# Step-by-Step Guides to Recommended Ergonomic Assessment Tools

ErgoPlus

ErgoPlus **Industrial**

# Manage Ergonomics the Modern Way

## Train Your Team

Empower your team with online, on-demand ergonomics training.

## Assess Risk

Gain a clear understanding of the ergonomic risk at your worksite.

## Plan Improvements

Easily plan and quantify the value of workplace improvements.

## Measure Progress

Track and improve leading and lagging ergonomics metrics.

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# Welcome!

The foundation of every successful ergonomics process is conducting accurate and efficient ergonomic risk assessments. This is what gives you the information you need to make smart decisions and take proactive actions to reduce risk factors that lead to common and costly musculoskeletal disorders.

We put together these guides to help you do just that.  Let's get started!

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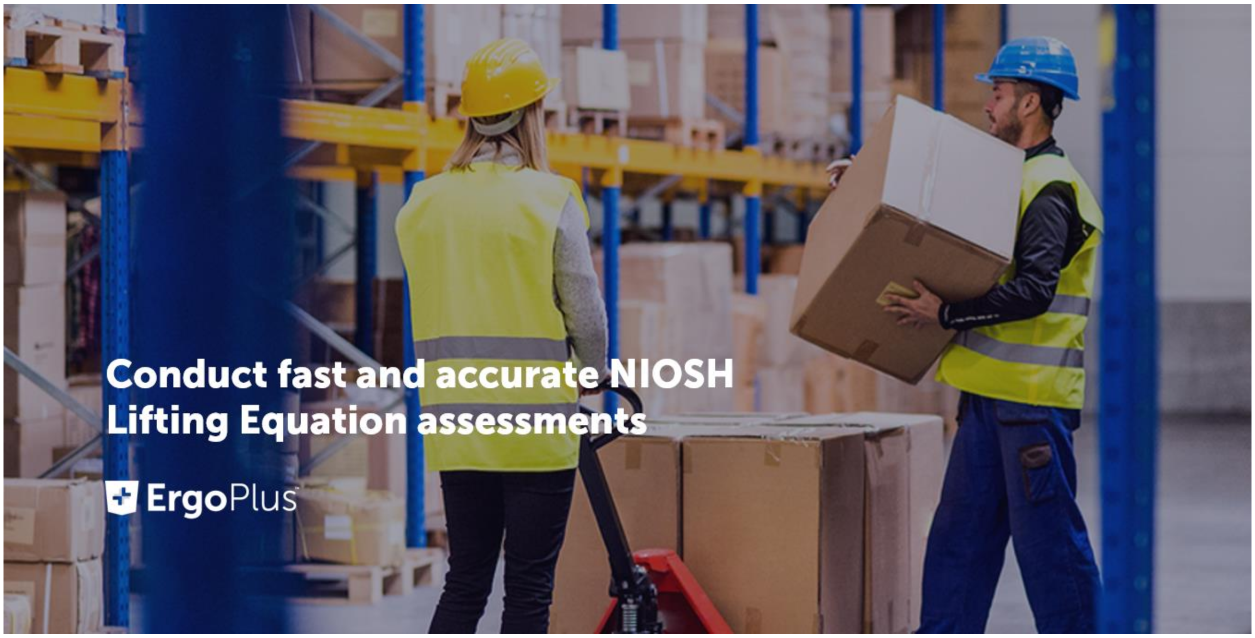
# A Step-by-Step Guide to the NIOSH Lifting Equation



The Revised NIOSH Lifting Equation is a tool used by occupational health and safety professionals to assess the manual material handling risks associated with lifting and lowering tasks in the workplace.

A lifting task is defined as the act of manually grasping an object with two hands, and vertically moving the object without mechanical assistance. The NIOSH Lifting Equation considers several job task variables to determine safe lifting practices and guidelines.

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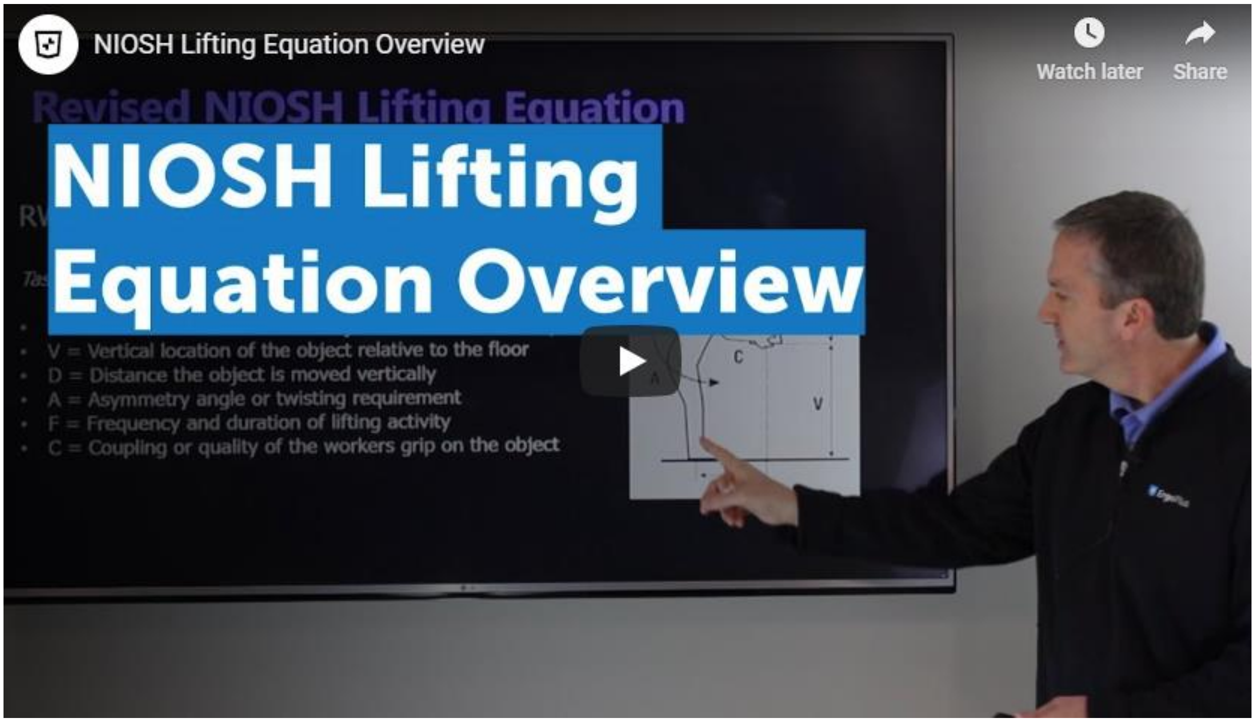

- V = Vertical location of the object relative to the floor
- D = Distance the object is moved vertically
- A = Asymmetry angle or twisting requirement
- F = Frequency and duration of lifting activity
- C = Coupling or quality of the workers grip on the object

## NIOSH Lifting Equation:

RWL = LC (51) x HM x VM x DM x AM x FM x CM

The NIOSH Lifting Equation is widely accepted as valid in the field of occupational ergonomics, providing occupational health and safety professionals an objective ergonomic risk assessment tool for manual material handling tasks. The NIOSH Lifting Equation is a great way to identify ergonomic opportunities and prioritize ergonomic improvement efforts, and it also provides an objective baseline from which you can document ergonomic improvements.

## NIOSH Lifting Equation Outputs:

**Recommended Weight Limit (RWL):** Answers the question… “Is this weight too heavy for the task?”

The primary product of the NIOSH equation is the Recommended Weight Limit (RWL), which defines the maximum acceptable weight (load) that nearly all healthy employees could lift over the course of an 8-hour shift without increasing the risk of musculoskeletal disorders (MSD) to the lower back.

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**Lifting Index (LI):** Answers the question... “How significant is the risk?”

In addition, a Lifting Index (LI) is calculated to provide a relative estimate of the level of physical stress and MSD risk associated with the manual lifting tasks evaluated. A Lifting Index value of 1.0 or less indicates a nominal risk to healthy employees. A Lifting Index greater than 1.0 denotes that the task is high risk for some fraction of the population. As the LI increases, the level of injury risk increases correspondingly. Therefore, the goal is to design all lifting jobs to accomplish an LI of 1.0 or less.

**Uses of RWL and LI:** The RWL and LI can be used to guide or engineer lifting task design in the following ways:

Individual multipliers that determine the RWL can be used to identify specific weaknesses in the design.

The LI can be used to estimate the relative physical stress and injury risk for a task or job. The higher the LI value, the smaller the percentage of workers capable of safely performing these lifting job demands. So using the LI, injury risk of two or more job designs could be compared.

The LI can also be used to prioritize ergonomic redesign efforts. For example jobs can be ranked by LI and a control strategy can be implemented based on a priority order of the jobs or individual lifting tasks.

## NIOSH Equation Task Variables

$RWL = LC\ (51) \times HM \times VM \times DM \times AM \times FM \times CM$

The NIOSH Lifting Equation always uses a load constant (LC) of 51 pounds, which represents the maximum recommended load weight to be lifted under ideal conditions. From that starting point, the equation uses several task variables expressed as coefficients or multipliers (In the equation, M = multiplier) that serve to decrease the load constant and calculate the RWL for that lifting task.

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Task variables needed to calculate the RWL:

H = Horizontal location of the object relative to the body

V = Vertical location of the object relative to the floor

D = Distance the object is moved vertically

A = Asymmetry angle or twisting requirement

F = Frequency and duration of lifting activity

C = Coupling or quality of the workers grip on the object

Additional task variables needed to calculate LI:

Average weight of the objects lifted

Maximum weight of the objects lifted

Additional outputs of the NIOSH Lifting Equation:

The Frequency-Independent Recommended Weight Limit (FIRWL) and the Frequency-Independent Lifting Index (FILI) are additional outputs of the NIOSH lifting calculator.

The FIRWL is calculated by using a frequency multiplier (FI) of 1.0 along with the other task variable multipliers. This effectively removes frequency as a variable, reflecting a weight limit for a single repetition of that task and allows equal comparison to other single repetition tasks.

The Frequency-Independent Lifting Index (FILI) is calculated by dividing the weight lifted by the FIRWL. The FILI can help identify problems with infrequent lifting tasks if it exceeds the value of 1.0.

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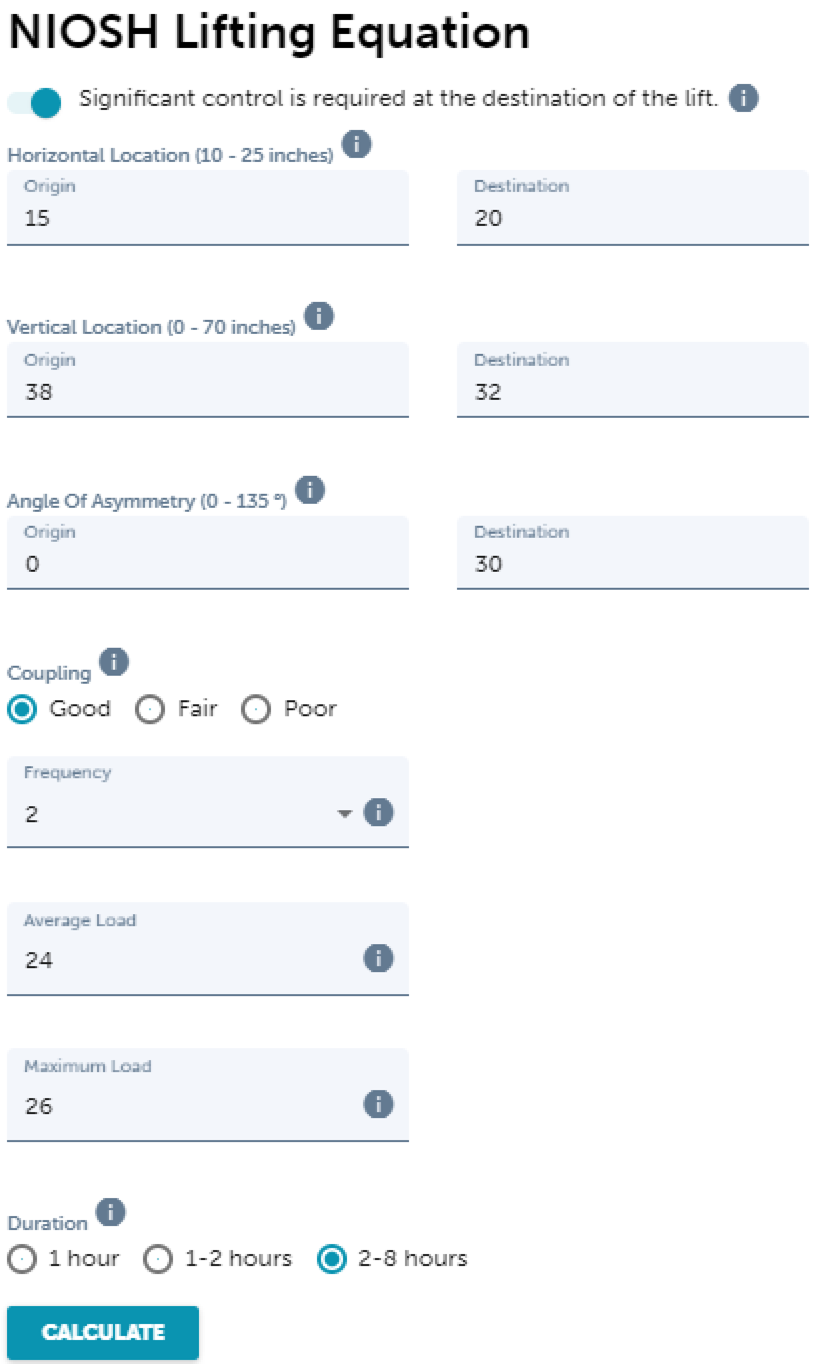
# ErgoPlus NIOSH Lifting Equation Calculator



NIOSH Lifting Equation

● Significant control is required at the destination of the lift.

Horizontal Location (10 - 25 inches)
Origin: 15
Destination: 20

Vertical Location (0 - 70 inches)
Origin: 38
Destination: 32

Angle Of Asymmetry (0 - 135 °)
Origin: 0
Destination: 30

Coupling
● Good ○ Fair ○ Poor

Frequency: 2

Average Load: 24

Maximum Load: 26

Duration
○ 1 hour ○ 1-2 hours ● 2-8 hours

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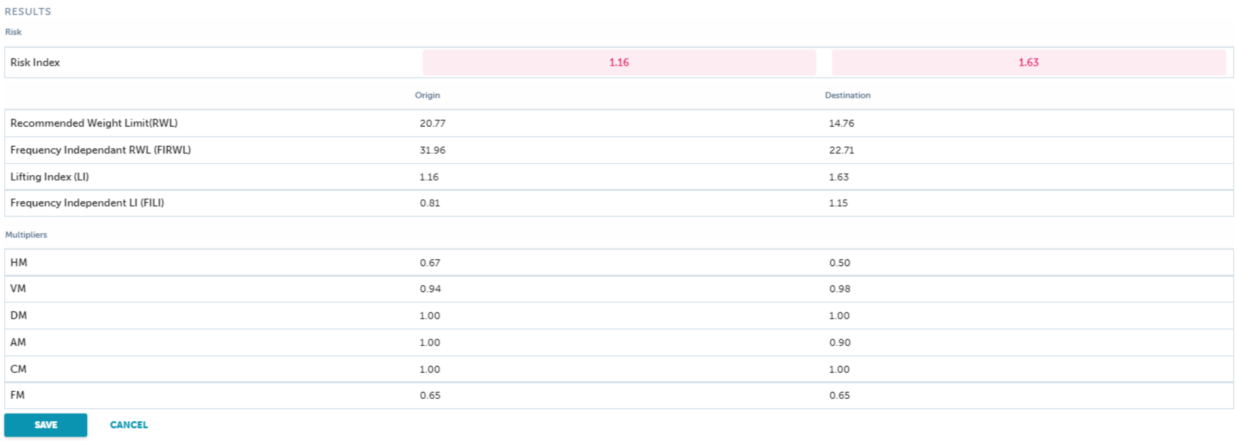

RESULTS

Risk

| | | |
|---|---|---|
| Risk Index | 1.16 | 1.63 |
| | Origin | Destination |
| Recommended Weight Limit(RWL) | 20.77 | 14.76 |
| Frequency Independant RWL (FIRWL) | 31.96 | 22.71 |
| Lifting Index (LI) | 1.16 | 1.63 |
| Frequency Independent LI (FILI) | 0.81 | 1.15 |

Multipliers

| | | |
|---|---|---|
| HM | 0.67 | 0.50 |
| VM | 0.94 | 0.98 |
| DM | 1.00 | 1.00 |
| AM | 1.00 | 0.90 |
| CM | 1.00 | 1.00 |
| FM | 0.65 | 0.65 |

The NIOSH Lifting Equation can be calculated by hand, but it’s much easier and a big time saver to use a calculator. We have developed a cloud-based NIOSH Lifting Equation calculator as a part of our ErgoPlus Industrial platform that can be used to efficiently conduct a NIOSH Lifting assessment, calculate the score and save your results. The task variables are simply selected or entered into the calculator fields. When the “calculate” button is pressed, the multipliers and the RWL and LI outputs are automatically calculated and can then be saved to your database. You can check out the application here: ErgoPlus Industrial.

# Using the NIOSH Lifting Equation

## Measure and Record Task Variables

The first step is to gather the needed information and measurements for lifting task variables.

Task variable data needed:

H = Horizontal Location of the object relative to the body

V = Vertical Location of the object relative to the floor

D = Distance the object is moved vertically

A = Asymmetry Angle or twisting requirement

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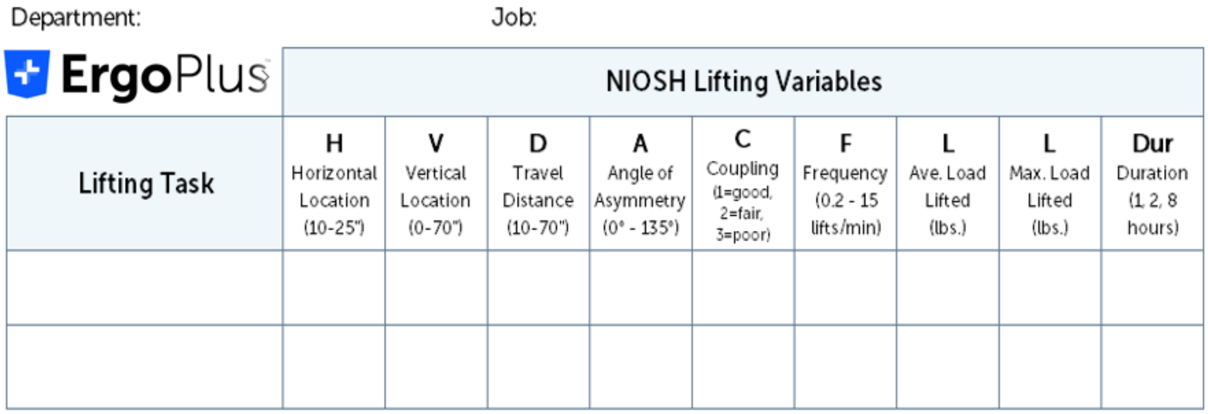
F = Frequency and Duration of lifting activity

C = Coupling or quality of the workers grip on the object

L = Average & maximum Load or weight of the object



Department: Job:

| | NIOSH Lifting Variables | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Lifting Task | **H** Horizontal Location (10-25") | **V** Vertical Location (0-70") | **D** Travel Distance (10-70") | **A** Angle of Asymmetry (0° - 135°) | **C** Coupling (1=good, 2=fair, 3=poor) | **F** Frequency (0.2 - 15 lifts/min) | **L** Ave. Load Lifted (lbs.) | **L** Max. Load Lifted (lbs.) | **Dur** Duration (1, 2, 8 hours) |
| | | | | | | | | | |
| | | | | | | | | | |

You can use a paper worksheet to assist you with data collection as pictured above, or you may prefer to enter data directly into the calculator as variables are determined:

The following task variables are evaluated to calculate the multipliers that are used in the NIOSH equation to determine the RWL. Here are some quick explanations and guidelines that you can use to gather the needed measurements:

**Horizontal Location of the Hands (H)** – Measure and record the horizontal location of the hands at both the start (origin) and end (destination) of the lifting task. Measure and record the horizontal location of the hands at the end (destination) of the lifting task only if significant control is required. The horizontal location is determined by measuring the distance between the point projected on the floor directly below the mid-point of the hands grasping the object (load center), and the mid-point of a line between the inside ankle bones as pictured below:

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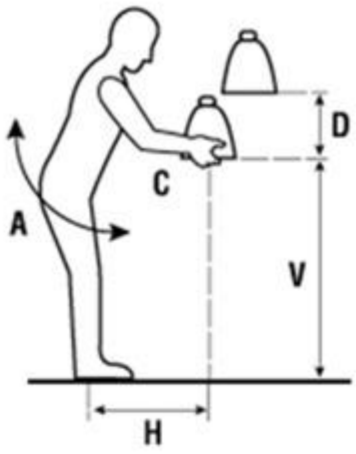
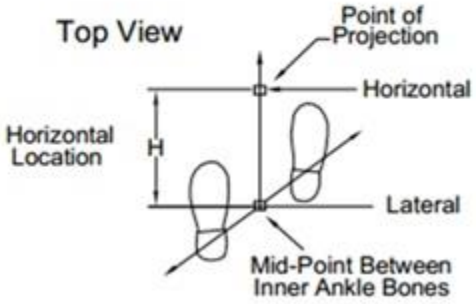
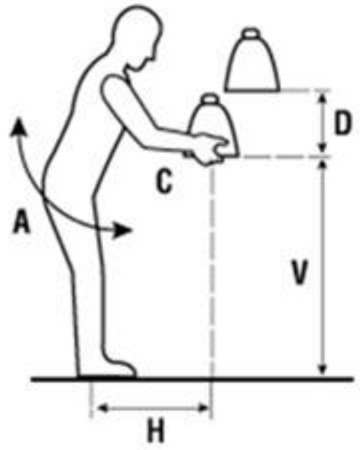




**Vertical Location of the Hands (V)** – Measure and record the vertical location of the hands above the floor at the start (origin) and end (destination) of the lifting task. The vertical location is measured from the floor (or standing surface) to the vertical mid-point between the hand grasps as defined by large middle knuckle (3rd MCP joint) of the hand.



**Vertical Travel Distance (D)** – The vertical travel distance of a lift is determined by subtracting the vertical location (V) at the start of the lift from the vertical location (V) at the end of the lift. For a lowering task, subtract the V location at the end from the V location at the start. If you're using ErgoPlus Industrial, there's no need to worry about this one, the calculator will do this work for you.

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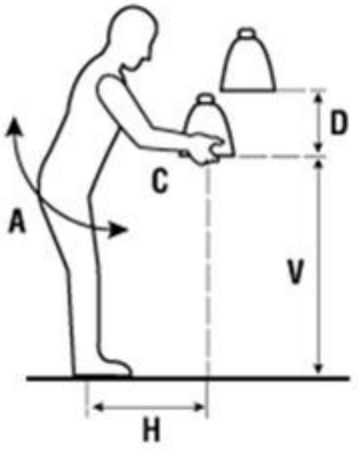
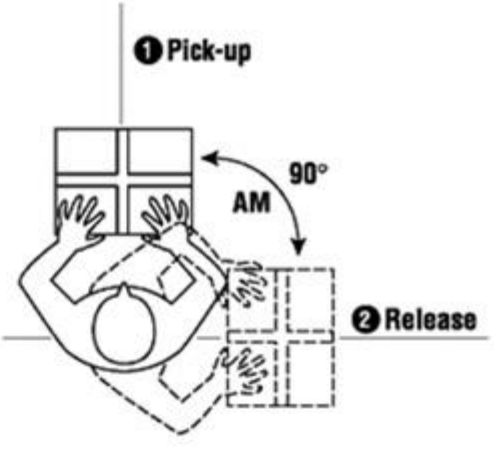


**Asymmetric Angle (A)** – Measure the degree to which the body is required to twist or turn during the lifting task. The asymmetric angle is the amount (in degrees) of trunk and shoulder rotation required by the lifting task. Note: Sometimes the twisting is not caused by the physical aspects of the job design, but rather by the employee using poor body mechanics. If this is the case, no twisting (0 degrees) is required by the job. If twisting is required by the design of the job, determine the number of degrees the back and body trunk must twist or rotate to accomplish the lift. (i.e. 90° as pictured below)



**Coupling (C)** – Determine the classification of the quality of the coupling between the worker’s hands and the object as good, fair, or poor (1, 2, or 3). A good coupling will reduce the maximum grasp forces required and increase the acceptable weight for lifting, while a poor coupling will

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generally require higher maximum grasp forces and decrease the acceptable weight for lifting.

