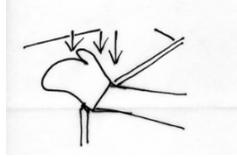
Subjective assessment of hand arm or whole body vibration. This involves exposure to mechanical vibration affecting the whole body or hand-arm. The rating is for the whole shift, cumulative. Vibration protective equipment includes anti-vibration gloves, anti-vibration grip tape for tools or anti-vibration seat pads. The amount of vibration can be quantitatively measured with an accelerometer and compared to guidelines.

Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action

Contact Stress

- None
- Occasional
- Use knee as a hammer
- Use hand as a hammer
- Constant

Resting a body part on a hard or sharp edge. Mostly the wrist or elbow areas. Includes using the hand or knee as a hammer.



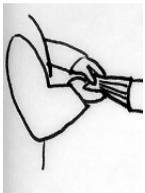
Thigh Contact Stress Wrist or use hand as a hammer Elbow of forearm Contact Stress Palm of the hand

Assessment # 1 Overall Task # 2 Specific Issue Assessment # 3 Corrective Action

Pinch Grip

- None
- More than 2 lbs
- >2 lbs with poor posture
- >2 lbs, poor posture or repetitive
- >2 lbs, poor posture and wrist flicking - Flicking includes rapid wrist twisting or jerky awkward motions.

Squeezing the fingers together. Examples include a key grip, pen grip or folding clothes. Greater than 2 lbs of force is like using a pen to write. Poor posture is any wrist bending while pinch gripping.



Wrist bent backwards Bending on thumb side Bending forwards Bending on pinky finger side

Assessment # 1 Overall Task # 2 Specific Issue Assessment # 3 Corrective Action

Vision		
None		
Shadows		
Reflection glare		
Direct glare		
Cannot see		
<i>Will the worker be able to see their work? Glare can be from overhead lights, windows or reflection off surfaces. Visual issues may also include small font on screens or documents, shadows or hidden or hard to see tasks. Do workers adopt poor postures in order to see better?</i>		
<u>Assessment # 1 Overall Task</u>	<u># 2 Specific Issue</u>	<u>Assessment # 3 Corrective Action</u>

Temperature Issues		
None		
Cold conditions, short duration		
Heat conditions, short duration		
Temperature issues , long duration		
Extreme conditions		
<i>Subjective assessment of work tasks that may be perceived as cold, hot or other climate conditions. Both heat and cold are associated with increased risk of developing musculoskeletal issues by different injury mechanisms.</i>		
<u>Assessment # 1 Overall Task</u>	<u># 2 Specific Issue</u>	<u>Assessment # 3 Corrective Action</u>

Time Pressure		
none		
occasional time pressure		
continuous time pressure		
lack of recovery from demands		
<i>Time pressure tasks include: meeting strict deadlines, bottle neck processes, time sensitive processes, or when workers are unable to rest and recover between processes. Tasks that have a high duty cycle.</i>		
<u>Assessment # 1 Overall Task</u>	<u># 2 Specific Issue</u>	<u>Assessment # 3 Corrective Action</u>

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Manufacturing Ergonomic Risk Evaluation Tool

Example 1: Existing Assembly Work - Hand- Arm complaints

Task Information and Description:

In this example, the worker performs repetitive assembly tasks.



The work is mostly performed standing with a height adjustable platform.

Wrist extension 'bending backwards' occurs for each assembled product.

Far reaching occurs for short period of time with weight.

There is time pressure to make parts within a standard time.




Assessor and Date: _____

Is the assessment for a pre-production task or currently in production? currently in production

List Sub Tasks: _____ Task Production Information: Frequency, Duration, Time Pressures, etc.

- 1) Set up workstation and equipment
- 2) Obtain parts from storage and place on workstation table
- 3) Assemble parts according to worksheet specifications with screws and caulking
- 4) Place finished product on conveyor
- 5) Obtain materials from overhead shelf

Assessment # 1: Assess the task as a whole or complete job. Focus on average forces, production timing and usual process methods. - For this example: wrist bending for each part

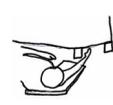
Assessment # 2: Assess the task by focusing on a specific sub-task, ergonomic issue or region of the body.