- **1 = Good** – Optimal design containers with handles of optimal design, or irregular objects where the hand can be easily wrapped around the object.
- **2 = Fair** – Optimal design containers with handles of less than optimal design, optimal design containers with no handles or cut-outs, or irregular objects where the hand can be flexed about 90°.
- **3 = Poor** – Less than optimal design container with no handles or cut-outs, or irregular objects that are hard to handle and/or bulky (e.g. bags that sag in the middle).

**Frequency (F)** – Determine the average number of lifts per minute of the lifting task being evaluated, this is the lifting frequency. This information can often be verified by asking for average production rates from a group leader, supervisor, or production manager. You can also accomplish this by determining the number of lifts per minute during a short sampling period. NIOSH recommends a 15-minute sampling or observation period. The Frequency (F) value will be between 0.2 lifts/minute and 15 lifts/minute. For lifting tasks with a frequency less than .2 lifts per minute (>1 lift every 5 minutes), you will use the minimum frequency of .2 lifts/minute.

**Load (L)** – Determine the weight of the object lifted. If necessary, use a scale to determine the exact weight. If the weight of the load varies from lift to lift, you should record the average and maximum weights lifted.

**Duration (Dur)** – Determine the lifting duration as classified into one of three categories: Enter 1 for short-duration, 2 for moderate-duration and 8 for long-duration as follows:

- **1 = Short** – lifting ≤ 1 hour with recovery time ≥ 1.2 X work time
- **2 = Moderate** – lifting between 1 and 2 hours with recovery time ≥ 0.3 X lifting time
- **8 = Long** – lifting between 2 and 8 hours with standard industrial rest allowances

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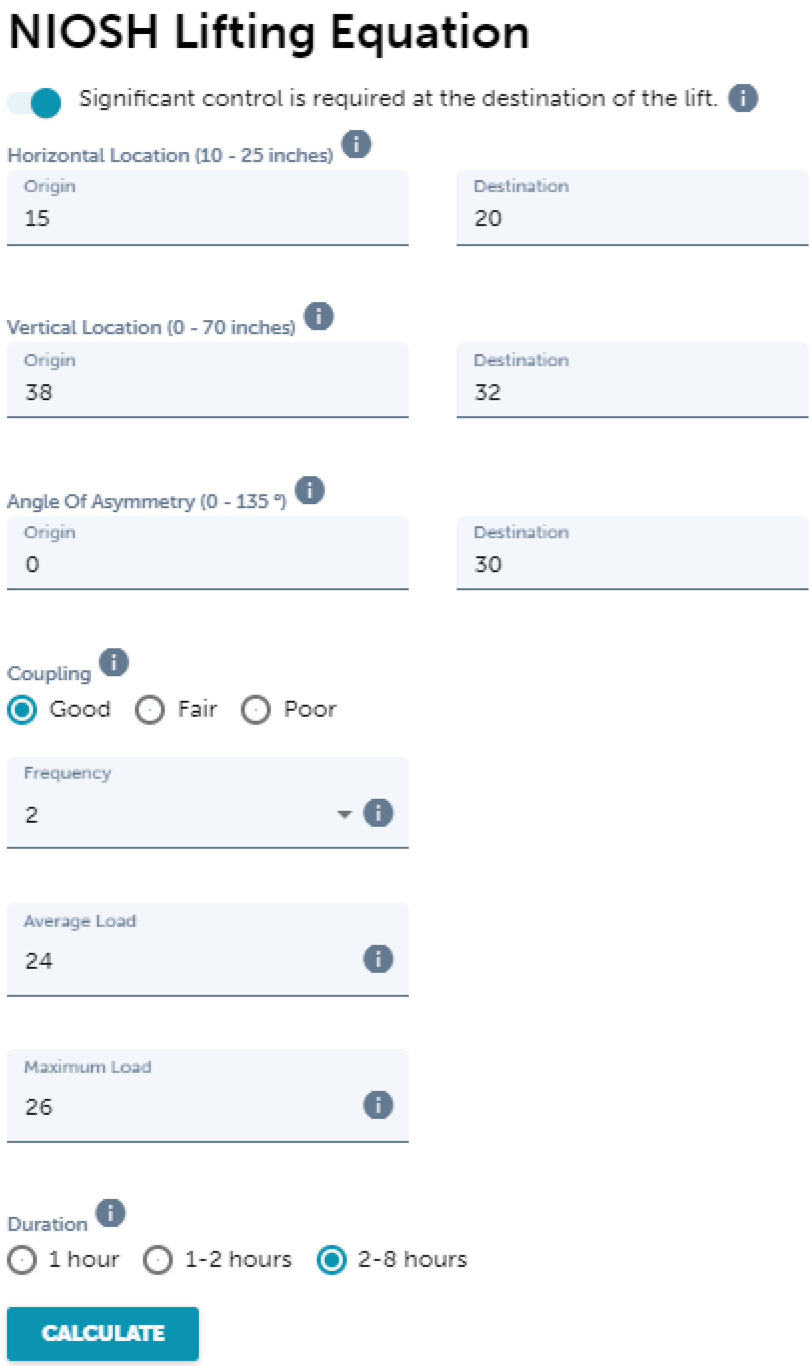
After task variables are determined, enter data into the calculator to determine the RWL and LI.



NIOSH Lifting Equation

Significant control is required at the destination of the lift.

Horizontal Location (10 - 25 inches)

Origin: 15

Destination: 20

Vertical Location (0 - 70 inches)

Origin: 38

Destination: 32

Angle Of Asymmetry (0 - 135 °)

Origin: 0

Destination: 30

Coupling

● Good ○ Fair ○ Poor

Frequency: 2

Average Load: 24

Maximum Load: 26

Duration

○ 1 hour ○ 1-2 hours ● 2-8 hours

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# NIOSH Lifting Equation Example – Warehouse Pick (Lifting)

## Step 1: Determine Task Variables Needed

The worker lifts and transfers containers from the rack pallet (Origin) to the picking cart (Destination), stepping toward the cart and pivoting his feet to perform this task. Significant control of the object is not required at the destination, therefore the only task variable needed at the destination is the vertical location of hands (V) which is needed to determine the Travel Distance (D).

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## Step 2: Determine and Record Task Variables

The Horizontal Location (H) of the hands is 15” at the origin. The Vertical Location (V) of the hands is 12-30”at the origin, but we will use the lowest level to assess the worst case. The Vertical Location (V) is 42” at the destination, therefore the Travel Distance (D) is 30”. The Asymmetric Angle (A) is 30 degrees at the origin. The container is of optimal design with handholds; therefore, coupling is defined as “good”. The average frequency of lifting in this manner is 1 lift every 2 minutes (.5 lifts per minute) over a duration of an 8-hour period.

Example 1 summary of task variable data:

H = 15” at the origin

V = 12” at the origin and 42” at the destination

D = 30” (calculated for you)

A = 30° at the origin

C = 1 (good – container is of optimal design with handhold cutouts)

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F = .5 lifts/minute (1 lift every 2 minutes)

L = 28 lb. average load and 28 lb. maximum load

Dur = Long (lifting between 2 and 8 hours with standard industrial rest allowances for lunch and rest breaks)

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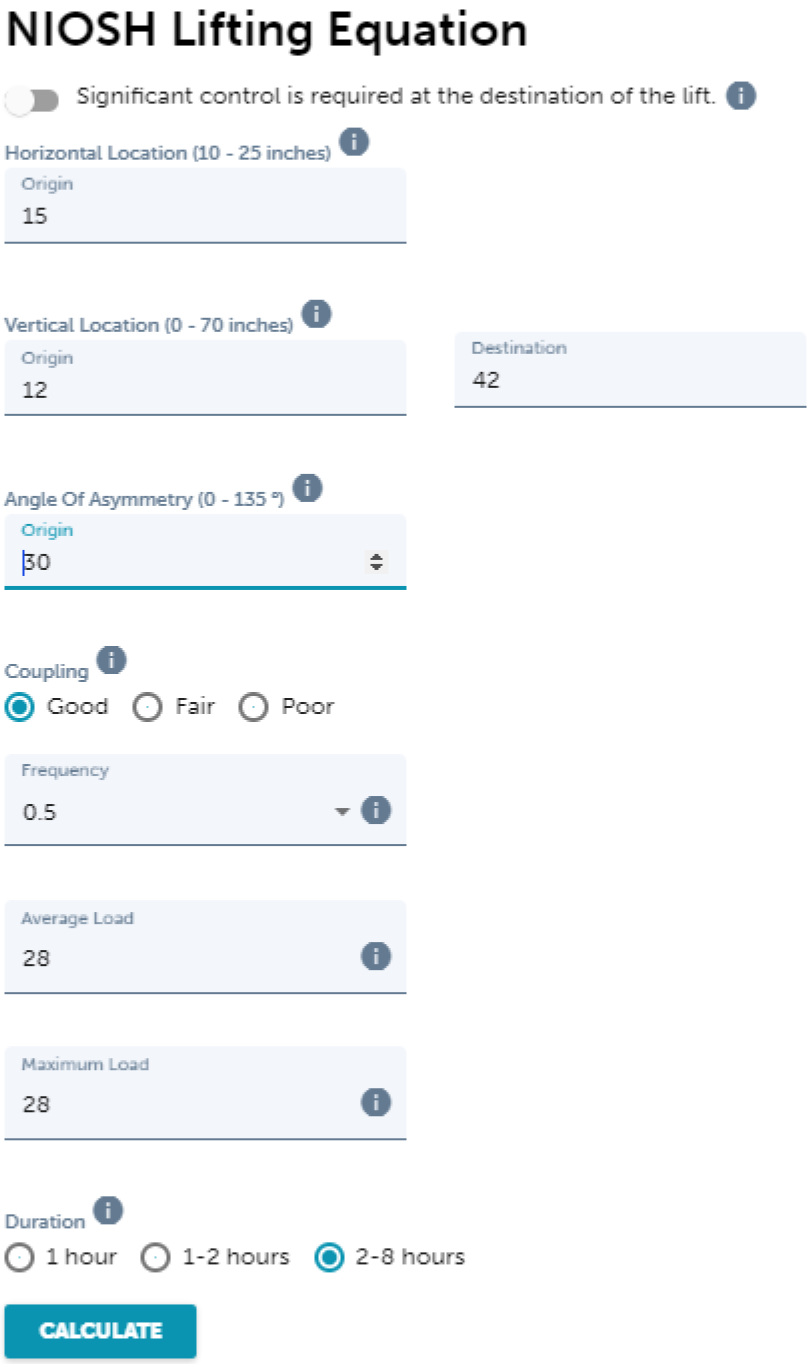
## Step 3: Use Calculator to Determine RWL and LI



NIOSH Lifting Equation

○ Significant control is required at the destination of the lift.

Horizontal Location (10 - 25 inches)

Origin: 15

Vertical Location (0 - 70 inches)

Origin: 12

Destination: 42

Angle Of Asymmetry (0 - 135 °)

Origin: 30

Coupling

● Good ○ Fair ○ Poor

Frequency: 0.5

Average Load: 28

Maximum Load: 28

Duration

○ 1 hour ○ 1-2 hours ● 2-8 hours

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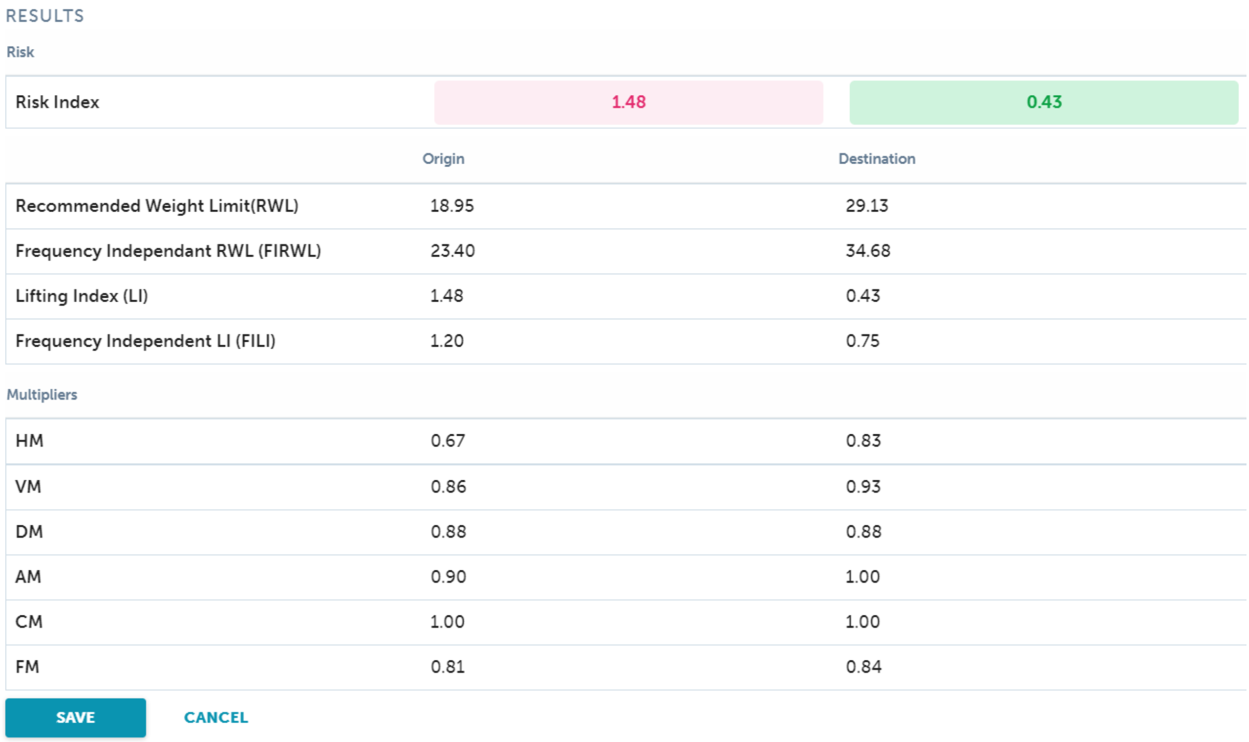

RESULTS

Risk

| | | |
|---|---|---|
| Risk Index | 1.48 | 0.43 |

| | Origin | Destination |
|---|---|---|
| Recommended Weight Limit(RWL) | 18.95 | 29.13 |
| Frequency Independant RWL (FIRWL) | 23.40 | 34.68 |
| Lifting Index (LI) | 1.48 | 0.43 |
| Frequency Independent LI (FILI) | 1.20 | 0.75 |

Multipliers

| | | |
|---|---|---|
| HM | 0.67 | 0.83 |
| VM | 0.86 | 0.93 |
| DM | 0.88 | 0.88 |
| AM | 0.90 | 1.00 |
| CM | 1.00 | 1.00 |
| FM | 0.81 | 0.84 |

## NIOSH Lifting Equation Example – Parts Container (Lowering)

### Step 1: Determine Task Variables Needed

This assembly worker is required to lower a container of parts periodically throughout an 8-hour shift. The worker lowers the container from an upper incoming conveyor (Origin), stepping and pivoting to place the container on the workstation staging location (Destination). Significant control of the

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container is required at the destination to guide it to a precise staging location, so task variables will need to be determined at both the origin and destination.

### Step 2: Determine and Record Task Variables

The Horizontal Location (H) is 16.75” at the origin, and 12” at the destination. The Vertical Location (V) is 49.5” at the origin, and 31” at the destination. The Travel Distance (D) is 18.5”. The Asymmetric Angle (A) is 25 degrees at the origin. Since pivoting the feet and stepping toward the destination is not restricted by job design and the container stays directly in front of the body (mid-sagittal plane), I would use 0 degrees for (A) at the destination.

(Note: Regarding (A) at the destination in this example: Remember that the lifting equation applications manual recommends that you assume that workers will not step and pivot. NIOSH acknowledges that this assumption may cause an overestimation of the Asymmetric multiplier’s reduction in the RWL but indicates that this assumption will provide the most conservative evaluation of the RWL. It’s obviously your call, but I prefer to stay away from such assumptions and try my best to evaluate the actual conditions of the lifting or lowering task.) The container is of optimal design with handholds (good), but the Coupling (C) is rated as fair because the high vertical hand position at the origin requires re-gripping. The average Frequency (F) of lowering this container is 1 lift every 12 minutes (< 0.2 lifts per minute) for 8 hours. Average and Max. Load (L) = 28 lbs.

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Example 2 summary of task variable data:

H = 16.75 at the origin, 12” at destination

V = 49.5” at the origin and 31” at the destination

D = 18.5” (calculated for you)

A = 25° at the origin and 0° at the destination

C = 2 (fair -high vertical hand position at the origin requires re-gripping)

F = <.2 lifts/minute (1 lift every 12 minutes)

L = 25.4 lb. average load and 25.4 lb. maximum load

Dur = Long (lifting between 2 and 8 hours with standard industrial rest allowances for lunch and rest breaks)

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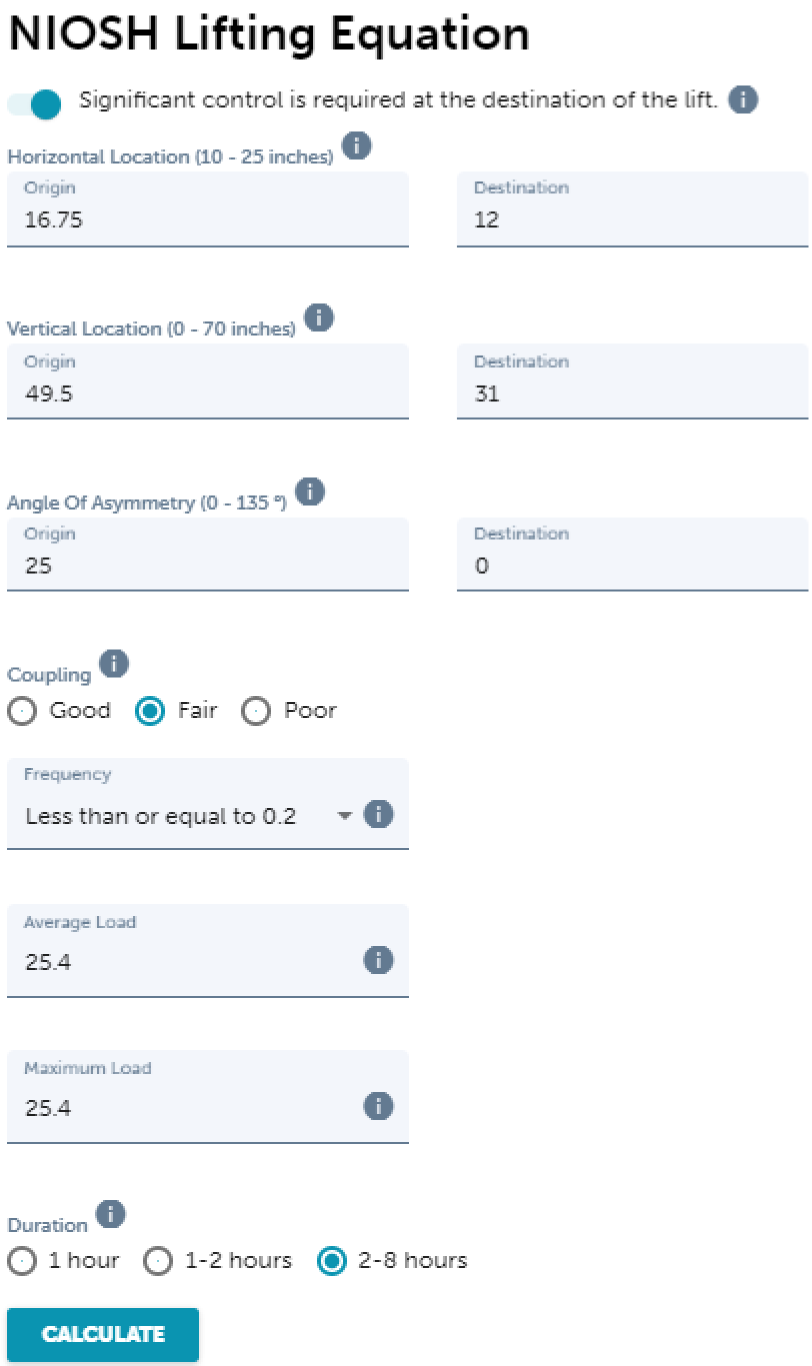
## Step 3: Use Calculator to Determine RWL and LI



### NIOSH Lifting Equation

● Significant control is required at the destination of the lift.

Horizontal Location (10 - 25 inches)

Origin: 16.75

Destination: 12

Vertical Location (0 - 70 inches)

Origin: 49.5

Destination: 31

Angle Of Asymmetry (0 - 135 °)

Origin: 25

Destination: 0

Coupling

○ Good ● Fair ○ Poor

Frequency: Less than or equal to 0.2

Average Load: 25.4

Maximum Load: 25.4

Duration

○ 1 hour ○ 1-2 hours ● 2-8 hours

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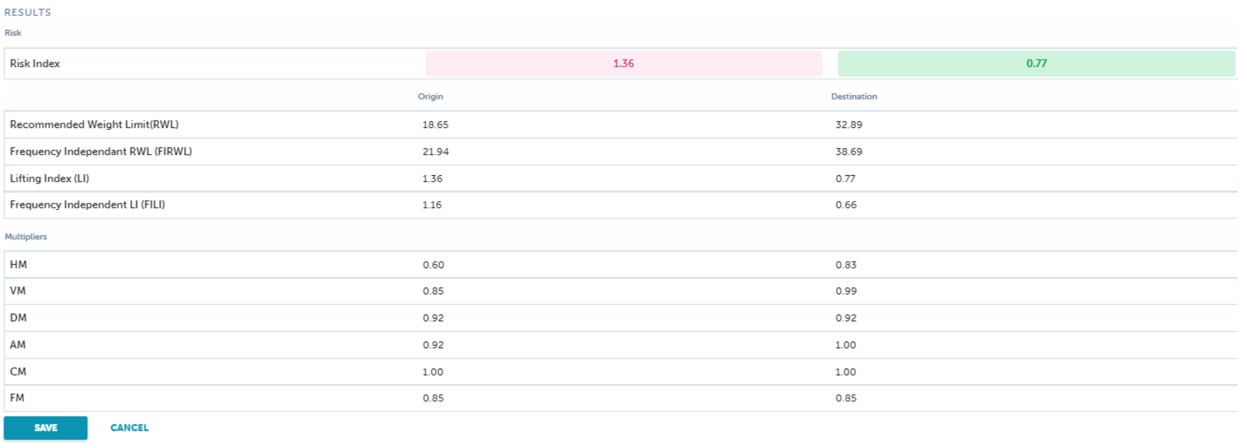

RESULTS

Risk

| | | |
|---|---|---|
| Risk Index | 1.36 | 0.77 |

| | Origin | Destination |
|---|---|---|
| Recommended Weight Limit(RWL) | 18.65 | 32.89 |
| Frequency Independant RWL (FIRWL) | 21.94 | 38.69 |
| Lifting Index (LI) | 1.36 | 0.77 |
| Frequency Independent LI (FILI) | 1.16 | 0.66 |

Multipliers

| | | |
|---|---|---|
| HM | 0.60 | 0.83 |
| VM | 0.85 | 0.99 |
| DM | 0.92 | 0.92 |
| AM | 0.92 | 1.00 |
| CM | 1.00 | 1.00 |
| FM | 0.85 | 0.85 |

## NIOSH Lifting Equation Resources

(source) NIOSH Lifting Equation Applications Manual [Original PDF]

## See ErgoPlus Industrial in action

ErgoPlus Industrial is cloud-based ergonomics management software. It empowers you to spend less time hassling with spreadsheets and more time improving your workplace.

With all your ergonomics data in one place, you'll always have all the information you need to make smart decisions and take proactive actions to reduce risk.

Click here to schedule a personalized demo. An Ergoplus product specialist will show you how leading safety teams are managing ergonomics the smart way.

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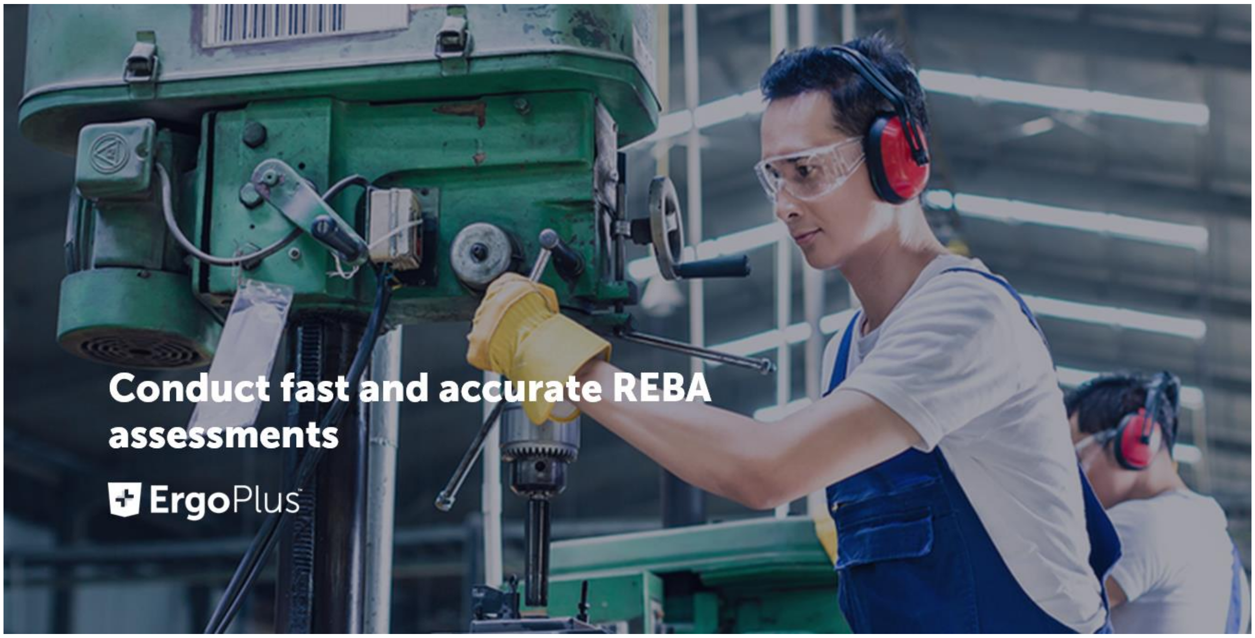
# A Step-by-Step Guide to Rapid Entire Body Assessment (REBA)



The Rapid Entire Body Assessment (REBA) was developed to “rapidly” evaluate risk of musculoskeletal disorders (MSD) associated with certain job tasks.

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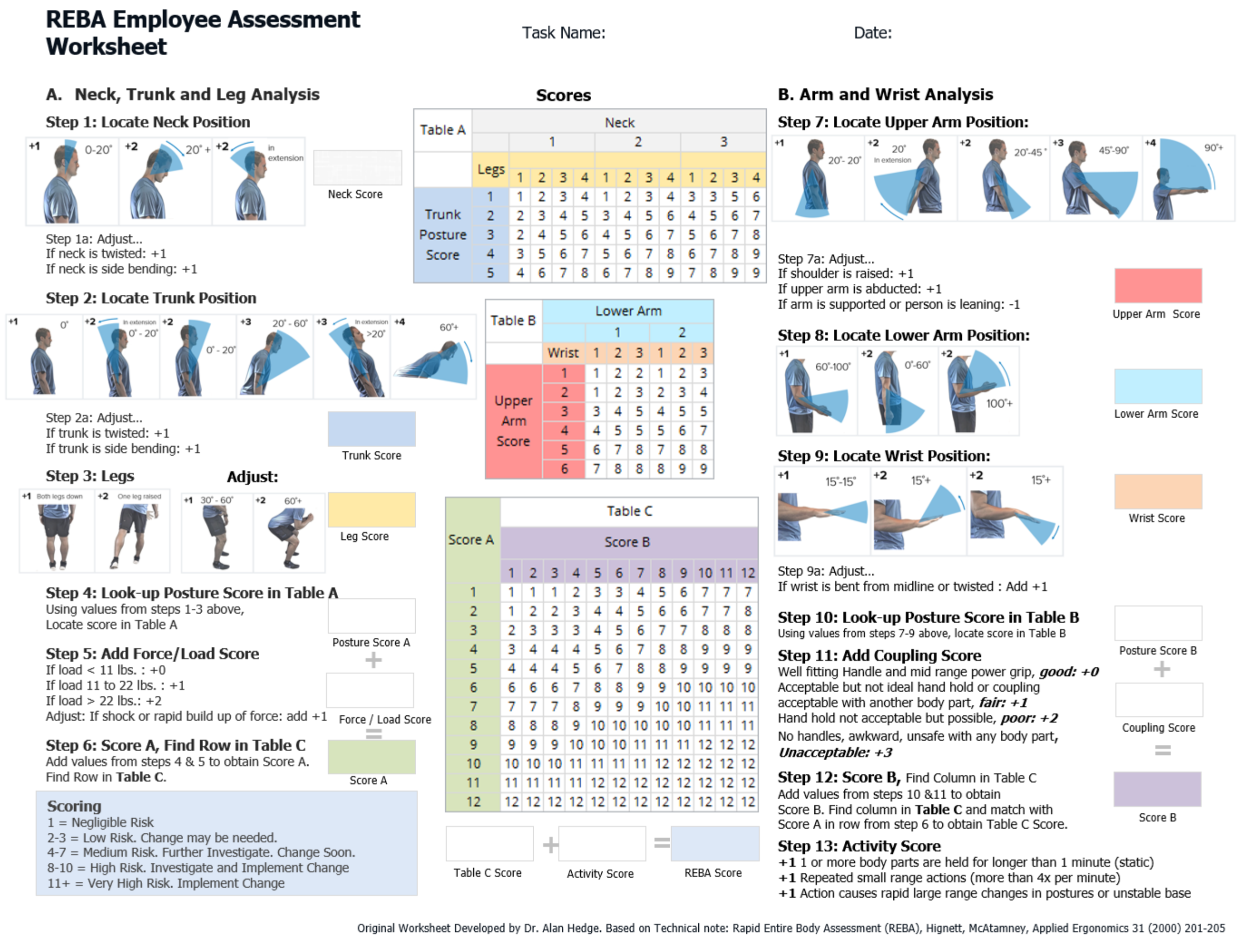

**REBA Employee Assessment Worksheet**

Task Name:

Date:

**A. Neck, Trunk and Leg Analysis**

**Step 1: Locate Neck Position**

Neck Score

Step 1a: Adjust...
If neck is twisted: +1
If neck is side bending: +1

**Step 2: Locate Trunk Position**

Step 2a: Adjust...
If trunk is twisted: +1
If trunk is side bending: +1

Trunk Score

**Step 3: Legs** **Adjust:**

Leg Score

**Step 4: Look-up Posture Score in Table A**
Using values from steps 1-3 above,
Locate score in Table A

Posture Score A

+

**Step 5: Add Force/Load Score**
If load < 11 lbs. : +0
If load 11 to 22 lbs. : +1
If load > 22 lbs.: +2
Adjust: If shock or rapid build up of force: add +1

Force / Load Score

=

**Step 6: Score A, Find Row in Table C**
Add values from steps 4 & 5 to obtain Score A.
Find Row in **Table C.**

Score A

**Scoring**
1 = Negligible Risk
2-3 = Low Risk. Change may be needed.
4-7 = Medium Risk. Further Investigate. Change Soon.
8-10 = High Risk. Investigate and Implement Change
11+ = Very High Risk. Implement Change

**Scores**

| Table A | | Neck | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | | | 2 | | | | 3 | | | |
| | Legs | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Trunk Posture Score | 1 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 3 | 3 | 5 | 6 |
| | 2 | 2 | 3 | 4 | 5 | 3 | 4 | 5 | 6 | 4 | 5 | 6 | 7 |
| | 3 | 2 | 4 | 5 | 6 | 4 | 5 | 6 | 7 | 5 | 6 | 7 | 8 |
| | 4 | 3 | 5 | 6 | 7 | 5 | 6 | 7 | 8 | 6 | 7 | 8 | 9 |
| | 5 | 4 | 6 | 7 | 8 | 6 | 7 | 8 | 9 | 7 | 8 | 9 | 9 |

| Table B | | Lower Arm | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | | | 2 | | |
| | Wrist | 1 | 2 | 3 | 1 | 2 | 3 |
| Upper Arm Score | 1 | 1 | 2 | 2 | 1 | 2 | 3 |
| | 2 | 1 | 2 | 3 | 2 | 3 | 4 |
| | 3 | 3 | 4 | 5 | 4 | 5 | 5 |
| | 4 | 4 | 5 | 5 | 5 | 6 | 7 |
| | 5 | 6 | 7 | 8 | 7 | 8 | 8 |
| | 6 | 7 | 8 | 8 | 8 | 9 | 9 |

| Score A | Table C | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Score B | | | | | | | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1 | 1 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 7 |
| 2 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 6 | 7 | 7 | 8 |
| 3 | 2 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 | 8 |
| 4 | 3 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 |
| 5 | 4 | 4 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 9 | 9 |
| 6 | 6 | 6 | 6 | 7 | 8 | 8 | 9 | 9 | 10 | 10 | 10 | 10 |
| 7 | 7 | 7 | 7 | 8 | 9 | 9 | 9 | 10 | 10 | 11 | 11 | 11 |
| 8 | 8 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 10 | 11 | 11 | 11 |
| 9 | 9 | 9 | 9 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 |
| 10 | 10 | 10 | 10 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 |
| 11 | 11 | 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |

Table C Score + Activity Score = REBA Score

**B. Arm and Wrist Analysis**

**Step 7: Locate Upper Arm Position:**

Step 7a: Adjust...
If shoulder is raised: +1
If upper arm is abducted: +1
If arm is supported or person is leaning: -1

Upper Arm Score

**Step 8: Locate Lower Arm Position:**

Lower Arm Score

**Step 9: Locate Wrist Position:**

Wrist Score

Step 9a: Adjust...
If wrist is bent from midline or twisted : Add +1

**Step 10: Look-up Posture Score in Table B**
Using values from steps 7-9 above, locate score in Table B

Posture Score B

+

**Step 11: Add Coupling Score**
Well fitting Handle and mid range power grip, ***good: +0***
Acceptable but not ideal hand hold or coupling
acceptable with another body part, ***fair: +1***
Hand hold not acceptable but possible, ***poor: +2***
No handles, awkward, unsafe with any body part,
***Unacceptable: +3***

Coupling Score

=

**Step 12: Score B,** Find Column in Table C
Add values from steps 10 &11 to obtain
Score B. Find column in **Table C** and match with
Score A in row from step 6 to obtain Table C Score.

Score B

**Step 13: Activity Score**
**+1** 1 or more body parts are held for longer than 1 minute (static)
**+1** Repeated small range actions (more than 4x per minute)
**+1** Action causes rapid large range changes in postures or unstable base

Original Worksheet Developed by Dr. Alan Hedge. Based on Technical note: Rapid Entire Body Assessment (REBA), Hignett, McAtamney, Applied Ergonomics 31 (2000) 201-205

The REBA tool uses a systematic process to evaluate both upper and lower parts of the musculoskeletal system for biomechanical and MSD risks associated with the job task being evaluated.

A single page worksheet (above) can be used to evaluate required or selected body posture, forceful exertions, type of movement or action, repetition, and coupling.

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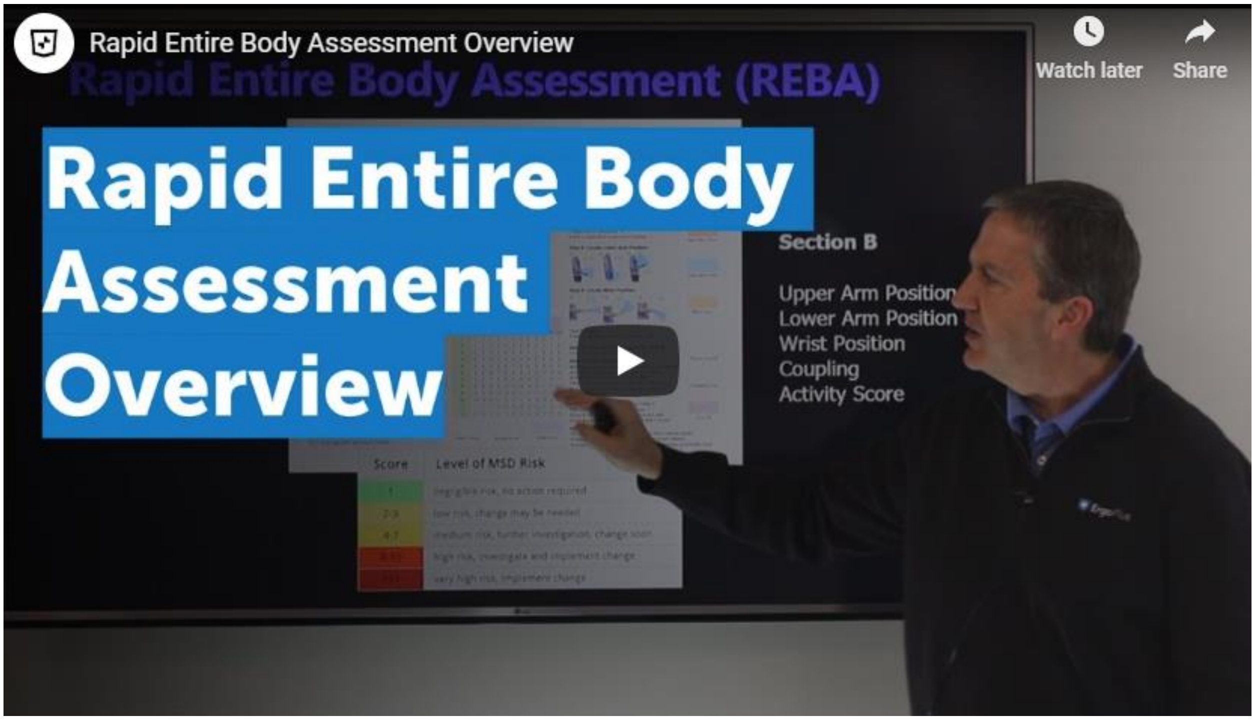

REBA was developed with the following objectives in mind:

1) To provide a simple postural analysis system sensitive to musculoskeletal risks in a variety of tasks.

2) To divide the body into segments to evaluate individually with reference to postures and movement planes.

3) To provide a scoring system for muscle activity caused by static, dynamic, rapid changing or unstable postures.

4) To consider coupling as an important variable in the handling of loads.

5) To give an action level output with an indication of urgency.

6) To provide a user-friendly assessment tool that requires minimal time, effort, and equipment.

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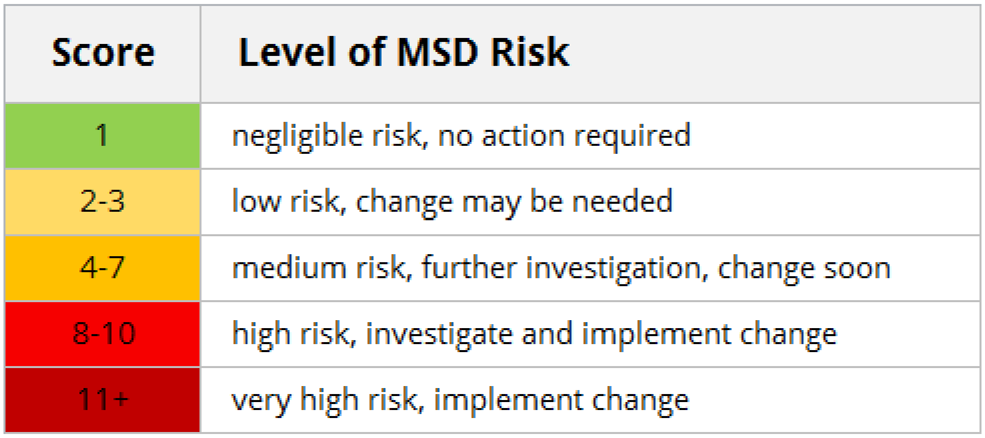
REBA Limitations:

1. Does not consider the duration of the task, available recovery time, or evaluate hand-arm vibration risk.

2. Only allows the evaluator to assess one employee’s worst-case posture at one point in time, requiring the use of representative postures.

3. Requires separate assessment of right and left sides of the body, although in most cases you will be able to quickly determine which side of the body has the greatest exposure to MSD risk.



| Score | Level of MSD Risk |
|---|---|
| 1 | negligible risk, no action required |
| 2-3 | low risk, change may be needed |
| 4-7 | medium risk, further investigation, change soon |
| 8-10 | high risk, investigate and implement change |
| 11+ | very high risk, implement change |

The output of the REBA assessment tool is the final REBA Score, which is a single score that represents the level of MSD risk for the job task being evaluated. The minimum REBA Score = 1, and the maximum REBA Score = 15. Outlined in the above chart are the REBA level of MSD risk descriptions and cut points.

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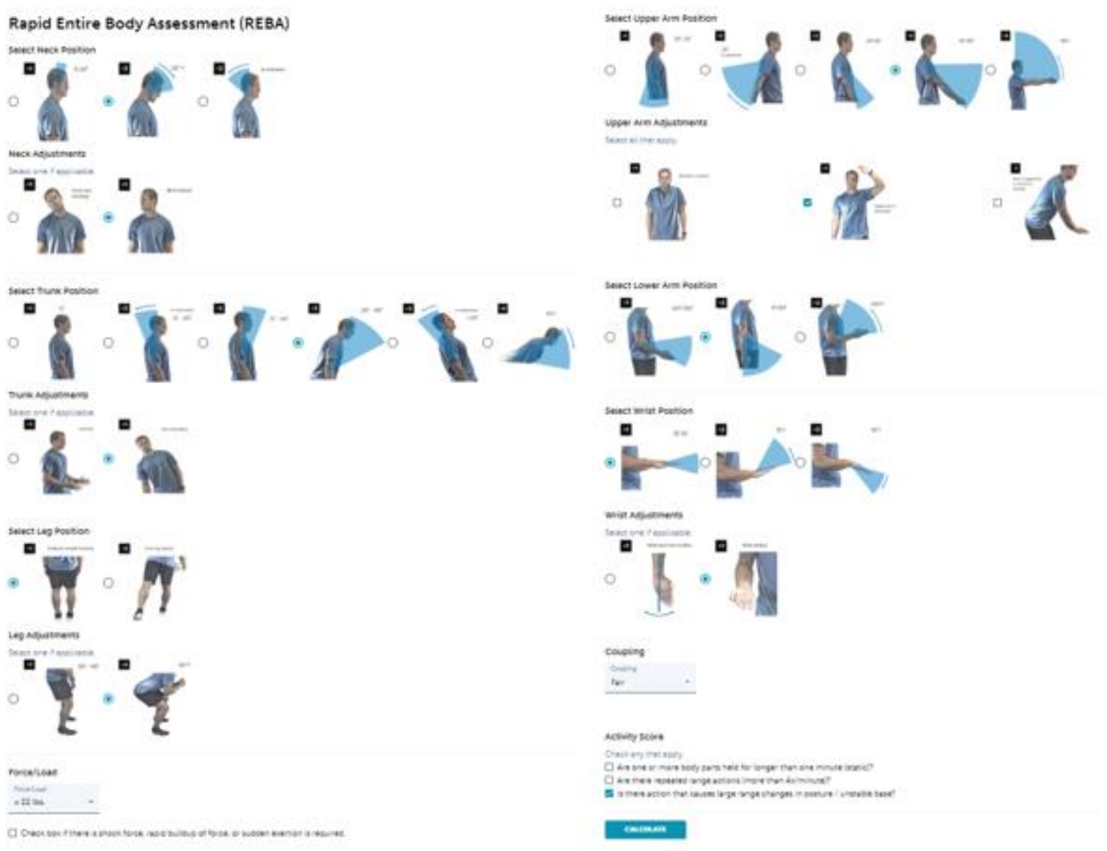
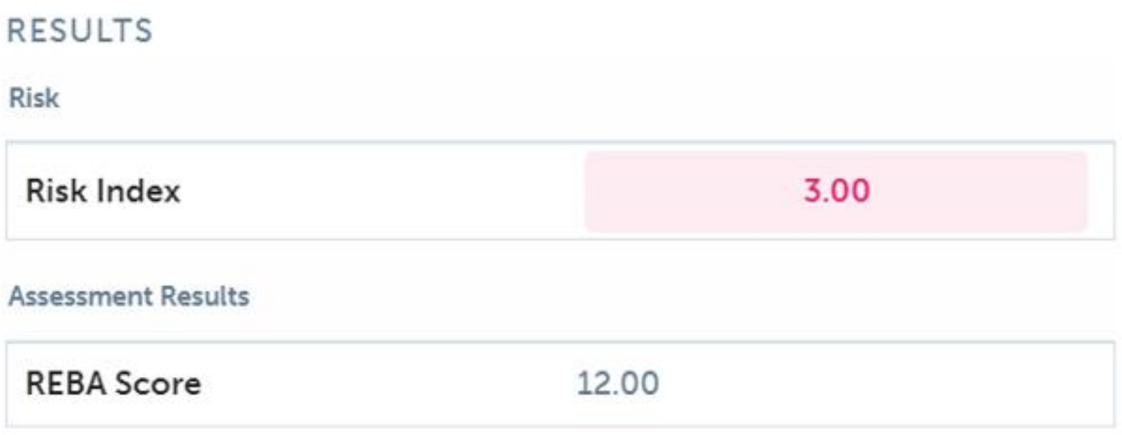
# ErgoPlus REBA Calculator





RESULTS

Risk

| | |
|---|---|
| Risk Index | 3.00 |

Assessment Results

| | |
|---|---|
| REBA Score | 12.00 |

We have developed a cloud-based REBA calculator as a part of our ErgoPlus Industrial platform that can be used to efficiently conduct an assessment, calculate the score and save your results. Simply select the appropriate body segment positions/postures, load force, coupling, and

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activity to calculate the REBA score and risk index. The ErgoPlus REBA web-based calculator is shown above and you can also check out the application here:

ErgoPlus Industrial

## Using REBA

### Getting Ready

The evaluator should prepare for the assessment by interviewing the worker being evaluated to gain an understanding of the job tasks and demands and observing the worker's movements and postures during several work cycles. Selection of the postures to be evaluated should be based on 1) the most difficult postures and work tasks (based on worker interview and initial observation), 2) the posture sustained for the longest period of time, or 3) the posture where the highest force loads occur. The REBA can be conducted quickly, so multiple positions and tasks within the work cycle can usually be evaluated without a significant time/effort cost. When using REBA, only the right or left side is assessed at a time. After interviewing and observing the worker, the evaluator can determine if only one arm should be evaluated, or if an assessment is needed for both sides.