- Far reach with weight, <30min

Assessment # 3: Assess additional issues or evaluate the changes a corrective action may achieve.

- Solution is to change layout to reduce reach

Access to Work		
Front/ Work Table	- around waist height and within 22" reach	Majority of time is standing at a work table
Extended Side Reach	- the arm is almost fully extended, reach more than 24".	
Overhead	- above head height, > 68"	
At Floor Level	- or below knee height, <18"	
Underneath/Blind	- body is in an awkward position to see	
<i>The design of the workstation which dictates the worker's ability to perform or conduct the task.</i>		
		
Front/Work Table	Extended Reach	Overhead
		
Floor Level	Underneath/Blind	
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
Front/Work Table	Extended Reach * chosen as an awkward posture which occurs for a short period of time	Front/Work Table - improvement

Body Position		
Stand	- note footwear, no leg support, clearance issues, shrugging or stooping	
Sit	- assume knowledge of how to adjust chair, good back support and foot support	
Bend/Reach	- more than 20 degrees, forward reach more than 22"	
Crouch/Squat/Kneeling	- more than 2/min or 50% of task cycle	
Laying on Back	- for more than 5% of process time or longer than 3 minutes.	
<i>The body position to perform the task as dictated by the workstation for the majority of the time.</i>		
		
Stand with leg support	Sitting with back support	Bend/Stoop
		
		Crouch/Squat
		
		Kneeling
		
		Laying on Back
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
Standing	Standing	Standing

Motion, Speed, Static Work		
Smooth Motion, moderate pace and regular pauses in work		Observation of the task found little movement of the arms with long duration holding of parts.
Smooth Motion, quick pace and/or lack of variety in work		
Rapid, Jerky Motions, moderate pace and regular pauses in work		
Rapid, Jerky Motions, quick pace and/or lack of variety in work		
Little Movement, hold > 30 seconds or long duration static postures		
<i>Observe the worker or consider the tasks involved from labour standards.</i>		
<i>Would/are workers performing the same motions for more than half the task cycle or duration of the process? What would the speed or pace of movement be/is?</i>		
<i>Is there a lack of variety in the task which would change the worker's body positions?</i>		
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
Little Movement, hold > 30 seconds or long duration static postures	Jerky Motions, * the extended reach includes a jerky motion to obtain boxes of parts	Smooth motion, regular pauses *closer also allows for a smooth motion

Manipulation Force		
< 2lbs	Light	Barely noticeable or relaxed effort
2-10lbs	Somewhat Hard	Noticeable or definite effort
11-25lbs	Hard	Obvious effort; Unchanged expression
26-50lbs	Very Hard	Substantial effort; Changed expression
>50lbs	Near Maximal	Uses shoulder or trunk for force
Subjective rating of effort as barely noticeable or relaxed effort.		
<i>The effort required to perform the task. Are the weights or force measurements known?</i>		
<i>May include power grip, pinch grip, manipulation effort to accomplish a task.</i>		
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
<2-lbs, Light Barely noticeable or relaxed effort	2-10lbs, Somewhat Hard *box is actually 8lbs	2-10lbs, Somewhat Hard

Duration of the Process		
>8hrs	example 1: choose to look at the task over an entire shift	Worker indicates 8 hours of work at this task.
4-8hrs	example 2: choose a specific task cycle time, eg, 2 hours	
1-4hrs	example 3: choose a duration for a specific sub-task or body motion,	
30min-1 hr	eg, overhead for <30min	
<30min		
<i>A process is a series of actions or steps taken in order to achieve a particular end.</i>		
<i>The rater is to choose a duration based on an entire shift or the actual cycle of each process.</i>		
<i>Must be consistent with how the rater chooses the Process Repetition category.</i>		
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
4-8hrs	<30min * this sub-task occurs less than 30min but is the focus of step two	<30min

Process Repetition

1-2 times example 1: I do this all shift, 21-50 times
 3-10 times example 2: I do this 1 hour, 11-20 5 times
 11-20 times **example 3: I do this part for less than 10 minutes, with 3-10**
 21-50 times efforts in that time
 >50 times

Observation of part assembly indicates 11-20 times per shift.