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## Determine Body Position Selections

The REBA assessment requires that you determine postural angles of six different body positions. In most cases, you will be able to determine the body position angle in the field as you observe the task. However, we find that it’s very helpful to take pictures or video of the task being performed from several angles if possible. You can then display the pictures on your computer monitor and use a goniometer (as pictured on left) or an overlaid transparent protractor image (as pictured on right) to measure the body segment angles. These methods are both very quick and easy and will give you the assurance that you’ve obtained the correct body position angles for the assessment.

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# Using the REBA – Example

## Neck, Trunk and Leg Analysis

Neck:

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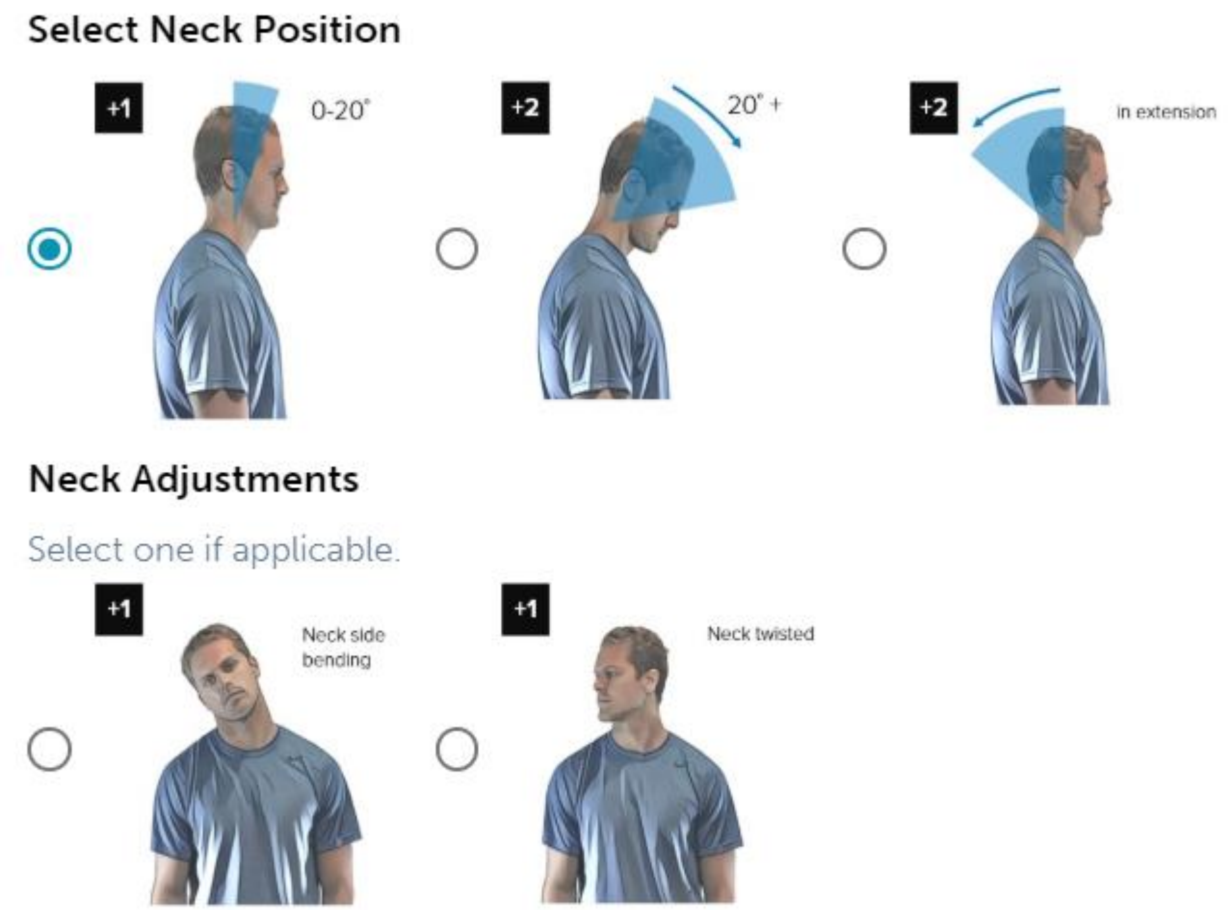

**Select Neck Position**

● +1 0-20°

○ +2 20° +

○ +2 in extension

**Neck Adjustments**

Select one if applicable.

○ +1 Neck side bending

○ +1 Neck twisted

The neck position score will be between 1-3. The score is based on the degree of neck flexion or extension, along with any adjustment for neck twisting or side bending (lateral flexion). Neck flexion is movement of the chin towards the chest from a neutral neck position. Neck extension is moving the chin away from the chest (backwards) from a neutral neck position.

In this example, neck flexion is less than 20 degrees. There is no twisting or side bending required, so no selection is made under neck adjustments.

Trunk:

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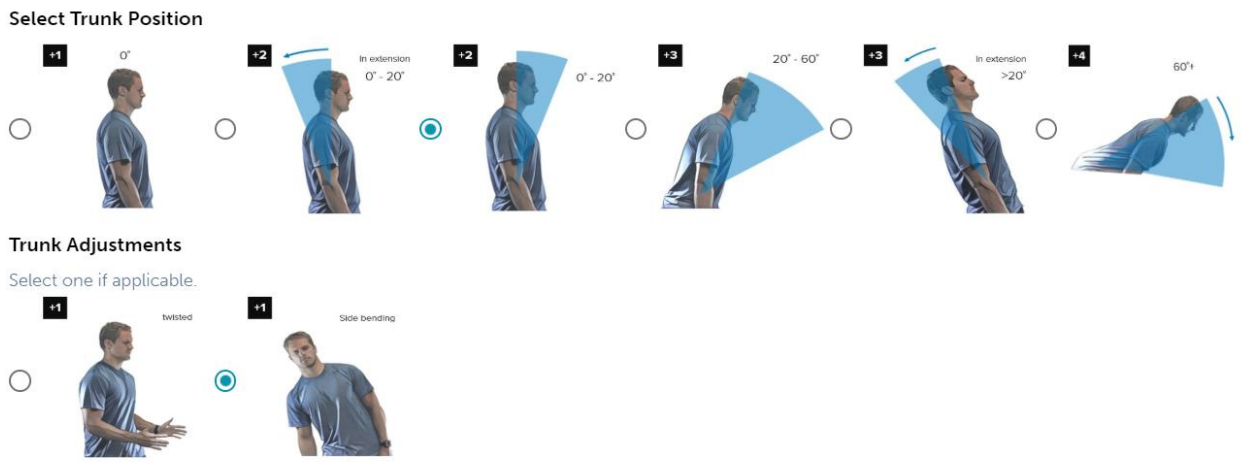

**Select Trunk Position**

○ +1 0°

○ +2 In extension 0° - 20°

● +2 0° - 20°

○ +3 20° - 60°

○ +3 In extension >20°

○ +4 60°+

**Trunk Adjustments**

Select one if applicable.

○ +1 twisted

● +1 Side bending

The trunk position score will be between 1-5. The score is based on the degree of trunk flexion or extension, along with any adjustment for twisting or side bending (lateral flexion) of the trunk/back. Trunk flexion is defined as anterior (forward) movement of the trunk in the sagittal plane (think toe touching). Trunk extension is defined as posterior (backward) movement of the trunk in the sagittal plane.

In this example, trunk flexion is less than 20 degrees. When viewed from behind, the trunk was in a side bending position so the side bending adjustment is selected.

Leg:

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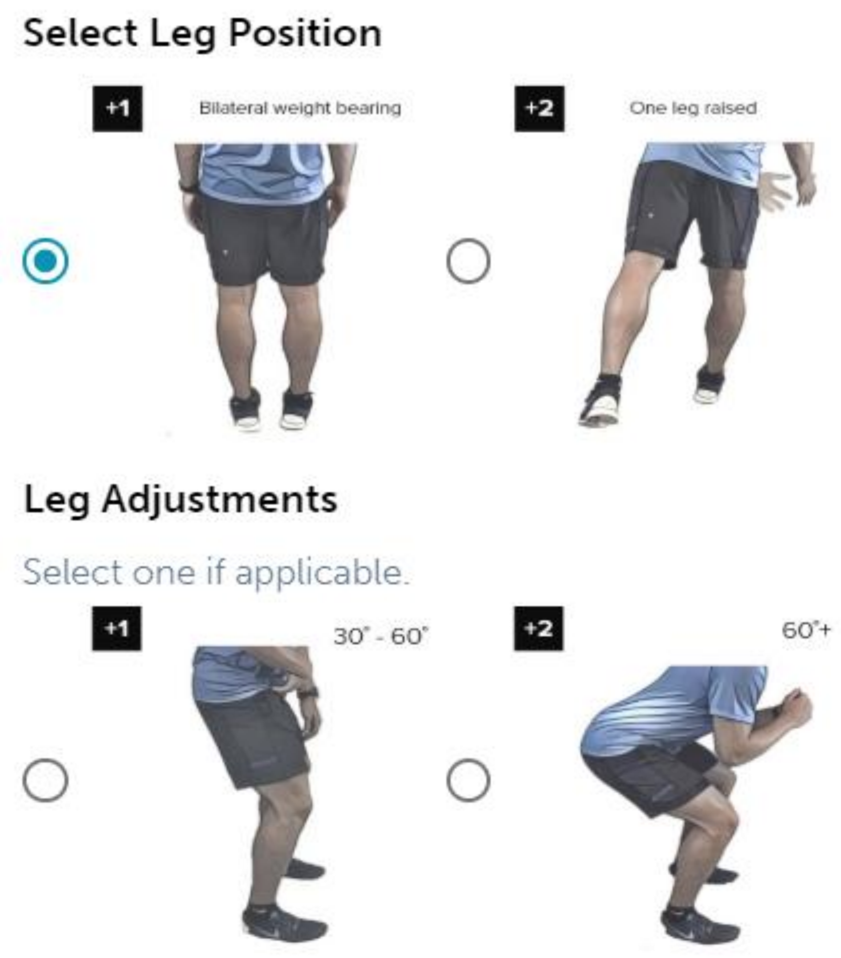

**Select Leg Position**

● +1 Bilateral weight bearing

○ +2 One leg raised

**Leg Adjustments**

Select one if applicable.

○ +1 30° - 60°

○ +2 60°+

The leg position score will be between 1-4. The score is based on bilateral or unilateral weight bearing on the legs, along with any adjustment for the degree of knee flexion. Knee flexion is defined as bending or decreasing the angle between the femur and tibia bones of the limb at the knee joint.

In this example, there is bilateral weight bearing on the legs. Because the knees are not flexed, no leg adjustment is applicable.

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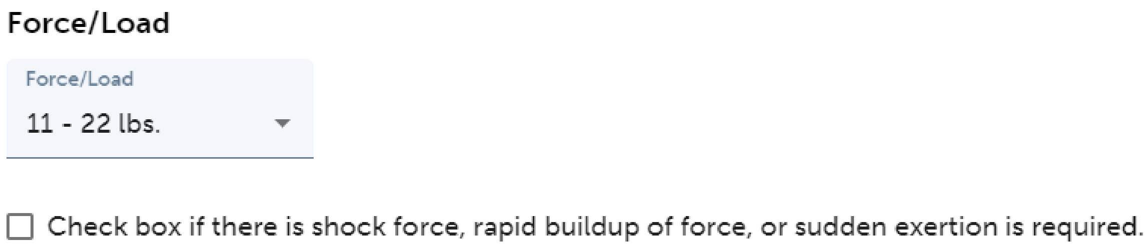
## Force/Load Analysis:



**Force/Load**

Force/Load: 11 - 22 lbs.

☐ Check box if there is shock force, rapid buildup of force, or sudden exertion is required.

The Force/Load score will be between 0-2. For this selection you will need to determine the load or force required to perform the task. Often, you can obtain the weight of the load from company production or shipping records. If necessary, use the nearest scale in the facility or a force measurement gauge to determine the exact weight of any load being moved or lifted.

In this example, the load being lifted is 11-22 lbs. There is no shock force, rapid buildup of force, or sudden exertion required by this task.

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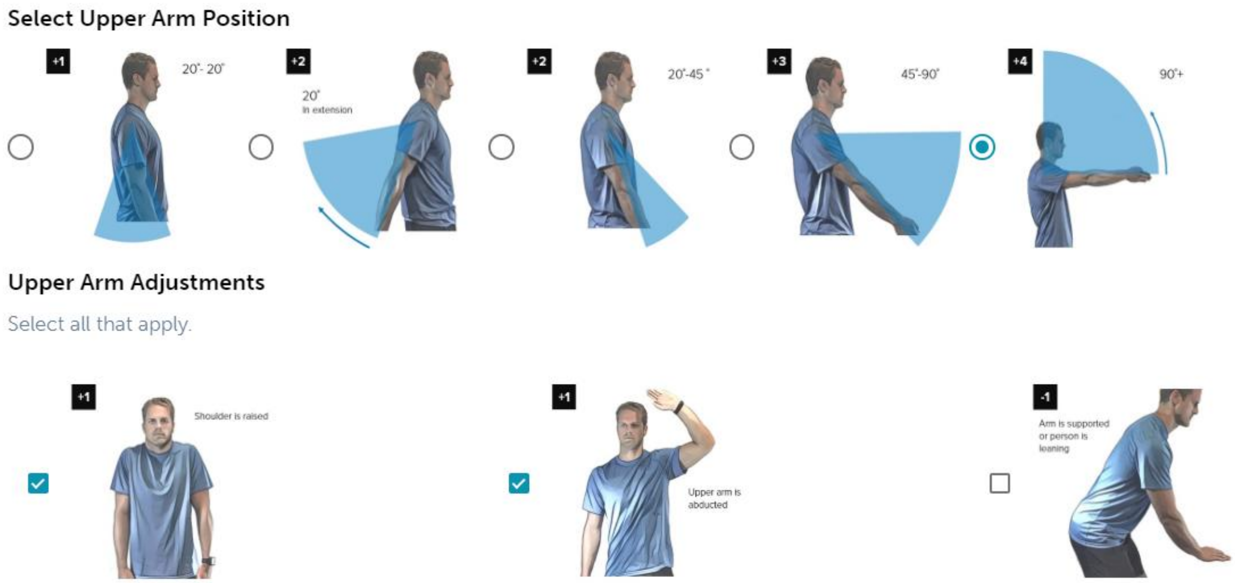
## Upper Arm, Lower Arm & Wrist Analysis

Upper arm:



**Select Upper Arm Position**

○ +1 20°- 20°

○ +2 20° in extension

○ +2 20°-45°

○ +3 45°-90°

● +4 90°+

**Upper Arm Adjustments**

Select all that apply.

☑ +1 Shoulder is raised

☑ +1 Upper arm is abducted

☐ -1 Arm is supported or person is leaning

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The upper arm position score will be between 1-6. The score is based on the degree of shoulder flexion or extension, along with any adjustment for the shoulder being raised and/or abducted. Shoulder flexion is defined as anterior movement of the upper arm in the sagittal plane (forward reaching). Shoulder extension is defined as posterior movement of the upper arm in the sagittal plane (backward reaching). Shoulder abduction is defined as sideways movement of the upper arm away from the body.

In this example, the right upper arm is raised more than 90 degrees for a score of +4. Two adjustments are added because the shoulder is raised (+1) and the upper arm is abducted (+1).

Lower Arm:

The lower arm position score will be 1 or 2. The score is based on the degree of elbow flexion or bending.

In this example, the elbow is flexed less than 60 degrees.

Wrist Position:

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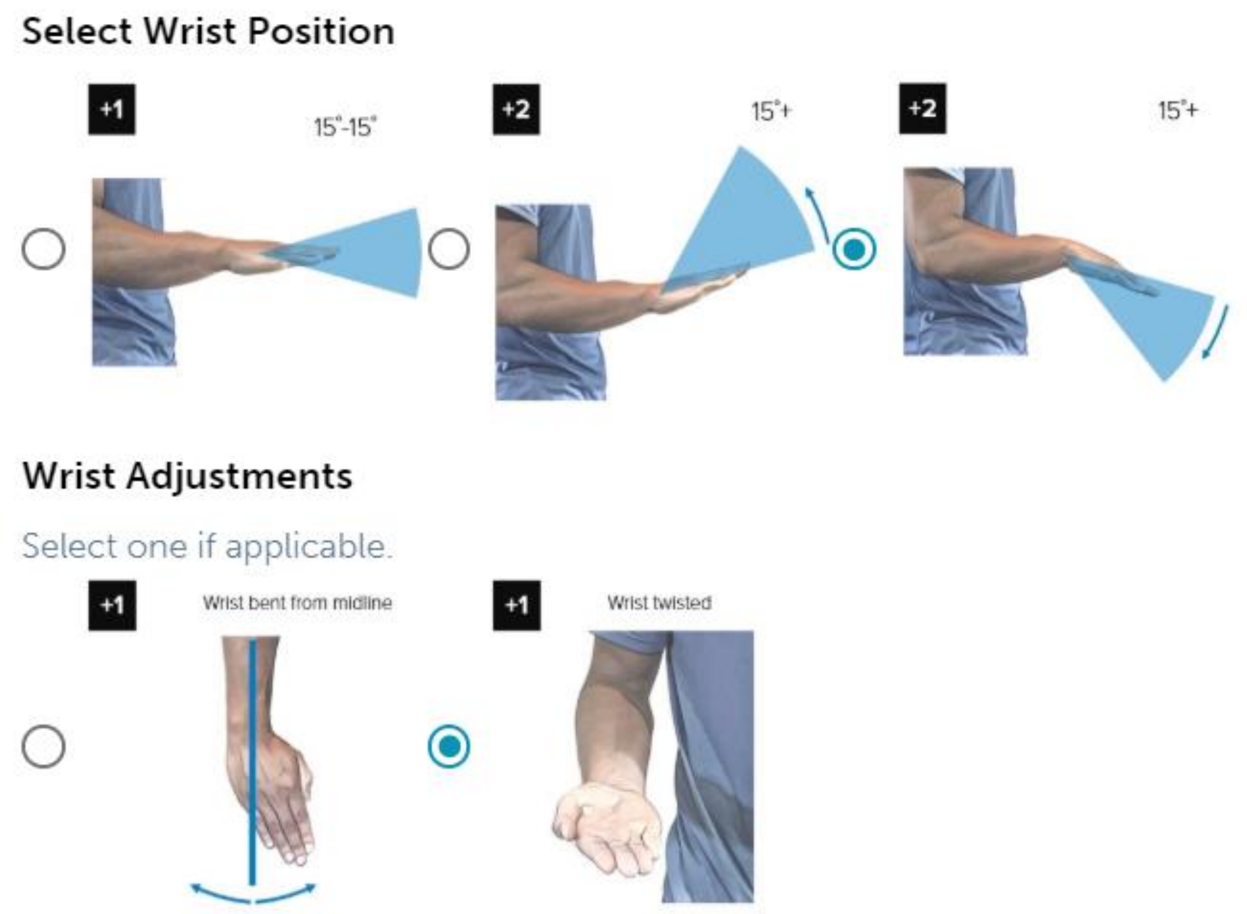

Select Wrist Position

○ +1 15°-15°

○ +2 15°+

● +2 15°+

Wrist Adjustments

Select one if applicable.

○ +1 Wrist bent from midline

● +1 Wrist twisted

The wrist position score will be 1-3. The score is based on the degree of wrist flexion or extension, along with an adjustment of +1 for wrist deviation or twisting.

In this example, the wrist is flexed more than 15 degrees. The wrist is also twisted, so under wrist adjustments select wrist twisted for an adjustment of +1.

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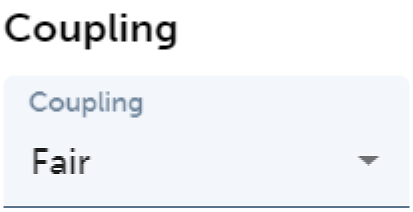
## Coupling Analysis

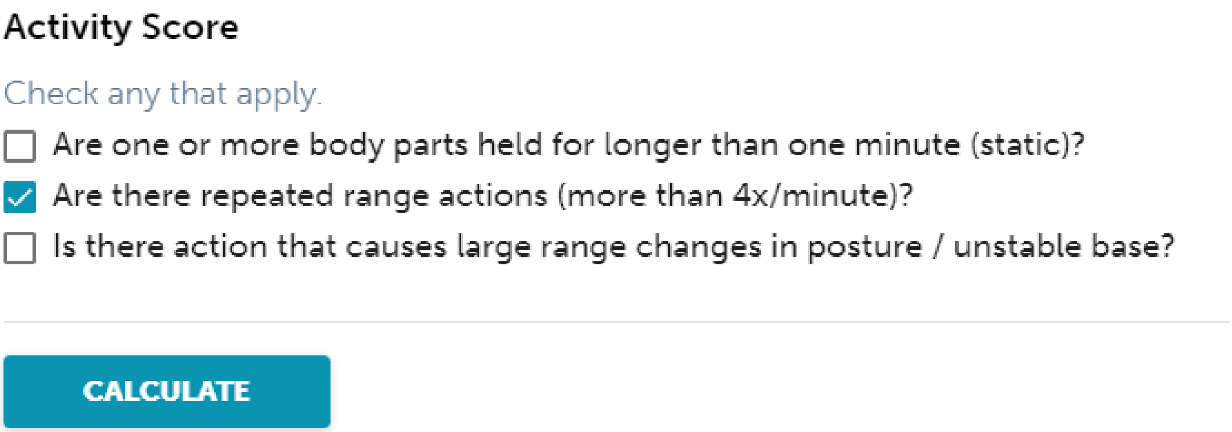

Coupling

Coupling: Fair

The coupling score will be between 0-3. Select Good when there's a well-fitting handle with mid-range power grip, Fair when acceptable but not ideal hand hold or coupling acceptable with another body part, Poor when and hold not acceptable but possible, and Unacceptable if no handles, awkward, and unsafe with any body part.

In this example, the coupling was determined to be Fair.

## Activity Score


Activity Score

Check any that apply.

- ☐ Are one or more body parts held for longer than one minute (static)?
- ☑ Are there repeated range actions (more than 4x/minute)?
- ☐ Is there action that causes large range changes in posture / unstable base?

The activity score will be either 0 or 1, as the criteria are mutually exclusive.

In this example, repeated small range actions (more than 4x per minute) are required.

Calculate Results

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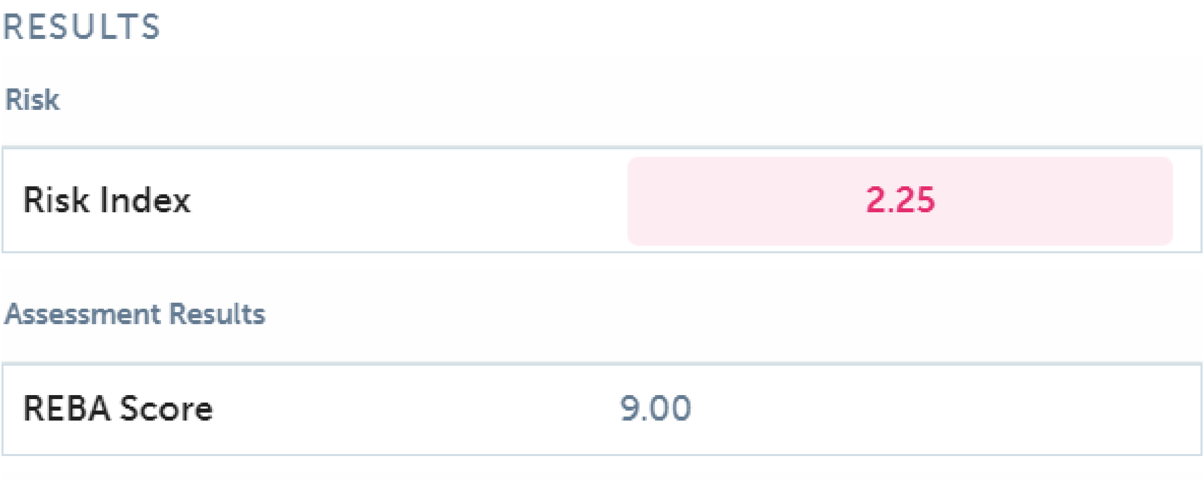

RESULTS

Risk

| | |
|---|---|
| Risk Index | 2.25 |

Assessment Results

| | |
|---|---|
| REBA Score | 9.00 |

After all entries are selected, press the calculate button for the results of the assessment. The ErgoPlus REBA calculator will display the Risk Index and the overall REBA score. The REBA score represents the level of MSD risk for the job task being evaluated. The minimum REBA Score = 1, and the maximum REBA Score = 15. The design goal for the REBA assessment is a score of 4. The Risk Index answers the question… "How significant is the risk?" A Risk Index value of 1.0 or less indicates a nominal risk to healthy employees. A Risk Index greater than 1.0 denotes that the task is high risk for some fraction of the population. As the Risk Index increases, the level of MSD risk increases correspondingly. Therefore, the goal is to design job tasks to accomplish a Risk Index of 1.0 or lower.