The number of times a task repeats itself within the process time. Can be cyclic or the same body motions over repeated cycles. Tasks are usually performed without any rest break or substantial interruption by any other task.

Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
11-20 times	3-10 times	3-10 times
* repetition for the extended reach and lifting of boxes (of parts).		

Vibration

None
 Vibration <2hours with anti-vibration PPE
 Vibration <2hours
 Vibration >2hrs with anti-vibration PPE
 Vibration > 2hrs



Hand-Arm Vibration



Whole Body Vibration

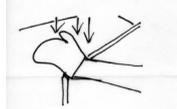
Subjective assessment of hand arm or whole body vibration. This involves exposure to mechanical vibration affecting the whole body or hand-arm. The rating is for the whole shift, cumulative. Vibration protective equipment includes anti-vibration gloves, anti-vibration grip tape for tools or anti-vibration seat pads. The amount of vibration can be quantitatively measured with an accelerometer and compared to guidelines.

Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
None	None	None

Contact Stress

None
 Occasional
 Use knee as a hammer
 Use hand as a hammer
 Constant

Resting a body part on a hard or sharp edge. Mostly the wrist or elbow areas. Includes using the hand or knee as a hammer.



Thigh Contact Stress Wrist or use hand as a hammer Elbow of forearm Contact Stress Palm of the hand

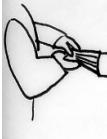
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
None	None	None

Pinch Grip

None
 More than 2 lbs
 >2 lbs with poor posture
 >2 lbs, poor posture or repetitive
 >2 lbs, poor posture and wrist flicking - Flicking includes rapid wrist twisting or jerky awkward motions.

Wrist bending backwards, repetitive and grip force.

Squeezing the fingers together. Examples include a key grip, pen grip or folding clothes. Greater than 2 lbs of force is like using a pen to write. Poor posture is any wrist bending while pinch gripping.

			
Wrist bent backwards	Bending on thumb side	Bending forwards	Bending on pinky finger side
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action	
>2 lbs, poor posture or repetitive	None	None	
	* no pinch grip when grasping the box		

Vision		
None		
Shadows		
Reflection glare		
Direct glare		
Cannot see		
<i>Will the worker be able to see their work? Glare can be from overhead lights, windows or reflection off surfaces. Visual issues may also include small font on screens or documents, shadows or hidden or hard to see tasks. Do workers adopt poor postures in order to see better?</i>		
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
None	None	None

Temperature Issues		
None		
Cold conditions, short duration		
Heat conditions, short duration		
Temperature issues , long duration		
Extreme conditions		
<i>Subjective assessment of work tasks that may be perceived as cold, hot or other climate conditions. Both heat and cold are associated with increased risk of developing musculoskeletal issues by different injury mechanisms.</i>		
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
None	None	None

Time Pressure		
none		
occasional time pressure		
continuous time pressure		
lack of recovery from demands		
<div style="border: 1px solid black; padding: 5px; display: inline-block;">Supervisor confirms continuous time pressure.</div>		
<i>Time pressure tasks include: meeting strict deadlines, bottle neck processes, time sensitive processes, or when workers are unable to rest and recover between processes. Tasks that have a high duty cycle.</i>		
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
continuous time pressure	continuous time pressure	continuous time pressure

Comments
Observations of a single worker with productivity demands reviewed by supervisor.
Initial evaluation was for the entire task and all body motions and exertions assessed over an 8 hour shift. Step One finding is a low risk task.
Step Two focused on the extended reach that occurs in a short period of time. This changed the six elements. Step two finding now indicates a higher risk of injury due to the High Force and Force/Body Position scores.
Step three allows for an evaluation of potential solutions. The solution to change the layout so the worker can get closer also results in a less jerky motion to obtain boxes of parts. Low Risk

Step One		
Evaluation Scores		
Cumulative Score ≥ 15		7.7
High Force Score ≥ 5		4.5
Force and Body Position Score ≥ 8		5.5

All scores are below threshold.