In this example, the final REBA score of 9 and a risk index of 2.25 indicates high risk and calls for further investigation with engineering and/or work method changes to reduce or eliminate MSD risk.

## See ErgoPlus Industrial in action

ErgoPlus Industrial is cloud-based ergonomics management software. It empowers you to spend less time hassling with spreadsheets and more time improving your workplace.

With all your ergonomics data in one place, you'll always have all the information you need to make smart decisions and take proactive actions to reduce risk.

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Click here to schedule a personalized demo. An Ergoplus product specialist will show you how leading safety teams are managing ergonomics the smart way.

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# A Step-by-Step Guide to Rapid Upper Limb Assessment (RULA)

The Rapid Upper Limb Assessment (RULA) was developed to “rapidly” evaluate the exposure of individual workers to ergonomic risk factors associated with upper extremity MSD. The RULA ergonomic assessment tool considers biomechanical and postural load requirements of job tasks/demands on the neck, trunk and upper extremities.

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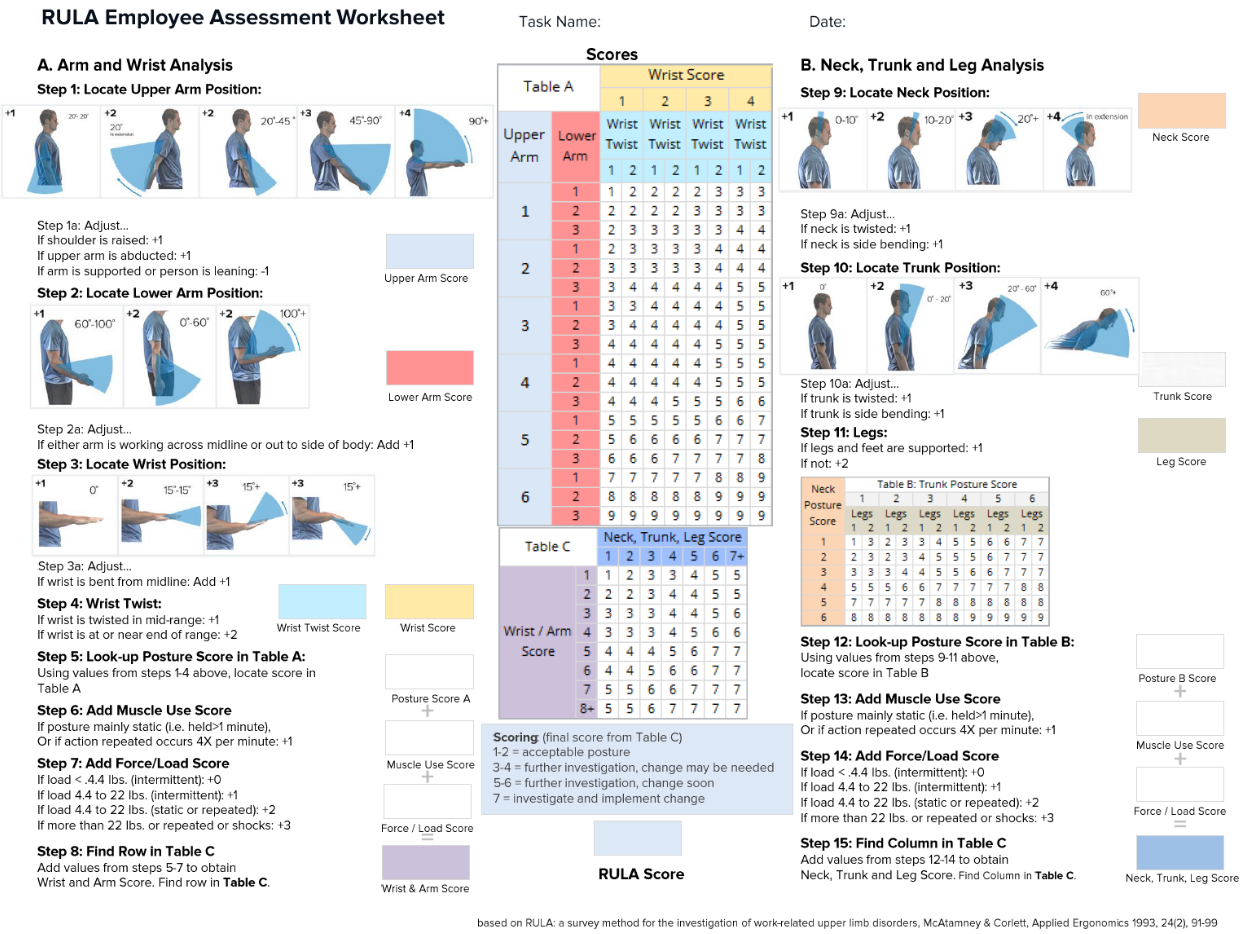

## RULA Employee Assessment Worksheet

Task Name:

Date:

### A. Arm and Wrist Analysis

**Step 1: Locate Upper Arm Position:**

Step 1a: Adjust...
If shoulder is raised: +1
If upper arm is abducted: +1
If arm is supported or person is leaning: -1

Upper Arm Score

**Step 2: Locate Lower Arm Position:**

Lower Arm Score

Step 2a: Adjust...
If either arm is working across midline or out to side of body: Add +1

**Step 3: Locate Wrist Position:**

Step 3a: Adjust...
If wrist is bent from midline: Add +1

**Step 4: Wrist Twist:**
If wrist is twisted in mid-range: +1
If wrist is at or near end of range: +2

Wrist Twist Score

Wrist Score

**Step 5: Look-up Posture Score in Table A:**
Using values from steps 1-4 above, locate score in Table A

Posture Score A
+

**Step 6: Add Muscle Use Score**
If posture mainly static (i.e. held>1 minute),
Or if action repeated occurs 4X per minute: +1

Muscle Use Score
+

**Step 7: Add Force/Load Score**
If load < .4.4 lbs. (intermittent): +0
If load 4.4 to 22 lbs. (intermittent): +1
If load 4.4 to 22 lbs. (static or repeated): +2
If more than 22 lbs. or repeated or shocks: +3

Force / Load Score
=

**Step 8: Find Row in Table C**
Add values from steps 5-7 to obtain
Wrist and Arm Score. Find row in **Table C**.

Wrist & Arm Score

**Scores**

| Table A | | Wrist Score | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | | 2 | | 3 | | 4 | |
| Upper Arm | Lower Arm | Wrist Twist | | Wrist Twist | | Wrist Twist | | Wrist Twist | |
| | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 |
| 2 | 1 | 2 | 3 | 3 | 3 | 3 | 4 | 4 | 4 |
| | 2 | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 4 |
| | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 |
| 3 | 1 | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 5 |
| | 2 | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 |
| | 3 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 |
| 4 | 1 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 |
| | 2 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5 |
| | 3 | 4 | 4 | 4 | 5 | 5 | 5 | 6 | 6 |
| 5 | 1 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 7 |
| | 2 | 5 | 6 | 6 | 6 | 6 | 7 | 7 | 7 |
| | 3 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 8 |
| 6 | 1 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 9 |
| | 2 | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 9 |
| | 3 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |

| Table C | | Neck, Trunk, Leg Score | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7+ |
| Wrist / Arm Score | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 5 |
| | 2 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| | 3 | 3 | 3 | 3 | 4 | 4 | 5 | 6 |
| | 4 | 3 | 3 | 3 | 4 | 5 | 6 | 6 |
| | 5 | 4 | 4 | 4 | 5 | 6 | 7 | 7 |
| | 6 | 4 | 4 | 5 | 6 | 6 | 7 | 7 |
| | 7 | 5 | 5 | 6 | 6 | 7 | 7 | 7 |
| | 8+ | 5 | 5 | 6 | 7 | 7 | 7 | 7 |

**Scoring**: (final score from Table C)
1-2 = acceptable posture
3-4 = further investigation, change may be needed
5-6 = further investigation, change soon
7 = investigate and implement change

**RULA Score**

### B. Neck, Trunk and Leg Analysis

**Step 9: Locate Neck Position:**

Neck Score

Step 9a: Adjust...
If neck is twisted: +1
If neck is side bending: +1

**Step 10: Locate Trunk Position:**

Step 10a: Adjust...
If trunk is twisted: +1
If trunk is side bending: +1

Trunk Score

**Step 11: Legs:**
If legs and feet are supported: +1
If not: +2

Leg Score

| Neck Posture Score | Table B: Trunk Posture Score | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | |
| | Legs | | Legs | | Legs | | Legs | | Legs | | Legs | |
| | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| 1 | 1 | 3 | 2 | 3 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 7 |
| 2 | 2 | 3 | 2 | 3 | 4 | 5 | 5 | 5 | 6 | 7 | 7 | 7 |
| 3 | 3 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 7 |
| 4 | 5 | 5 | 5 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 8 | 8 |
| 5 | 7 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| 6 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 9 |

**Step 12: Look-up Posture Score in Table B:**
Using values from steps 9-11 above,
locate score in Table B

Posture B Score
+

**Step 13: Add Muscle Use Score**
If posture mainly static (i.e. held>1 minute),
Or if action repeated occurs 4X per minute: +1

Muscle Use Score
+

**Step 14: Add Force/Load Score**
If load < .4.4 lbs. (intermittent): +0
If load 4.4 to 22 lbs. (intermittent): +1
If load 4.4 to 22 lbs. (static or repeated): +2
If more than 22 lbs. or repeated or shocks: +3

Force / Load Score
=

**Step 15: Find Column in Table C**
Add values from steps 12-14 to obtain
Neck, Trunk and Leg Score. Find Column in **Table C**.

Neck, Trunk, Leg Score

based on RULA: a survey method for the investigation of work-related upper limb disorders, McAtamney & Corlett, Applied Ergonomics 1993, 24(2), 91-99

The RULA tool uses a systematic process to evaluate required body posture, force, and repetition for the job task being evaluated. A single page worksheet (above) can be used to evaluate required or selected body posture, muscle use frequency, and forceful exertions.

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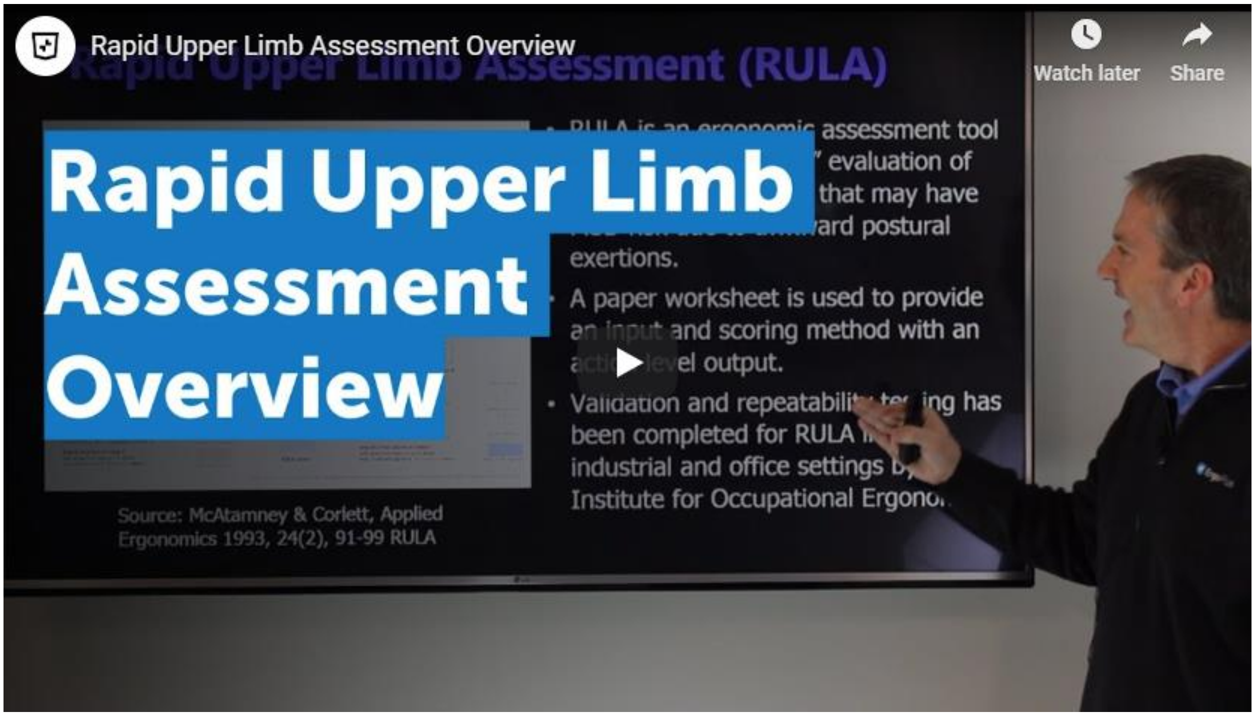

RULA was developed with the following objectives in mind:

1) To provide a method of screening a working population to assess exposure to significant risk of work-related upper extremity disorders.

2) To identify the muscular effort which is associated with working postures and excessive forces while performing static or repetitive work, and which may contribute to muscle fatigue.

3) To provide a simple scoring method with an action level output that identifies an indication of urgency.

4) To provide a user-friendly assessment tool that requires minimal time, effort, and equipment.

RULA Limitations:

1) Does not consider the duration of the task, available recovery time, or hand-arm vibration.

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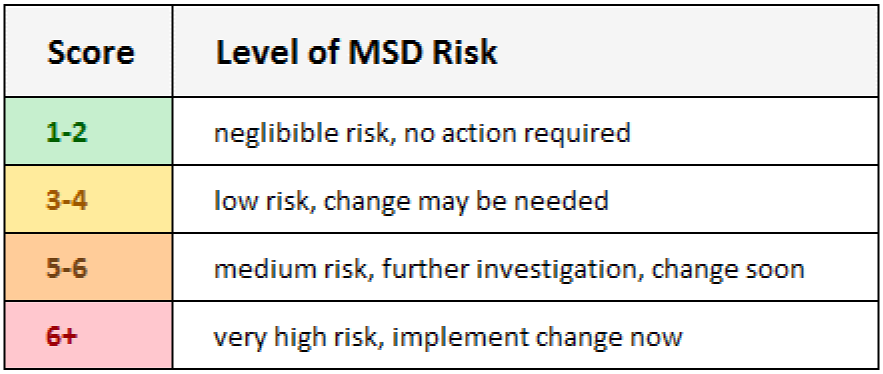
2) Only allows the evaluator to assess one employee’s worst-case posture at one point in time, requiring the use of representative postures.

3) Requires separate assessment of right and left sides of the body, although in most cases you will be able to quickly determine which side of the body has the greatest exposure to MSD risk.



| Score | Level of MSD Risk |
|---|---|
| 1-2 | neglibible risk, no action required |
| 3-4 | low risk, change may be needed |
| 5-6 | medium risk, further investigation, change soon |
| 6+ | very high risk, implement change now |

The output of the RULA assessment tool is the final RULA Score, which is a single score that represents the level of MSD risk for the job task being evaluated. The minimum RULA Score = 1, and the maximum RULA Score = 7. Outlined in the above chart are the RULA level of MSD risk descriptions and cut points.

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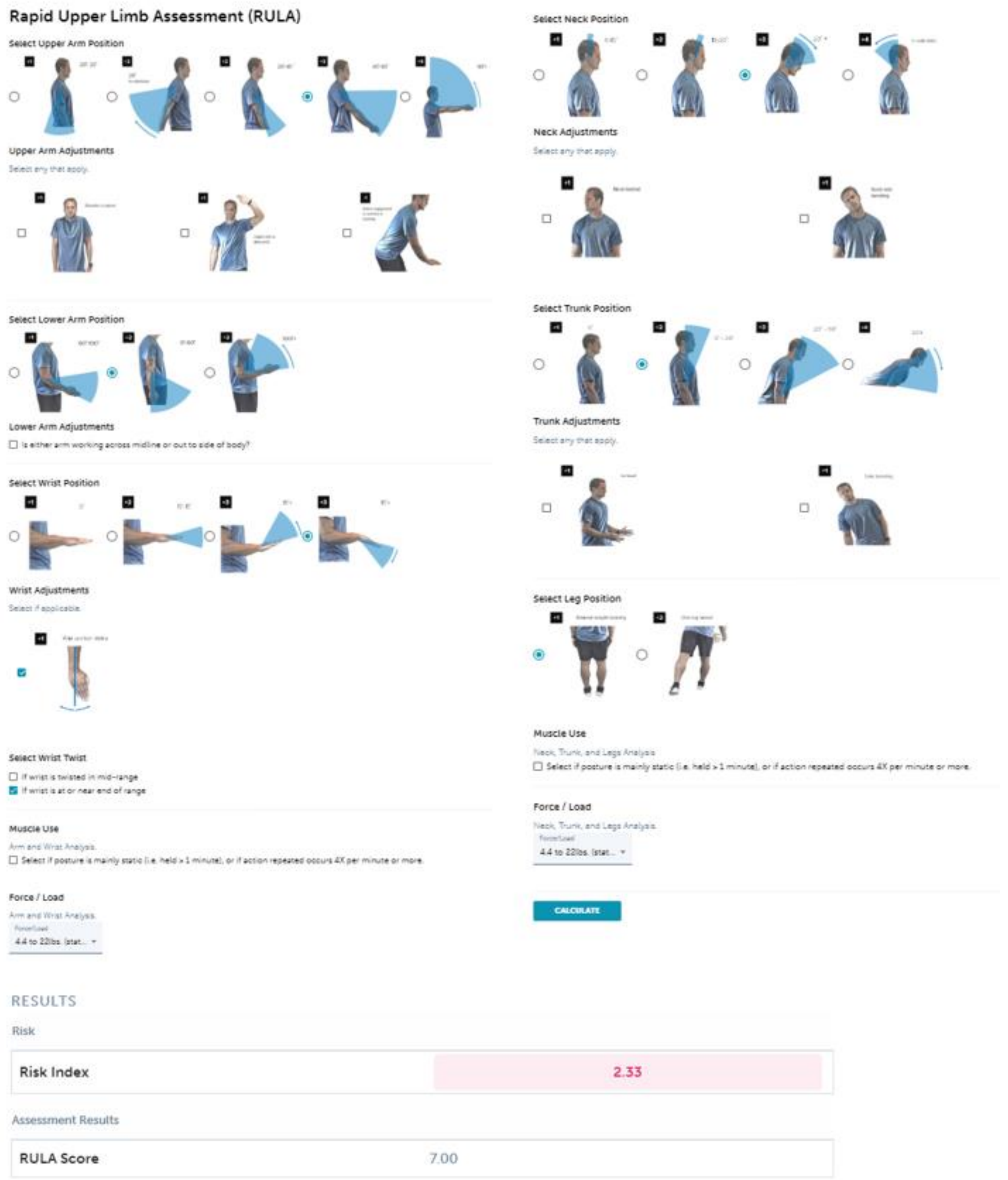
# ErgoPlus RULA Calculator:



Rapid Upper Limb Assessment (RULA)

Select Upper Arm Position

Upper Arm Adjustments

Select any that apply.

Select Lower Arm Position

Lower Arm Adjustments

☐ Is either arm working across midline or out to side of body?

Select Wrist Position

Wrist Adjustments

Select if applicable.

☑

Select Wrist Twist

☐ If wrist is twisted in mid-range
☑ If wrist is at or near end of range

Muscle Use

Arm and Wrist Analysis.

☐ Select if posture is mainly static (i.e. held > 1 minute), or if action repeated occurs 4X per minute or more.

Force / Load

Arm and Wrist Analysis.

Force/Load: 4.4 to 22lbs. (stat...

Select Neck Position

Neck Adjustments

Select any that apply.

Select Trunk Position

Trunk Adjustments

Select any that apply.

Select Leg Position

Muscle Use

Neck, Trunk, and Legs Analysis.

☐ Select if posture is mainly static (i.e. held > 1 minute), or if action repeated occurs 4X per minute or more.

Force / Load

Neck, Trunk, and Legs Analysis.

Force/Load: 4.4 to 22lbs. (stat...

RESULTS

Risk

| | |
|---|---|
| Risk Index | 2.33 |

Assessment Results

| | |
|---|---|
| RULA Score | 7.00 |

We have developed a cloud based RULA calculator as a part of our ErgoPlus Industrial platform that can be used to efficiently conduct an

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assessment, calculate the score and save your results. Simply select the appropriate body segment positions/postures, load force and muscle use selections to calculate the RULA score and Risk Index. The ErgoPlus RULA web-based calculator is shown above and you can also check out the application here:

ErgoPlus Industrial

## Getting Ready

The evaluator should prepare for the assessment by interviewing the worker being evaluated to gain an understanding of the job tasks, and by observing the worker's movements and postures during several work cycles. Selection of the postures to be evaluated should be based on:

1) the most difficult postures and work tasks (determined during worker interview and initial observation), 2) the posture sustained for the longest period of time, or 3) the posture where the highest force loads occur.

The RULA can be conducted quickly, so multiple positions and tasks within the work cycle can usually be evaluated without a significant time and effort. When using RULA, only the right or left side is assessed at a time. After interviewing and observing the worker, the evaluator can determine if only one arm should be evaluated or if an assessment is needed for both sides.

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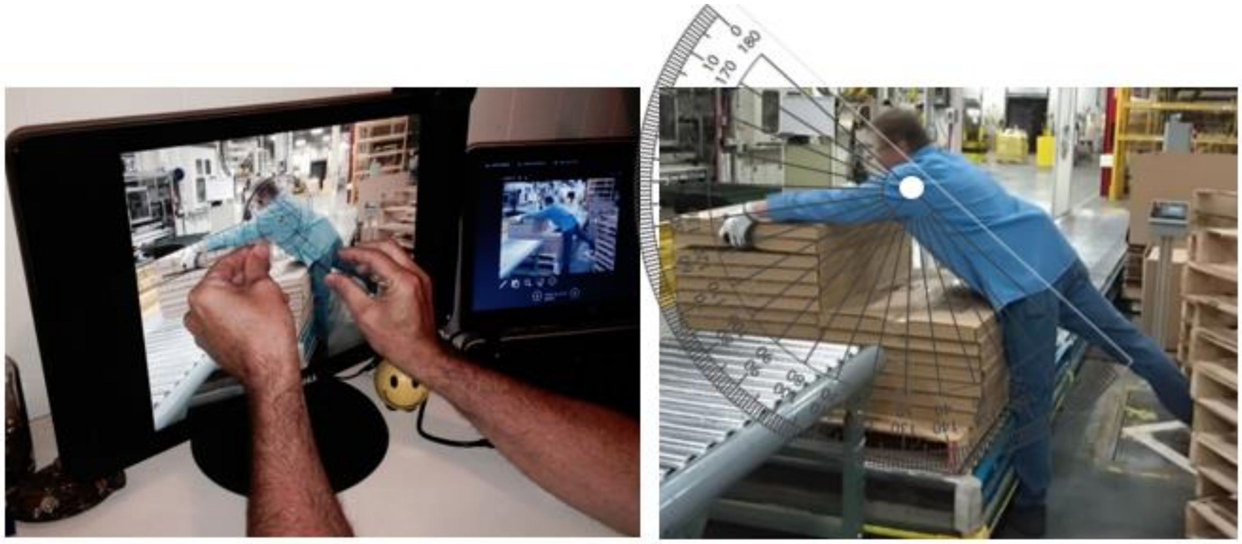
# Determine Body Position Selections



The RULA assessment requires that you determine postural angles of six different body positions. In most cases, you will be able to determine the body position angle in the field as you observe the task. However, we find that it’s very helpful to take pictures or video of the task being performed from several angles if possible. You can then display the pictures on your computer monitor and use a goniometer (as pictured on left) or an overlaid transparent protractor image (as pictured on right) to measure the body segment angles. These methods are both very quick and easy and will give you the assurance that you’ve obtained the correct body position angles for the assessment.