Step Two		
Evaluation Scores		
Cumulative Score ≥ 15		13.8
High Force Score ≥ 5		11.3
Force and Body Position Score ≥ 8		13.3

Higher risk of injury due to High Force and Force/Body Position scores.

Step Three		
Evaluation Scores		
Cumulative Score ≥ 15		5.4
High Force Score ≥ 5		3.8
Force and Body Position Score ≥ 8		4.8

Low Risk due to layout changes and less jerky motions to obtain parts.

For this example, the overall task has a low risk of injury, however when a specific sub-task is the focus, a higher risk was found. The Manufacturing Ergonomic Risk Evaluation Tool was able to score a potential solution as being effective.

May 2019, Version 1.0

Developed by: A. Dolhy Ergonomics Inc. and Motor Coach Industries

supported from a grant by the Research and Workplace Innovation Program of the Workers Compensation Board of Manitoba



Manufacturing Ergonomic Risk Evaluation Tool

Example 2: New Welding Task - Evaluation from Drawings

Task Information and Description:

In this example, an industrial engineer is developing a workstation that involves welding.



The work is mostly performed standing with some crouching and stooping.



Parts are welded to a larger product in front and along sides.



Awkward stooping and twisting might occur to weld side parts.

There is time pressure to make parts within a standard time.

Assessor and Date: _____

Is the assessment for a pre-production task or currently in production? pre-production task

List Sub Tasks: _____ Task Production Information: Frequency, Duration, Time Pressures, etc.

- 1) Set Up workstation and equipment according to safe work procedures
- 2) Review work orders and scan parts, manually enter codes as required
- 3) Obtain parts from work in progress racks
- 4) Perform welds according to specifications - front and sides, grind and sand finished areas
- 5) Use hoist to place finished product in shipping bin

Assessment # 1: Assess the task as a whole or complete job. Focus on average forces, production timing and usual process methods. - For this example: welding over the entire shift

Assessment # 2: Assess the task by focusing on a specific sub-task, ergonomic issue or area of the body - side bending is required

Assessment # 3: Assess additional issues or evaluate the changes a corrective action may achieve. - Solution is to develop a fixture that spins

Access to Work

Front/ Work Table - around waist height and within 22" reach

Extended Side Reach - the arm is almost fully extended, reach more than 24".

Overhead - above head height, > 68"

At Floor Level - or below knee height, <18"

Underneath/Blind - body is in an awkward position to see

Majority of time is standing at a work table

The design of the workstation which dictates the worker's ability to perform or conduct the task.



Front/Work Table

Extended Reach

Overhead

Floor Level

Underneath/Blind

Assessment # 1 Overall Task

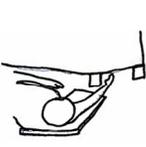
2 Specific Issue

Assessment # 3 Corrective Action

Front/Work Table

Hard to see the sides - (Blind)
* worker would need to bend which occurs repetitively

Front/Work Table
- improvement is to build a a fixture to turn the large part

Body Position					
Stand	- note footwear, no leg support, clearance issues, shrugging or stooping				
Sit	- assume knowledge of how to adjust chair, good back support and foot support				
Bend/Reach	- more than 20 degrees, forward reach more than 22"				
Crouch/Squat/Kneeling	- more than 2/min or 50% of task cycle				
Laying on Back	- for more than 5% of process time or longer than 3 minutes.				
<i>The body position to perform the task as dictated by the workstation for the majority of the time.</i>					
					
Stand with leg support	Sitting with back support	Bend/Stoop	Crouch/Squat	Kneeling	Laying on Back
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action			
Standing	Bending - to see the side welds	Standing			

Motion, Speed, Static Work			
Smooth Motion, moderate pace and regular pauses in work	<div style="border: 1px solid gray; padding: 5px;"> Welders will be able to change postures and perform a variety of tasks. Work needs to be smooth. </div>		
Smooth Motion, quick pace and/or lack of variety in work			
Rapid, Jerky Motions, moderate pace and regular pauses in work			
Rapid, Jerky Motions, quick pace and/or lack of variety in work			
Little Movement, hold > 30 seconds or long duration static postures			
<i>Observe the worker or consider the tasks involved from labour standards.</i>			
<i>Would/are workers performing the same motions for more than half the task cycle or duration of the process? What would the speed or pace of movement be/is?</i>			
<i>Is there a lack of variety in the task which would change the worker's body positions?</i>			
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action	
Smooth Motion, moderate pace and regular pauses in work	Smooth Motion, moderate pace and regular pauses in work	Smooth Motion, moderate pace and regular pauses in work	

Manipulation Force			
< 2lbs	Light	Barely noticeable or relaxed effort	<div style="border: 1px solid gray; padding: 5px;"> Parts weights: Average - 2-10lbs Main product - 25lbs NOTE: the force to hold the welding tools is light </div>
2-10lbs	Somewhat Hard	Noticeable or definite effort	
11-25lbs	Hard	Obvious effort; Unchanged expression	
26-50lbs	Very Hard	Substantial effort; Changed expression	
>50lbs	Near Maximal	Uses shoulder or trunk for force	
<i>The effort required to perform the task. Are the weights or force measurements known?</i>			
<i>May include power grip, pinch grip, manipulation effort to accomplish a task.</i>			
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action	
< 2lbs Light	Will have a crane to lift product from workstation to container	< 2lbs	
A separate evaluation on handling parts can be performed which changes the repetition scores.			

Duration of the Process

>8hrs example 1: choose to look at the task over an entire shift
 4-8hrs example 2: **choose a specific task cycle time, eg, 2 hours**
 1-4hrs example 3: choose a duration for a specific sub-task or body motion,
 30min-1 hr eg, overhead for <30min
 <30min

Production standard is one cycle every 1.3 hours.

*A process is a series of actions or steps taken in order to achieve a particular end.
 The rater is to choose a duration based on an entire shift or the actual cycle of each process.
 Must be consistent with how the rater chooses the Process Repetition category.*

Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
1-4hrs production cycle is 1.3hours	<30min *side welding occurs less than 30min but is the focus of step two	<30min

Process Repetition

1-2 times example 1: I do this all shift, 21-50 times
 3-10 times example 2: I do this 1 hour, 11-20 5 times
 11-20 times example 3: I do this part for less than 10 minutes, with 3-10
 21-50 times efforts in that time
 >50 times

Production information indicates 12 welds per part with 6 parts welded per 8 hour shift

The number of times a task repeats itself within the process time. Can be cyclic or the same body motions over repeated cycles. Tasks are usually performed without any rest break or substantial interruption by any other task.

Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
>50 times 12 welds X 6 parts over a shift	3-10 times * 6 welds on the sides 6 X 1 part for <30 min	3-10 times * 6 welds on the sides 6 X 1 part for <30 min

Vibration

None
 Vibration <2hours with anti-vibration PPE
Vibration <2hours
 Vibration >2hrs with anti-vibration PPE
 Vibration > 2hrs

Hand-Arm
Vibration



Whole Body
Vibration



Subjective assessment of hand arm or whole body vibration. This involves exposure to mechanical vibration affecting the whole body or hand-arm. The rating is for the whole shift, cumulative. Vibration protective equipment includes anti-vibration gloves, anti-vibration grip tape for tools or anti-vibration seat pads. The amount of vibration can be quantitatively measured with an accelerometer and compared to guidelines.

Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
Vibration <2hours some grinding of welds	Vibration <2hours	Vibration <2hours

Contact Stress

None
 Occasional
 Use knee as a hammer
 Use hand as a hammer
 Constant

Resting a body part on a hard or sharp edge. Mostly the wrist or elbow areas. Includes using the hand or knee as a hammer.