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# Using the RULA – Example

### Arm & Wrist Analysis

Upper Arm Position:

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**Select Upper Arm Position**

○ +1 20°- 20°

○ +2 20° in extension

○ +2 20°-45°

● +3 45°-90°

○ +4 90°+

**Upper Arm Adjustments**

Select any that apply.

☐ +1 Shoulder is raised

☑ +1 Upper arm is abducted

☐ -1 Arm is supported or person is leaning

The upper arm score will be between 1-6. The score is based on the degree of shoulder flexion or extension, along with any adjustment for the shoulder being raised and/or abducted. Shoulder flexion is defined as anterior movement of the upper arm in the sagittal plane (forward reaching). Shoulder extension is defined as posterior movement of the upper arm in the sagittal plane (backward reaching). Upper Arm (shoulder) elevation and abduction are possible adjustments that may apply. Also note the scoring adjustment (-1) possibility that is used if the worker's shoulder is supported or the worker is forward leaning in such a way that gravity assists the shoulder position.

In this example, the shoulder is flexed slightly less than 90 degrees for a score of +3, with an upper arm adjustment (+1) selected for shoulder abduction.

Lower Arm Position:

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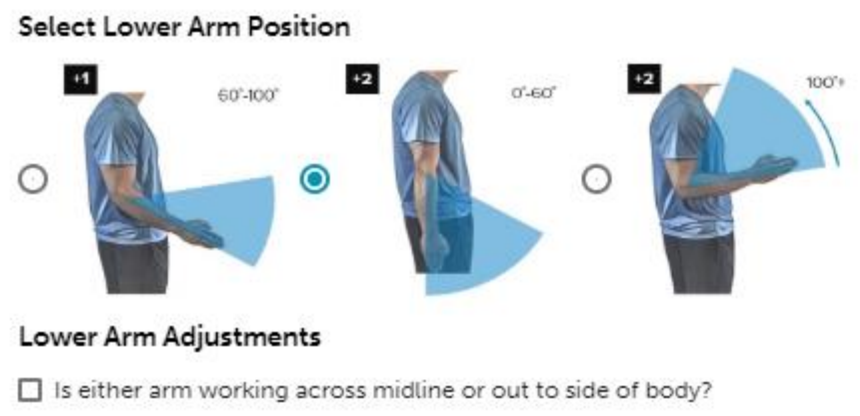


**Select Lower Arm Position**

○ +1 60°-100°
● +2 0°-60°
○ +2 100°+

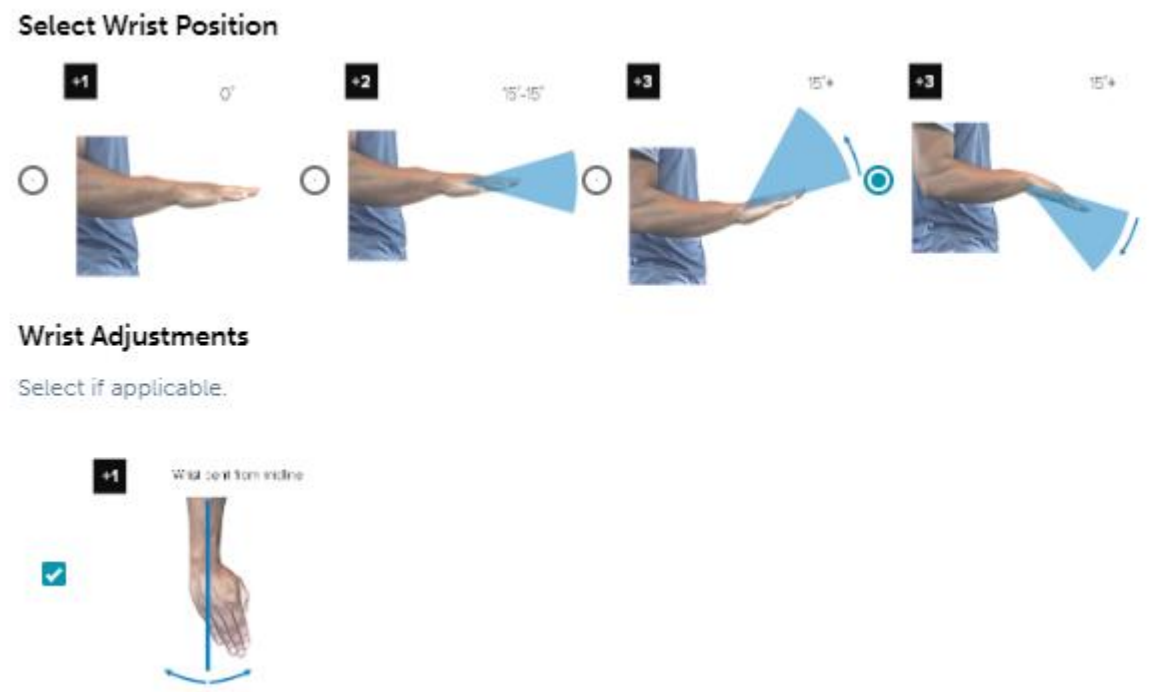
**Lower Arm Adjustments**

☐ Is either arm working across midline or out to side of body?

The lower arm score will be between 1-3. The score is based on the degree of elbow flexion or bending. Select the lower arm adjustment if either lower arm is working across the midline or to the outside of the body.

In this example, the elbow is flexed slightly less than 60 degrees for a score of +2. There is no adjustment for the arm working across the midline.

Wrist Position:



**Select Wrist Position**

○ +1 0°
○ +2 15°-15°
○ +3 15°+
● +3 15°+

**Wrist Adjustments**

Select if applicable.

☑ +1 Wrist bent from midline

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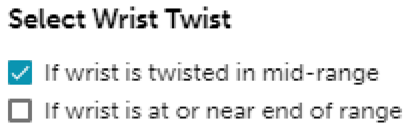
The wrist score will be 1-4. The score is based on the degree of wrist flexion or extension, along with a potential adjustment of +1 if wrist deviation is required. Select wrist twist pronation or supination) if the wrist is twisted in the mid-range of if the wrist is twisted at or near the end of range.

In this example, the wrist is flexed greater than 15 degrees for a score of +3 and the wrist is deviated significantly, so the wrist adjustment (+1) should be selected as shown above.

Wrist Twist:



**Select Wrist Twist**

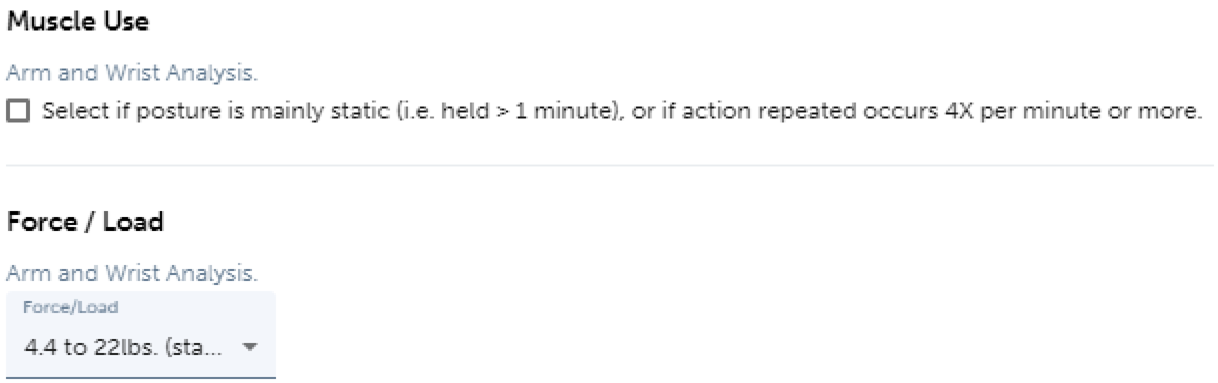
☑ If wrist is twisted in mid-range

☐ If wrist is at or near end of range

Determine and select the degree of wrist twist depending on the degree of forearm pronation or supination. Pronation is defined as rotation of the hand or forearm from a neutral (thumb up) position so that the surface of the palm is facing downward. Typical range of motion for pronation is 80-90 degrees. Supination is defined as rotation of the hand or forearm from a neutral (thumb up or handshake) position so that the surface of the palm is facing upward. Typical range of motion for supination is 70-80 degrees.

In this example, the wrist is twisted in the mid-range.

## (Arm and Wrist) Muscle Use & Force/Load Analysis



**Muscle Use**

Arm and Wrist Analysis.

☐ Select if posture is mainly static (i.e. held > 1 minute), or if action repeated occurs 4X per minute or more.

**Force / Load**

Arm and Wrist Analysis.

Force/Load: 4.4 to 22lbs. (sta...

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The muscle use (arm & wrist) score box will be checked if the posture of the task is mainly static (i.e. held>1 minute), or if action repeated occurs 4X per minute. If neither condition exists, there is no entry made for the muscle use score.

Make one of the following selections for the Load / Force score.

If load < .4.4 lbs. (intermittent) when action occurs < 4x per minute

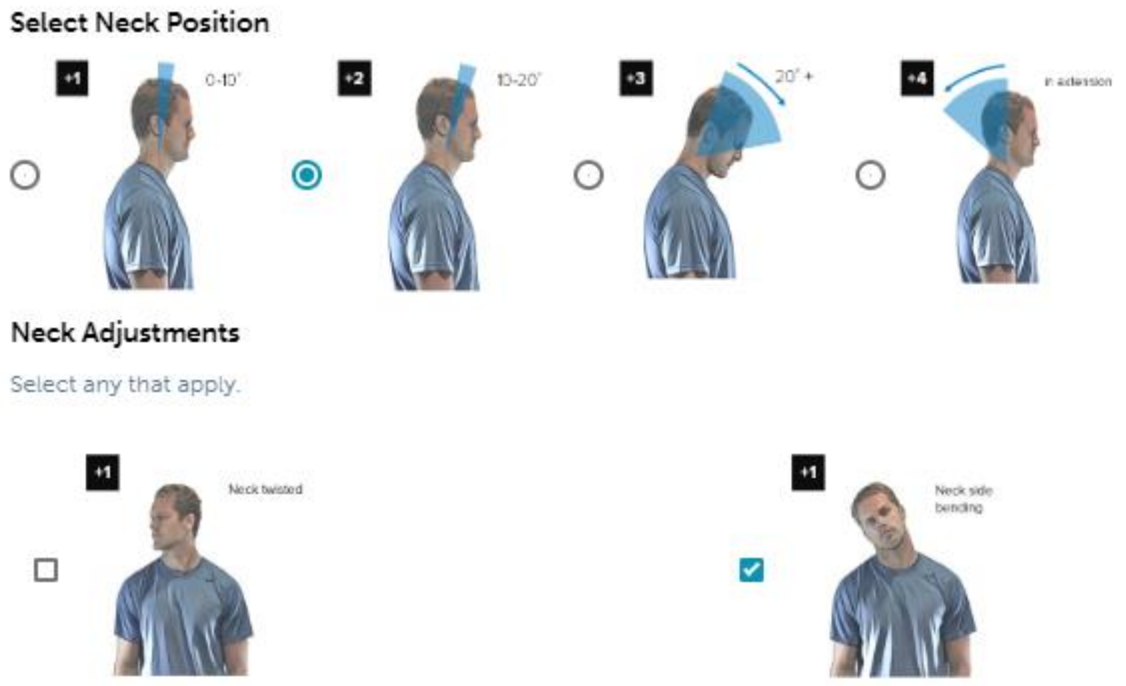
If load 4.4 to 22 lbs. (intermittent) when action occurs < 4x per minute

If load 4.4 to 22 lbs. (static or repeated) when held > 10 minutes, or if action is repeated occurs 4x per minute

If more than 22 lbs. or if repeated or shocks such as hammer use is required

In this example, the muscle use score is 0 and the load weight is between 4.4 – 22 lbs.

## Neck, Trunk, and Leg



Select Neck Position

○ +1 0-10°
● +2 10-20°
○ +3 20° +
○ +4 in extension

Neck Adjustments

Select any that apply.

☐ +1 Neck twisted
☑ +1 Neck side bending

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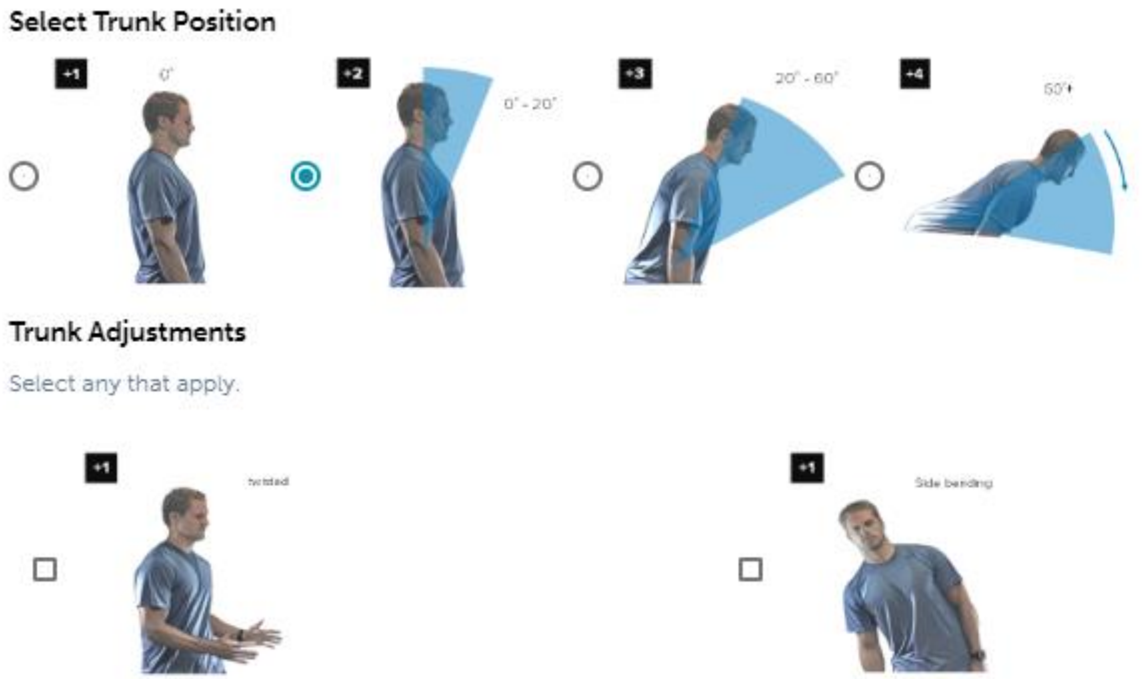
The neck position score will be between 1-6. The score is based on the degree of neck flexion or extension, along with any adjustment for neck twisting or side bending (lateral flexion). Neck flexion is movement of the chin towards the chest from a neutral neck position. Neck extension is moving the chin away from the chest (backwards) from a neutral neck position. Experts in biomechanics use a variety of landmarks and methods to define the neutral position (or the zero point between flexion and extension) of the neck. To keep it really simple, I would define neutral as the posture of the head/neck when the trunk of the body is erect (sitting or standing up straight) and looking at a visual target directly ahead at eye level.

In this example, the neck position was determined to be between 10 – 20 degrees. In addition, side bending of the neck was observed.

Trunk Position:



Select Trunk Position

○ +1 0°

● +2 0° - 20°

○ +3 20° - 60°

○ +4 60°+

Trunk Adjustments

Select any that apply.

☐ +1 twisted

☐ +1 Side bending

The trunk position score will be between 1-6. The score is based on the degree of trunk flexion or extension, along with any adjustment for twisting or side bending (lateral flexion) of the trunk/back. Trunk flexion is defined as anterior (forward) movement of the trunk in the sagittal plane (think toe

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touching). Trunk extension is defined as posterior (backward) movement of the trunk in the sagittal plane (think painting the ceiling).

In this example, the trunk position was observed to be flexed more than nuetral up to 20 degrees. There is no significant trunk twisting or side bending, so the trunk adjustments do not apply and neither box is checked.

Leg Position:

Select Leg Position

● +1 Bilateral weight bearing

○ +2 One leg raised

The leg position score will be 1 or 2. If legs and feet are supported with even weight distribution the score is +1. If the legs and feet are not supported or there is uneven weight distribution, the score is +2.

In this example, the legs and feet are supported and weight is evenly ditributed, therefore the leg score is +1.

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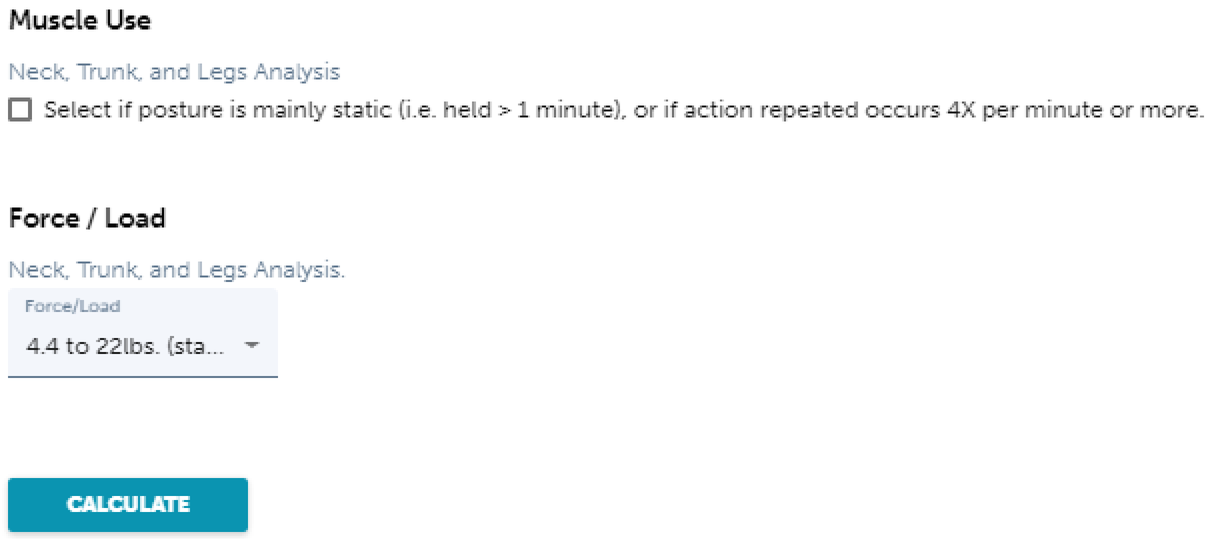
## (Neck, Trunk & Leg) Muscle Use & Force/Load Analysis



**Muscle Use**

Neck, Trunk, and Legs Analysis

☐ Select if posture is mainly static (i.e. held > 1 minute), or if action repeated occurs 4X per minute or more.

**Force / Load**

Neck, Trunk, and Legs Analysis.

Force/Load

4.4 to 22lbs. (sta...

The muscle use (neck, trunk & legs) score box will be checked if the posture of the task is mainly static (i.e. held>1 minute), or if action repeated occurs 4X per minute. If neither condition exists, there is no entry made for the muscle use score.

Make one of the following selections for the Load/Force score for the neck, trunk, & legs.

If load < .4.4 lbs. (intermittent) when action occurs < 4x per minute

If load 4.4 to 22 lbs. (intermittent) when action occurs < 4x per minute

If load 4.4 to 22 lbs. (static or repeated) when held > 10 minutes, or if action is repeated occurs 4x per minute

If more than 22 lbs. or if repeated or shocks such as hammer use is required

In this example, the muscle use score is 0 and the load weight is between 4.4 – 22 lbs.

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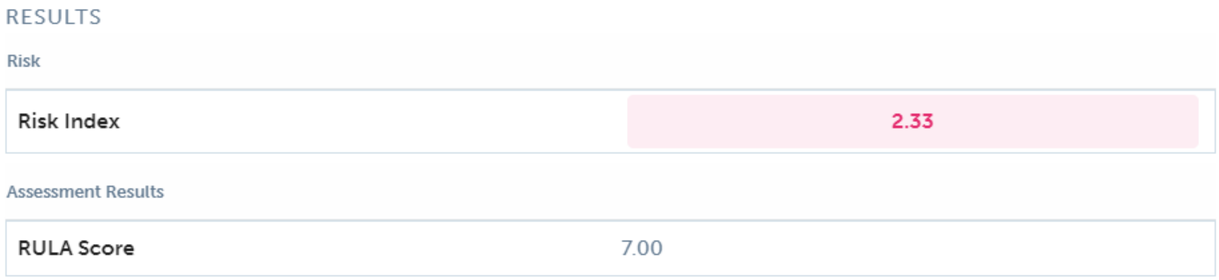
# Calculate Results



RESULTS

Risk

| | |
|---|---|
| Risk Index | 2.33 |

Assessment Results

| | |
|---|---|
| RULA Score | 7.00 |

After all entries are selected, press the calculate button for the results of the assessment. The ErgoPlus RULA calculator will display the overall RULA score and Risk Index. The RULA score represents the level of MSD risk for the job task being evaluated. The minimum RULA Score = 1, and the maximum RULA Score = 7. The design goal for the RULA assessment is a score of 3. The Risk Index answers the question… "How significant is the risk?" A Risk Index value of less than 1.0 indicates a nominal risk to healthy employees. A Risk Index of 1.0 or more denotes that the task is high risk for some fraction of the population. As the Risk Index increases, the level of MSD risk increases correspondingly. Therefore, the goal is to design job tasks to accomplish a Risk Index of 1.0 or lower.

In this example, the final RULA score of 7 and a risk index of 2.33 indicates high risk and calls for further investigation and engineering and/or work method changes to reduce or eliminate MSD risk.

# Implemented Ergonomic Improvements

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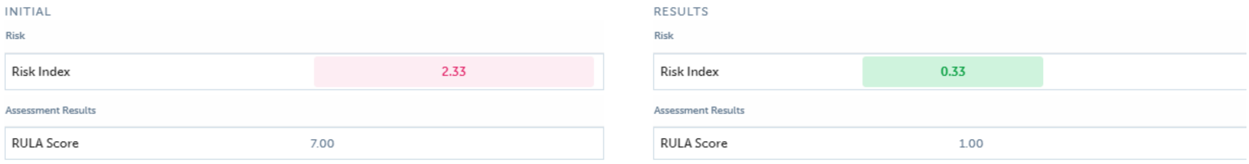
To reduce the level of MSD risk, the assembly process was changed to install the access plate prior to riveting the can together. A fixture was fabricated to hold the can open while the access plate is being installed. A straight or “in-line” pneumatic screwdriver (on a tool balancer) is now used to improve upper extremity work postures and eliminate the force required.



INITIAL

Risk

| | |
|---|---|
| Risk Index | 2.33 |

Assessment Results

| | |
|---|---|
| RULA Score | 7.00 |

RESULTS

Risk

| | |
|---|---|
| Risk Index | 0.33 |

Assessment Results

| | |
|---|---|
| RULA Score | 1.00 |

A follow-up analysis using the ErgoPlus Industrial software RULA calculator was performed upon completion of this ergonomic process and tool improvement. The results are pictured above. When using the new work process and tools, the RULA total score is reduced from 7 to 1 and the risk index is reduced from 2.33 to .33.

## See ErgoPlus Industrial in action

ErgoPlus Industrial is cloud-based ergonomics management software. It empowers you to spend less time hassling with spreadsheets and more time improving your workplace.

With all your ergonomics data in one place, you’ll always have all the information you need to make smart decisions and take proactive actions to reduce risk.

Click here to schedule a personalized demo. An Ergoplus product specialist will show you how leading safety teams are managing ergonomics the smart way.

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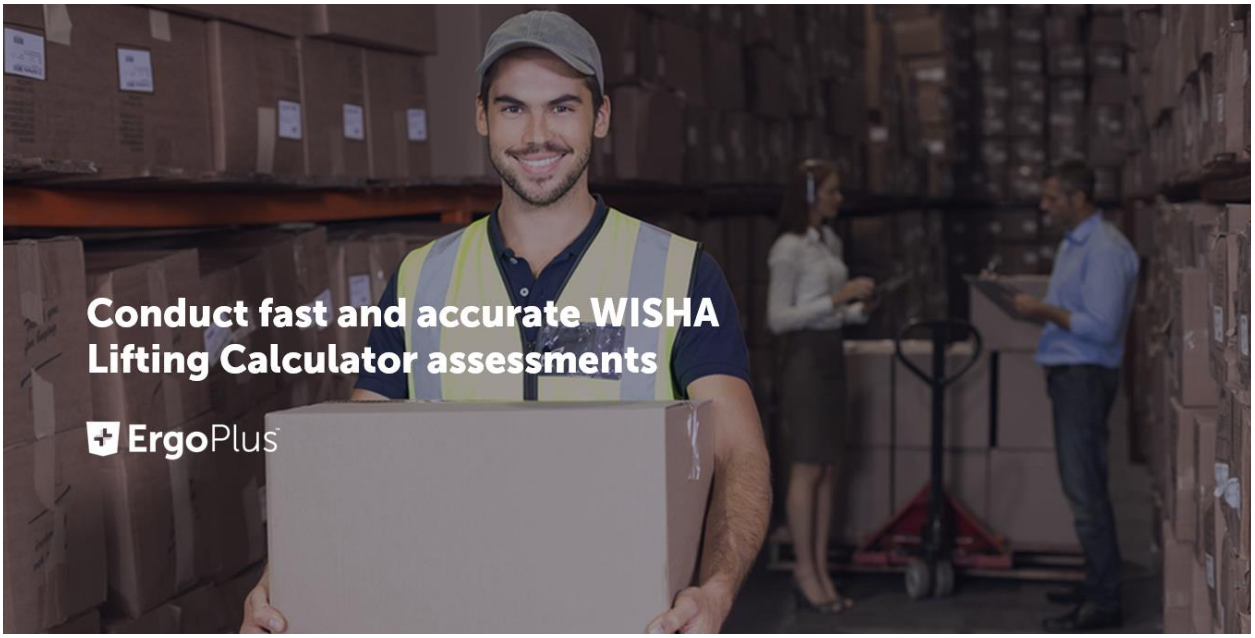
# A Step-by-Step Guide to the WISHA Lifting Calculator



The WISHA Lifting Calculator is a very effective and practical risk assessment tool for manual material handling tasks. Developed by the Washington State Department of Labor and Industries, this lifting calculator is very simple in design and application.

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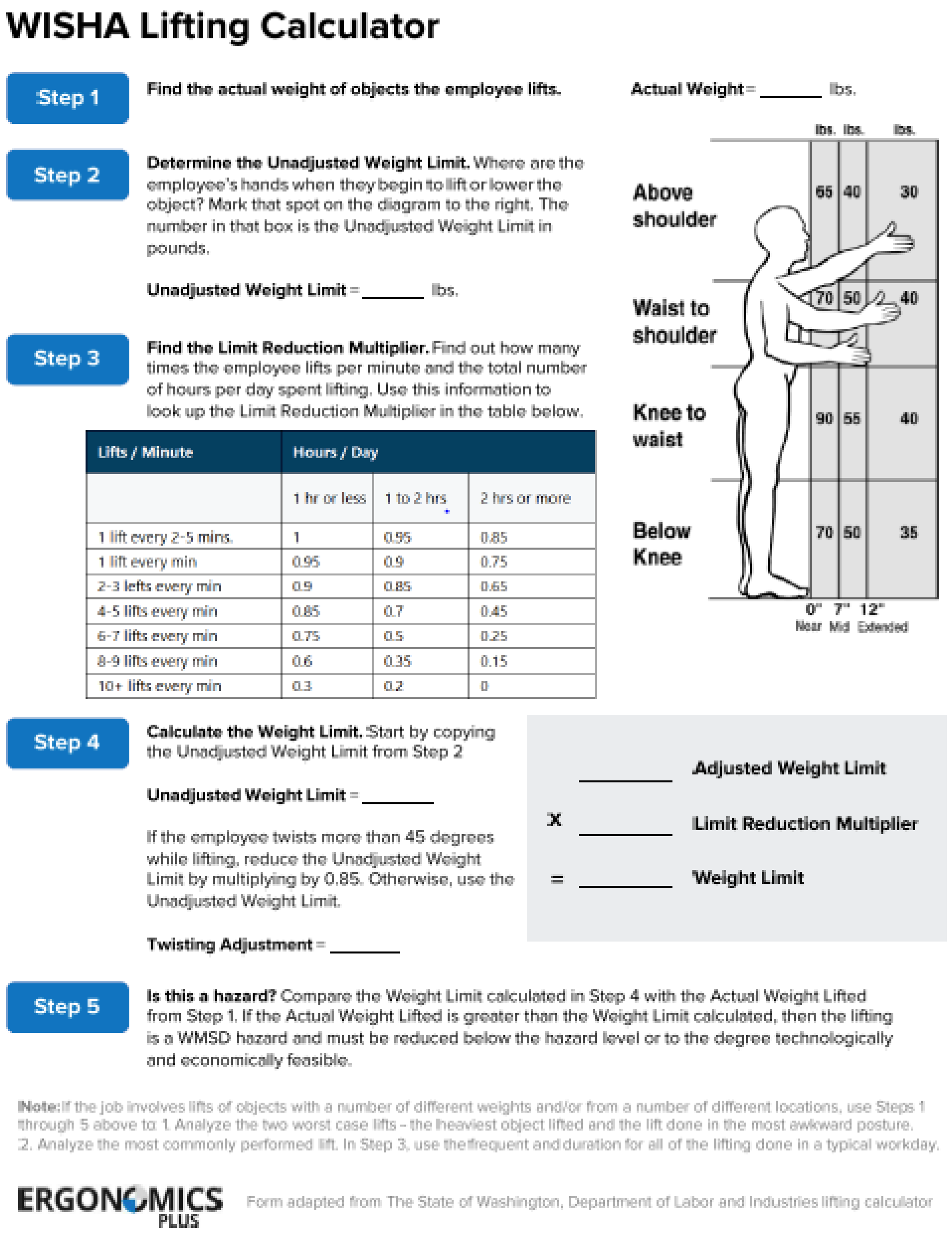

## WISHA Lifting Calculator

**Step 1** **Find the actual weight of objects the employee lifts.**

**Actual Weight** = ______ lbs.

**Step 2** **Determine the Unadjusted Weight Limit.** Where are the employee's hands when they begin to lift or lower the object? Mark that spot on the diagram to the right. The number in that box is the Unadjusted Weight Limit in pounds.

**Unadjusted Weight Limit** = ______ lbs.

| | lbs. | lbs. | lbs. |
|---|---|---|---|
| **Above shoulder** | 65 | 40 | 30 |
| **Waist to shoulder** | 70 | 50 | 40 |
| **Knee to waist** | 90 | 55 | 40 |
| **Below Knee** | 70 | 50 | 35 |
| | 0"<br>Near | 7"<br>Mid | 12"<br>Extended |

**Step 3** **Find the Limit Reduction Multiplier.** Find out how many times the employee lifts per minute and the total number of hours per day spent lifting. Use this information to look up the Limit Reduction Multiplier in the table below.

| Lifts / Minute | Hours / Day | | |
|---|---|---|---|
| | 1 hr or less | 1 to 2 hrs | 2 hrs or more |
| 1 lift every 2-5 mins. | 1 | 0.95 | 0.85 |
| 1 lift every min | 0.95 | 0.9 | 0.75 |
| 2-3 lefts every min | 0.9 | 0.85 | 0.65 |
| 4-5 lifts every min | 0.85 | 0.7 | 0.45 |
| 6-7 lifts every min | 0.75 | 0.5 | 0.25 |
| 8-9 lifts every min | 0.6 | 0.35 | 0.15 |
| 10+ lifts every min | 0.3 | 0.2 | 0 |

**Step 4** **Calculate the Weight Limit.** Start by copying the Unadjusted Weight Limit from Step 2

**Unadjusted Weight Limit** = ________

If the employee twists more than 45 degrees while lifting, reduce the Unadjusted Weight Limit by multiplying by 0.85. Otherwise, use the Unadjusted Weight Limit.

**Twisting Adjustment** = ________

________ **Adjusted Weight Limit**

x ________ **Limit Reduction Multiplier**

= ________ **Weight Limit**

**Step 5** **Is this a hazard?** Compare the Weight Limit calculated in Step 4 with the Actual Weight Lifted from Step 1. If the Actual Weight Lifted is greater than the Weight Limit calculated, then the lifting is a WMSD hazard and must be reduced below the hazard level or to the degree technologically and economically feasible.

**Note:** If the job involves lifts of objects with a number of different weights and/or from a number of different locations, use Steps 1 through 5 above to: 1. Analyze the two worst case lifts – the heaviest object lifted and the lift done in the most awkward posture. 2. Analyze the most commonly performed lift. In Step 3, use the frequent and duration for all of the lifting done in a typical workday.

ERGONOMICS PLUS

Form adapted from The State of Washington, Department of Labor and Industries lifting calculator

The WISHA Lifting Calculator is an adaptation of the Revised NIOSH Lifting Equation (1,2), which is based on scientific research on the primary causes of work-related back injuries. It can be used to perform simple ergonomic risk assessments on a wide variety of manual lifting and lowering tasks and can also be used as a screening tool to identify lifting tasks which should be analyzed further using the more comprehensive NIOSH Lifting Equation.

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The WISHA Lifting calculator has some limitations in that it uses less precise measurement of lifting task variables and does not include the Vertical Distance (D) traveled or Coupling (C) components of the NIOSH Lifting Equation.

WISHA Lifting Calculator Outputs:

Weight Limit: Answers the question… “Is this weight too heavy for the task?”

The primary output of the WISHA Lifting Calculator is the Weight Limit (or Lifting Limit), which defines the maximum acceptable weight (load) that nearly all healthy employees could lift or lower, given the task variables of the lifting task being evaluated, without increasing the risk of lifting related musculoskeletal disorders (MSD).

Lifting Index (LI): Answers the question… “How significant is the risk?”

A Lifting Index (LI) is calculated to provide a relative estimate of the level of physical stress and MSD risk associated with the manual lifting tasks evaluated. A Lifting Index value of 1.0 or less indicates a nominal risk to healthy employees. A Lifting Index greater than 1.0 denotes that the task is high risk for some fraction of the population. As the LI increases, the level of injury risk increases correspondingly. Therefore, the goal is to design all lifting jobs to accomplish an LI of 1.0 or less.

Uses of Weight Limit and Lifting Index:

The Weight Limit and Lifting index can be used to guide or engineer lifting task design in the following ways:

1) The task variables used to calculate the Weight Limit can be analyzed to identify specific weaknesses in the design. For example, lifting with a horizontal reach over 12” or from the floor or above shoulder height significantly increases injury risk.

2) The Lifting Index can be used to estimate the relative injury risk from manual material handling for a certain task or job. The higher the Lifting

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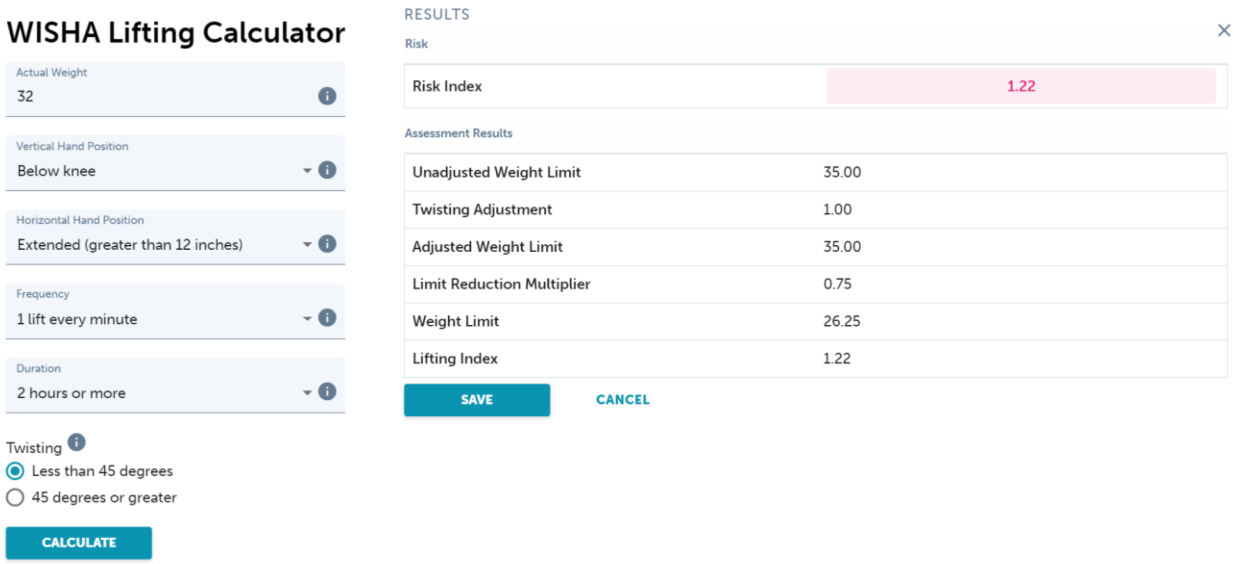
Index, the smaller the percentage of workers capable of safely performing these job demands. Using the Lifting Index, ergonomic risk of two or more job designs can be compared.

3) The Lifting Index can also be used to prioritize ergonomic improvement and redesign efforts. Job task risk can be ranked by the index value and a control strategy can be implemented based on a priority order of individual lifting tasks or jobs.

## ErgoPlus WISHA Lifting Calculator



WISHA Lifting Calculator

Actual Weight: 32

Vertical Hand Position: Below knee

Horizontal Hand Position: Extended (greater than 12 inches)

Frequency: 1 lift every minute

Duration: 2 hours or more

Twisting
● Less than 45 degrees
○ 45 degrees or greater

RESULTS

Risk

| | |
|---|---|
| Risk Index | 1.22 |

Assessment Results

| | |
|---|---|
| Unadjusted Weight Limit | 35.00 |
| Twisting Adjustment | 1.00 |
| Adjusted Weight Limit | 35.00 |
| Limit Reduction Multiplier | 0.75 |
| Weight Limit | 26.25 |
| Lifting Index | 1.22 |

We have developed a cloud-based WISHA Lifting calculator as a part of our ErgoPlus Industrial platform that can be used to efficiently conduct a WISHA Lifting assessment, calculate the score and save your results. The task variables are simply selected or entered into the calculator fields. When the “calculate” button is pressed, the Weight Limit and Lifting Index (or Risk Index) outputs are automatically calculated and can then be saved to your database. You can check out the application here: ErgoPlus Industrial

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# Using the WISHA Calculator

To prepare for the assessment using the WISHA Lifting Calculator, you will first need to gather information about the job, interview supervisors and workers, and observe workers performing lifting and lowering tasks.

Selection of the lifting tasks to be evaluated should be based on the most difficult and demanding lifting or lowering tasks, such as the heaviest objects lifted from the most awkward positions (for example; below knees, above shoulder, and/or farthest reach).

If the job involves lifting of various objects with several different weights and/or from a few different locations, we recommend: 1) Analyze the two worst case lifts—the heaviest object lifted, and the lift performed in the most awkward posture. 2) Analyze the most commonly performed lift, using the frequency and duration for all the lifting done in a typical workday.

## Measure & Enter Task Variables

Task variables needed to calculate the Weight Limit and Lifting Index when using the WISHA Lifting Calculator:

1) Weight

2) Vertical Hand Position

3) Horizontal Hand Position

4) Frequency

5) Duration

6) Twisting

Here are some quick explanations and guidelines that you can use to gather the needed measurements for the WISHA Lifting Calculator:

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1) Weight – Determine the actual Weight of the object being lifted. Often, you can obtain the weight of the load from labeling on the object or from company production or shipping records. If necessary, use the nearest scale in the facility to determine the exact weight of any load being lifted. You will usually be able to find a scale in shipping and receiving departments. If the weight of the load varies significantly, you should obtain the average and maximum weights lifted.

2) Vertical Hand Position – Determine the Vertical Hand Position of the employee's hands relative to the knees, waist, and shoulders of the worker as they begin to lift, lower, or place the object. The Vertical Location has four selection options; 1) Below Knee, 2) Knee to Waist, 3) Waist to Shoulder, or 4) Above Shoulder

3) Horizontal Hand Position – Determine the Horizontal Hand Position by measuring the distance between the point projected on the floor directly below the mid-point of the hands grasping the object (load center), and the mid-point of a line between the toes. Note: This method differs from the NIOSH Lifting Equation, which measures the distance between the mid-point of the hands (or load center) and the mid-point of the inside ankle bones. You will select one of the following three options: 1) 0-7" = Near, 2) 7-12" = Middle, or 3) >12" = Extended

4) Frequency – Determine the average number of lifts per minute of the lifting task being evaluated, this is the lifting frequency. This information can often be verified by asking for average production rates from a group leader, supervisor, or production manager. You can also accomplish this by determining the number of lifts per minute during a short 15-minute sampling or observation period. You will select the closest of the five options given in the calculator.

5) Duration – Determine the lifting duration as classified into one of three categories: 1) 1 hour or less, 2) 1 – 2 hours, or 3) 2 hours or more.

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6) Twisting – Determine the degree to which the body is required to twist or turn during the lifting task. The twisting angle is the amount (in degrees) of trunk and shoulder rotation required by the lifting task. Note: Sometimes the twisting is not caused by the physical aspects of the job design, but rather by the employee using poor body mechanics. If this is the case, no twisting (0 degrees) is required by the job. If twisting is required by the design of the job, determine if theirs is less than 45 degrees or more than 45 degrees. And don't forget to train the workplace athlete to use proper body mechanics to avoid unnecessary twisting!

After task variables are determined, you will simply enter the data into the calculator and push the "Calculate" button for the results of the assessment.

## Example 1 – DC Lifting Task

### Step 1: Determine and Record Task Variables

The workplace athlete lifts and transfers boxes of product in in the shipping department of a distribution center. The variables for this example are as follows:

Weight of Load = 32 pounds

Vertical Hand Position = Below knee

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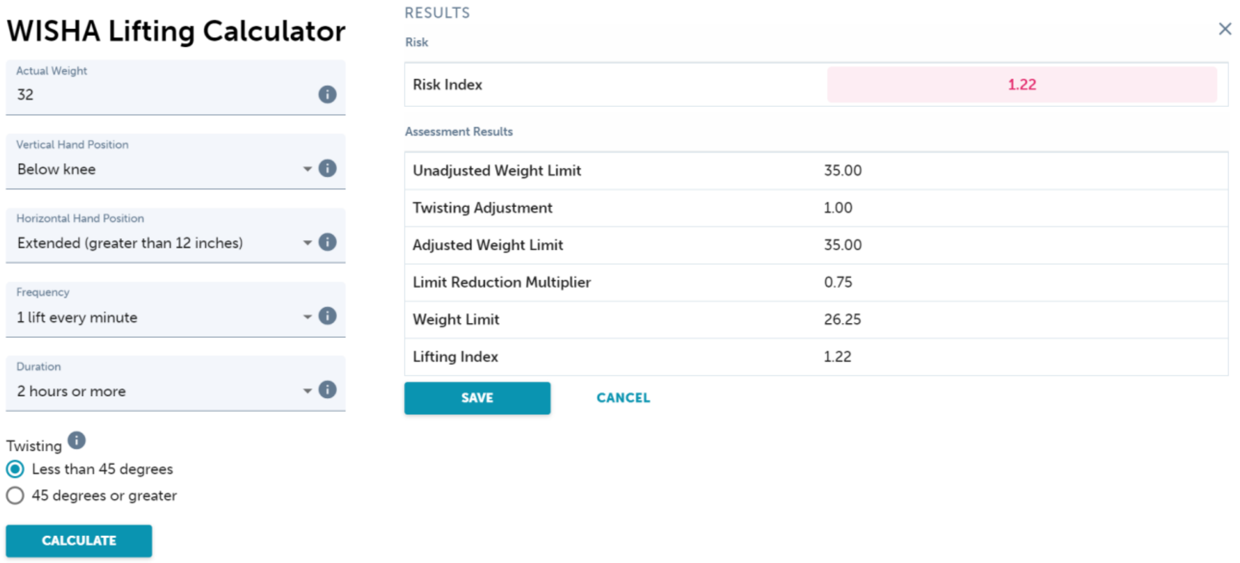
Horizontal Hand Position = Extended (greater than 12”)

Frequency = 1 lift every minute

Duration = 2 hours or more

Twisting = Less than 45 degrees

## Step 2: Calculate Results



### WISHA Lifting Calculator

Actual Weight: 32

Vertical Hand Position: Below knee

Horizontal Hand Position: Extended (greater than 12 inches)

Frequency: 1 lift every minute

Duration: 2 hours or more

Twisting
● Less than 45 degrees
○ 45 degrees or greater

RESULTS

Risk

| | |
|---|---|
| Risk Index | 1.22 |

Assessment Results

| | |
|---|---|
| Unadjusted Weight Limit | 35.00 |
| Twisting Adjustment | 1.00 |
| Adjusted Weight Limit | 35.00 |
| Limit Reduction Multiplier | 0.75 |
| Weight Limit | 26.25 |
| Lifting Index | 1.22 |

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## Example 2 – Parts Rack Stocking

### Step 1: Determine and Record Task Variables

The workplace athlete lifts parts containers to stock an assembly line parts rack. The variables for this example are as follows:

Weight of Load = 43 pounds

Vertical Hand Position = Above shoulder

Horizontal Hand Position = Extended (greater than 12”)

Frequency = 2-3 lifts every minute

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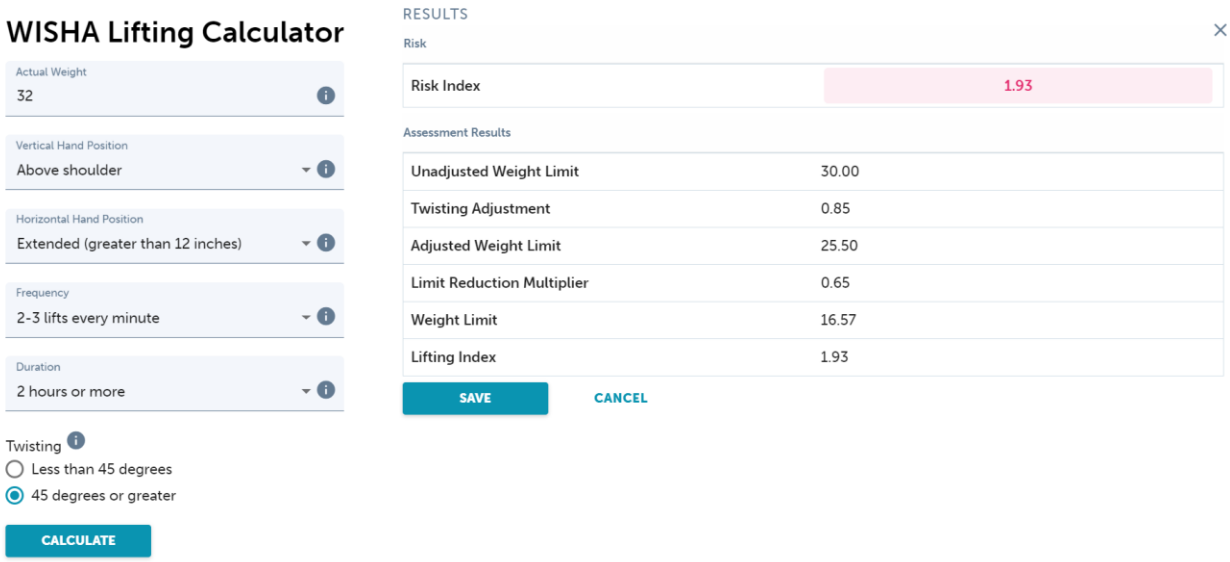
Duration = 2 hours or more

Twisting = Less than 45 degrees

### Step 2: Calculate Results



Actual Weight
32

Vertical Hand Position
Above shoulder

Horizontal Hand Position
Extended (greater than 12 inches)

Frequency
2-3 lifts every minute

Duration
2 hours or more

Twisting
○ Less than 45 degrees
● 45 degrees or greater

Risk

| | |
|---|---|
| Risk Index | 1.93 |

Assessment Results

| | |
|---|---|
| Unadjusted Weight Limit | 30.00 |
| Twisting Adjustment | 0.85 |
| Adjusted Weight Limit | 25.50 |
| Limit Reduction Multiplier | 0.65 |
| Weight Limit | 16.57 |
| Lifting Index | 1.93 |

## See ErgoPlus Industrial in action

ErgoPlus Industrial is cloud-based ergonomics management software. It empowers you to spend less time hassling with spreadsheets and more time improving your workplace.