Thigh Contact Stress Wrist or use hand as a hammer Elbow of forearm Contact Stress Palm of the hand

Assessment # 1 Overall Task	# 2 Specific Issue	Asssment # 3 Corrective Action
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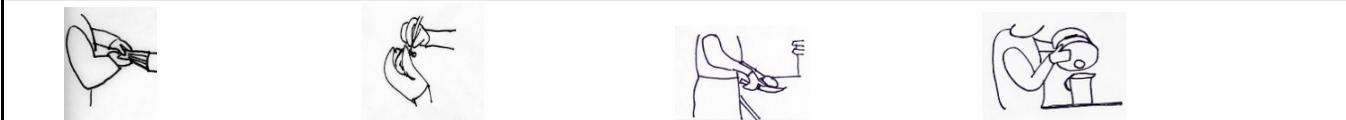
None	None	None
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Pinch Grip

None
 More than 2 lbs
 >2 lbs with poor posture
 >2 lbs, poor posture or repetitive
 >2 lbs, poor posture and wrist flicking - Flicking includes rapid wrist twisting or jerky awkward motions.

Welder will need to pinch grip small clamps to hold parts.

Squeezing the fingers together. Examples include a key grip, pen grip or folding clothes. Greater than 2 lbs of force is like using a pen to write. Poor posture is any wrist bending while pinch gripping.



Wrist bent backwards Bending on thumb side Bending forwards Bending on pinky finger side

Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
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>2 lbs, poor posture * based on observations of current welding tasks with clamps. Not repetitive, yet some wrist bending	>2 lbs, poor posture	>2 lbs, poor posture
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Vision

None
 Shadows
 Reflection glare
 Direct glare
 Cannot see
Will the worker be able to see their work? Glare can be from overhead lights, windows or reflection off surfaces. Visual issues may also include small font on screens or documents, shadows or hidden or hard to see tasks. Do workers adopt poor postures in order to see better?

Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
Direct glare	Direct glare	Direct glare

Temperature Issues		
None		
Cold conditions, short duration		
Heat conditions, short duration		
Temperature issues , long duration		
Extreme conditions		
<i>Subjective assessment of work tasks that may be perceived as cold, hot or other climate conditions. Both heat and cold are associated with increased risk of developing musculoskeletal issues by different injury mechanisms.</i>		
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
None	None	None

Time Pressure		
none		
occasional time pressure		
continuous time pressure		
lack of recovery from demands		
<i>Time pressure tasks include: meeting strict deadlines, bottle neck processes, time sensitive processes, or when workers are unable to rest and recover between processes. Tasks that have a high duty cycle.</i>		
Assessment # 1 Overall Task	# 2 Specific Issue	Assessment # 3 Corrective Action
continuous time pressure	continuous time pressure	occasional time pressure * fixture may reduce wasted motion

Task will be a bottle neck position.
Review engineering labour standards.

Comments

Initial drawings, production information along with experience with other tasks formed the basis for this evaluation. Step one evaluation was for the entire welding task but an emphasis on performing the welds.
The handling of parts can be evaluated separately. Step One finding is a low risk task.
Step Two focused on the awkward bod position to weld the side of the product. This changed some of the six elements. Step two finding now indicates a higher risk of injury due to the Cumulative nature when focusing on the side welds only.
Step three allows for an evaluation of potential solutions. The solution to develop a fixture to spin the product to improve posture also resulted in less time pressure due to reduced wasted motion.

Step One**Evaluation Scores**

Cumulative Score ≥ 15	10.8
High Force Score ≥ 5	4.5
Force and Body Position Score ≥ 8	5.5

No concerns with the overall task.

Step Two**Evaluation Scores**

Cumulative Score ≥ 15	18.7
High Force Score ≥ 5	1.9
Force and Body Position Score ≥ 8	3.9

A higher risk due to the cumulative nature with the side bending welds.

Step Three**Evaluation Scores**

Cumulative Score ≥ 15	5.8
High Force Score ≥ 5	1.9
Force and Body Position Score ≥ 8	3.9

Low Risk due to providing a spinning fixture.

For this example, the overall task has a low risk of injury, however when a specific sub-task is the focus, a higher risk was found. The Manufacturing Ergonomic Risk Evaluation Tool was able to score a potential solution as being effective.

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