With all your ergonomics data in one place, you'll always have all the information you need to make smart decisions and take proactive actions to reduce risk.

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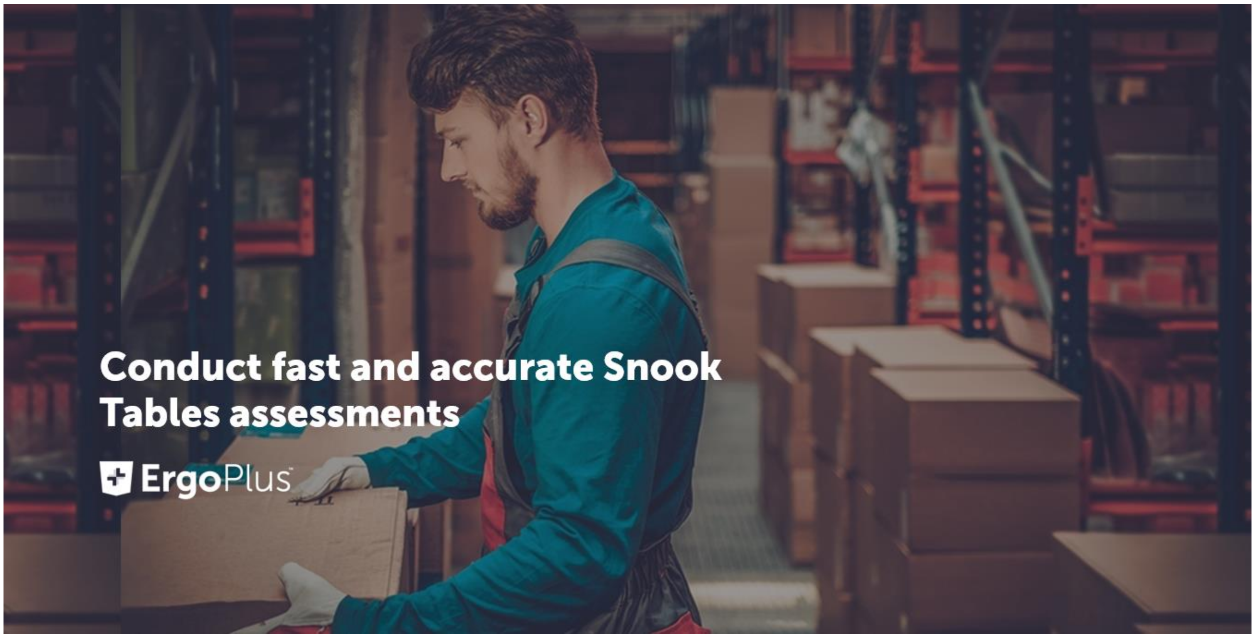
# A Step-by-Step Guide to the Snook Tables



The Liberty Mutual MMH Tables, commonly known as “Snook Tables”, outline maximum acceptable weights and forces for the design of various manual material handling tasks. The Snook Tables are based on research by Dr. Stover Snook and Dr. Vincent Ciriello at the Liberty Mutual Research Institute for Safety. The tables provide design goals, in pounds of weight or force, that are deemed to be acceptable to a defined percentage of the population. This is done by comparing data for each of the specific manual handling tasks against the appropriate table.

The tables have been adapted by Thomas E. Bernard (University of South Florida) with some support from the OSHA Salt Lake Technical Center. This adaptation yields a design goal output for various lifting, lowering, pushing, pulling, and carrying tasks. The ErgoPlus Industrial Snook Tables Calculator is based on Bernard’s adapted tables.

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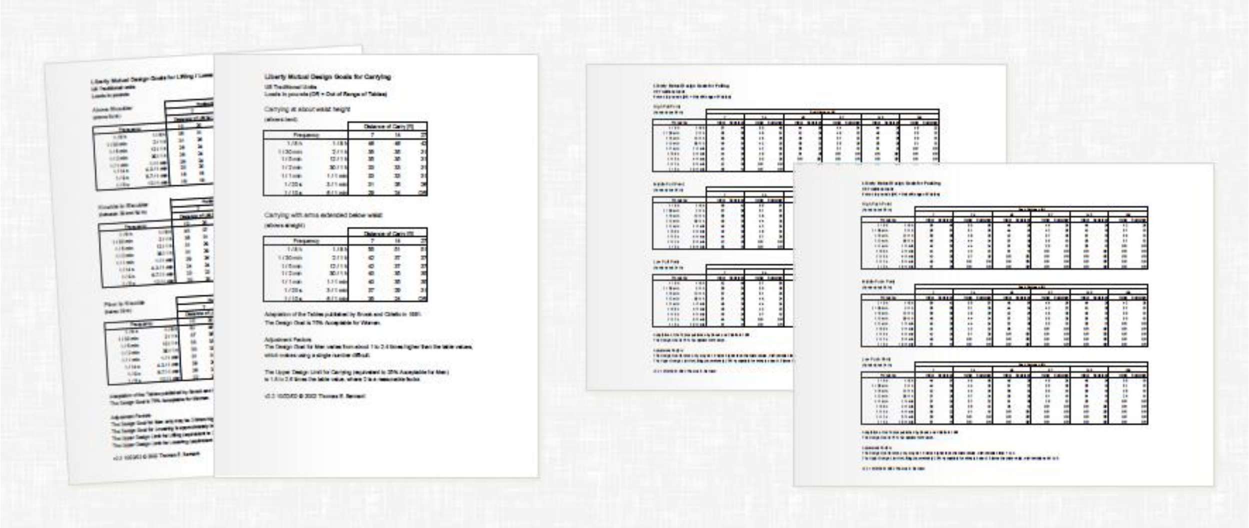
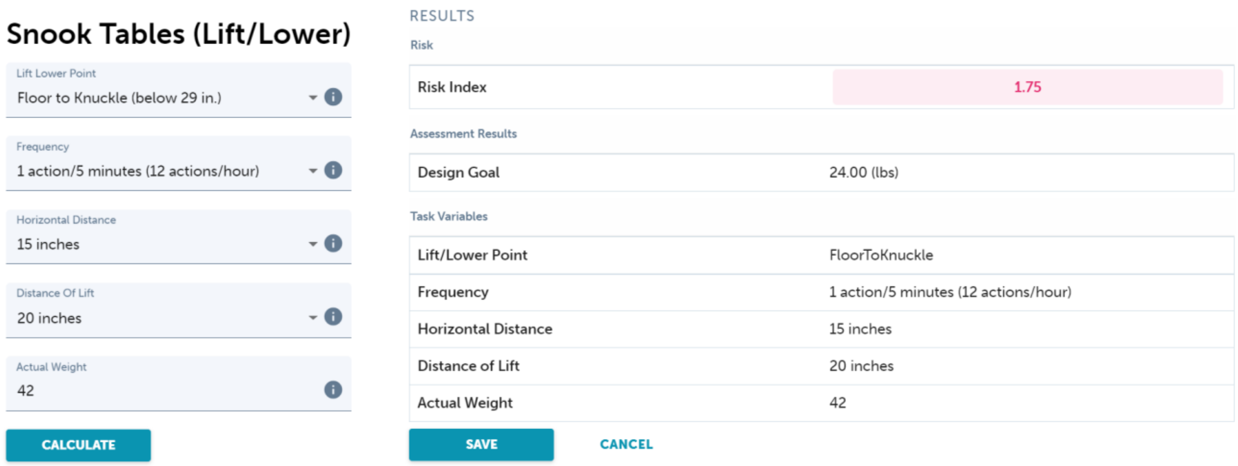


Notes from Thomas E. Bernard on reported values: For design goals, 75% acceptable for women was selected as the appropriate target. In some cases, multipliers (adjustment factors) are provided to adjust to 75% acceptable for males and to an upper limit representing 25% acceptable for men. The format and some content of the tables have been changed from the original. There was also a harmonization of frequencies in the carry, push, and pull tables that required some judgment of what the value should be. In the carry, push and pull tables, OR (out of range) is used for some combinations of frequency and distance that were not in the reported range of results.

## ErgoPlus Snook Tables Calculator



Snook Tables (Lift/Lower)

Lift Lower Point: Floor to Knuckle (below 29 in.)

Frequency: 1 action/5 minutes (12 actions/hour)

Horizontal Distance: 15 inches

Distance Of Lift: 20 inches

Actual Weight: 42

RESULTS

Risk

| | |
|---|---|
| Risk Index | 1.75 |

Assessment Results

| | |
|---|---|
| Design Goal | 24.00 (lbs) |

Task Variables

| | |
|---|---|
| Lift/Lower Point | FloorToKnuckle |
| Frequency | 1 action/5 minutes (12 actions/hour) |
| Horizontal Distance | 15 inches |
| Distance of Lift | 20 inches |
| Actual Weight | 42 |

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We have developed a cloud-based REBA calculator as a part of our ErgoPlus Industrial platform that is based on Thomas Bernard's adapted tables that can be used to efficiently determine the design goal for the task being evaluated. After task variables are collected, you will simply select from each drop-down menu for each variable. The ErgoPlus Industrial Snook Tables calculator is shown above and you can also check out the application here: ErgoPlus Industrial

Snook Tables Calculator Outputs

The Design Goal is the primary output of the Snook Tables Calculator. The Design Goal answers the question… "Is this weight or force too heavy or forceful for this task?" If the actual weight or force exceeds the design goal, risk reduction controls should be implemented.

A Risk Index is also calculated to provide a relative estimate of the level of physical stress and MSD risk associated with the tasks evaluated.

Risk Index = Actual Weight/Force Requirement ÷ Snook Tables Design Limit

Answers the question… "How significant is the risk?"

A Risk Index value of 1.0 or less indicates a nominal risk to healthy employees. A Risk Index greater than 1.0 denotes that the task is high risk for some fraction of the population. As the LI increases, the level of injury risk increases correspondingly. Therefore, the goal is to design all lifting jobs to accomplish an LI of 1.0 or less.

## Using the Snook Tables

To prepare for the assessment using the Snook Tables, you will first need to gather information about the job, interview supervisors and workers, and observe workers performing required manual material handling tasks. Select the tasks to be evaluated based on the most difficult and demanding lifting, lowering, carrying, pushing, or pulling tasks. For example, when evaluating lifting tasks, select tasks with the heaviest objects lifted from the most awkward positions (below knees, above shoulder, and/or farthest

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reach); and when evaluating pushing and pulling tasks, select the most forceful task requirements or from low or high push pull points.

## Task Variables

Task variables needed to conduct assessments using the Snook Tables:

- Weight of Object
- Force Requirement
- Lift/Lower Distance
- Hand Distance (Horizontal Hand Position)
- Hand Height
- Push/Pull/Carry Distance
- Frequency
- Lifting/Lowering Zone

Select the tasks to be evaluated based on the most difficult and demanding lifting, lowering, carrying, pushing, or pulling tasks. For example, when evaluating lifting tasks, select tasks with the heaviest objects lifted from the most awkward positions (below knees, above shoulder, and/or farthest reach); and when evaluating pushing and pulling tasks, select the most forceful task requirements or from low or high push pull points.

For each job task analyzed, the evaluator will need to collect relevant data. Measurements and data required for assessments using the Snook Tables include the following:

**Weight:** The weight of the object being lifted, lowered, or carried.

**Force:** For each pushing and pulling task evaluated, you will need to measure the amount of force required to get the item moving (initial force) and then measure the amount of force it takes to keep the item moving (sustained force).

**Lift/Lower Distance:** The distance of travel of the hands while lift or lower taking place.

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**Hand Distance (Horizontal Hand Position):** The distance from the front of the body to the hands. This will normally be half the width of the object being handled unless the object is purposely held away from the body. If the load is lifted away from the body, use the NIOSH Equation technique for determining the horizontal location of the lift.

**Hand Height:** The vertical height of the hands on the object being pushed or pulled, or the height of the hands when carrying a load.

**Push/Pull/Carry Distance:** The distance the item being handled is pushed or pulled, or carried.

**Frequency:** The number of lifts, lowers, pushes, pulls or carries expressed in terms of number of activities done in ‘x’ seconds, minutes, or hours (as outlined in tables and our calculator input fields).

**Lift/lower zone:** The area of the body in which the lift/lower starts and finishes respectively. Take note of the position of the hands when the worker has completed the lift/lower (floor to knuckle, knuckle to shoulders, or shoulder to overhead reach)

When the task specific data does not match the values in the calculator, select the next highest table value that is closest to the actual task requirements. By selecting the next highest value for any of the specific criteria, a more conservative or protective assessment will result.

## Multiple Tasks

Many jobs require a wide variety of manual handling tasks (lifting, lowering, pushing, pulling, and/or carrying) which can be assessed as a whole using the Snook Tables. This can be done by comparing data for each of the specific manual handling tasks against the appropriate table, and then using the total frequency for all the tasks as the frequency value to determine the percentage of the population that would find the task to be acceptable.

For example, if a job requires lifting at a rate of one lift every two minutes, a push every five minutes and a carry every five minutes, the worker would do four and a half ‘tasks’ over five minutes, or approximately one task per

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minute. The evaluator can then compare the data for the lift, carry and push, against the appropriate table but use the same frequency (one per minute) for each to determine a result.

When a mixture of males and females are doing the task, the task should be designed so that it is acceptable to at least 75% of the female population, which would make it acceptable to more than 90% of the male population. Any task that cannot be performed by at least 75% of the total population should be considered for MSD prevention controls and redesign.

## Example 1: Above Shoulder Lift

### Step 1: Determine and Record Task Variables

Variables determined by the assessment:

Lift Lower Point – Above Shoulder (above 54”)

Frequency – 1 action every 5 minutes (12 actions per hour)

Horizontal Distance – 10” (front of body to mid-line of hands)

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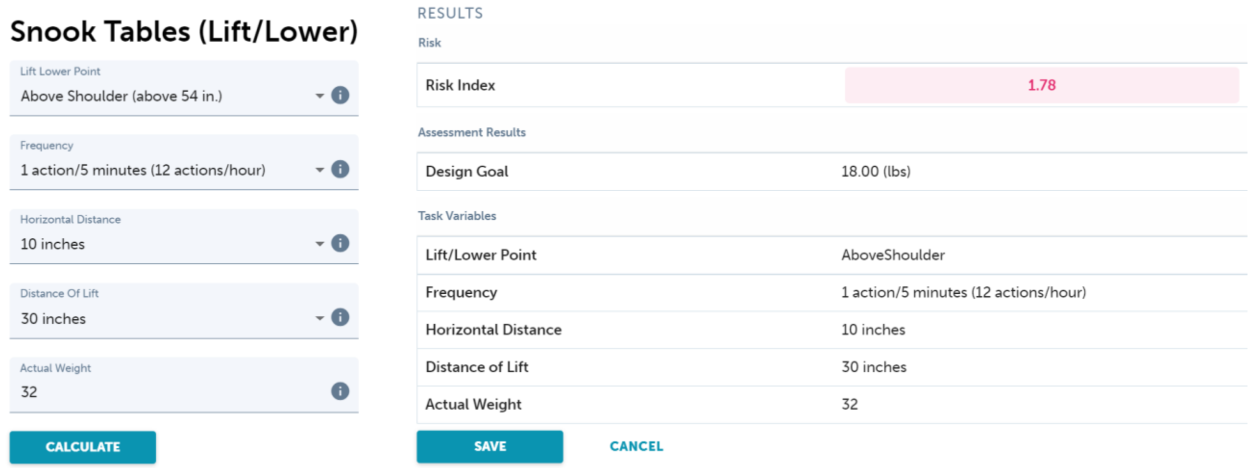
Distance of Lift – 30” (lifts from cart at 25” to rack height of 55”)

Actual Weight – 32 pounds

### Step 2: Calculate Results



Snook Tables (Lift/Lower)

Lift Lower Point: Above Shoulder (above 54 in.)

Frequency: 1 action/5 minutes (12 actions/hour)

Horizontal Distance: 10 inches

Distance Of Lift: 30 inches

Actual Weight: 32

RESULTS

Risk

| | |
|---|---|
| Risk Index | 1.78 |

Assessment Results

| | |
|---|---|
| Design Goal | 18.00 (lbs) |

Task Variables

| | |
|---|---|
| Lift/Lower Point | AboveShoulder |
| Frequency | 1 action/5 minutes (12 actions/hour) |
| Horizontal Distance | 10 inches |
| Distance of Lift | 30 inches |
| Actual Weight | 32 |

## Example 2: Below Knee Lift

### Step 1: Determine and Record Task Variables

Variables determined by the assessment:

Lift Lower Point – Floor to Knuckle (below 29”)

Frequency – 1 action every 2 minutes (30 actions per hour)

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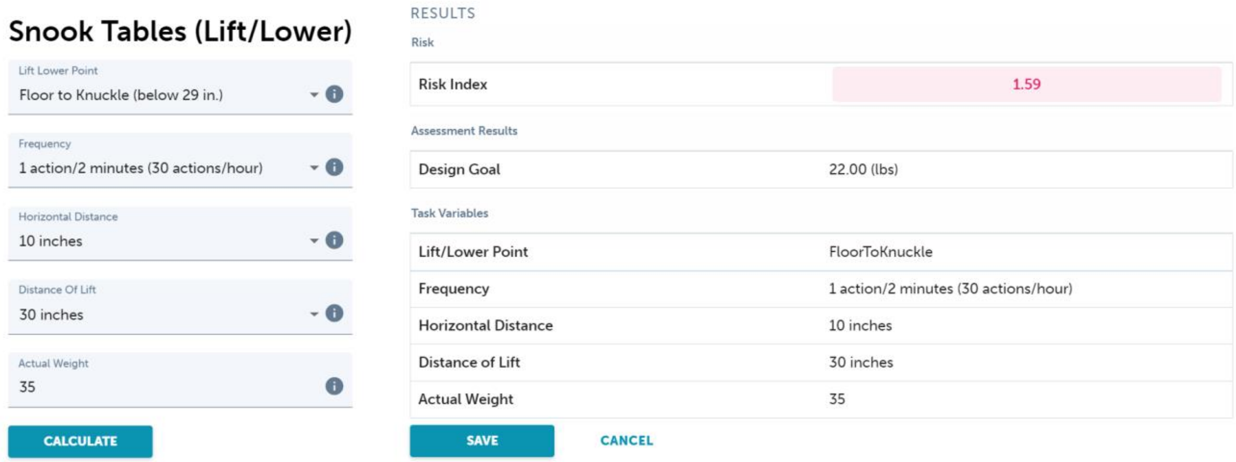
Horizontal Distance – 10” (front of body to mid-line of hands)

Distance of Lift – 30” (lifts from cart at 25” to rack height of 55”)

Actual Weight – 35 pounds

## Step 2: Calculate Results



### Snook Tables (Lift/Lower)

Lift Lower Point: Floor to Knuckle (below 29 in.)

Frequency: 1 action/2 minutes (30 actions/hour)

Horizontal Distance: 10 inches

Distance Of Lift: 30 inches

Actual Weight: 35

RESULTS

Risk

| | |
|---|---|
| Risk Index | 1.59 |

Assessment Results

| | |
|---|---|
| Design Goal | 22.00 (lbs) |

Task Variables

| | |
|---|---|
| Lift/Lower Point | FloorToKnuckle |
| Frequency | 1 action/2 minutes (30 actions/hour) |
| Horizontal Distance | 10 inches |
| Distance of Lift | 30 inches |
| Actual Weight | 35 |

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## Example 3: Carry

### Step 1: Determine and Record Task Variables

Variables determined by the assessment:

Carry Point – Waist Height

Frequency – 1 carry/2 minutes (30 carries per hour)

Carry Distance – 27’ (front of body to mid-line of hands)

Actual Weight – 52 pounds

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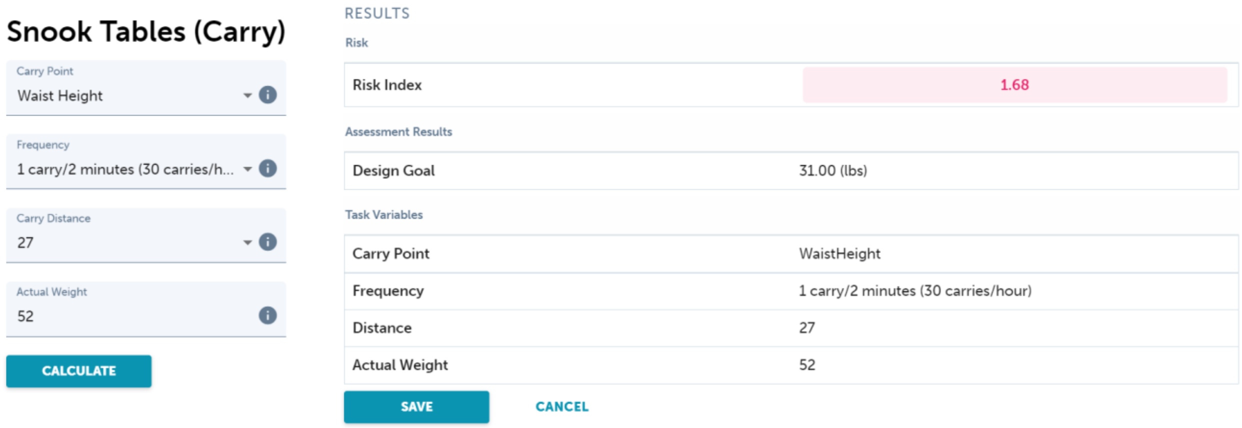
## Step 2: Calculate Results



Snook Tables (Carry)

Carry Point: Waist Height

Frequency: 1 carry/2 minutes (30 carries/h...

Carry Distance: 27

Actual Weight: 52

RESULTS

Risk

| | |
|---|---|
| Risk Index | 1.68 |

Assessment Results

| | |
|---|---|
| Design Goal | 31.00 (lbs) |

Task Variables

| | |
|---|---|
| Carry Point | WaistHeight |
| Frequency | 1 carry/2 minutes (30 carries/hour) |
| Distance | 27 |
| Actual Weight | 52 |

# Example 4: Pulling

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## Step 1: Determine and Record Task Variables

Variables determined by the assessment:

Pull Point – Low (Hands about 24”)

Frequency – 1 Pull/2 minutes (30 per hour)

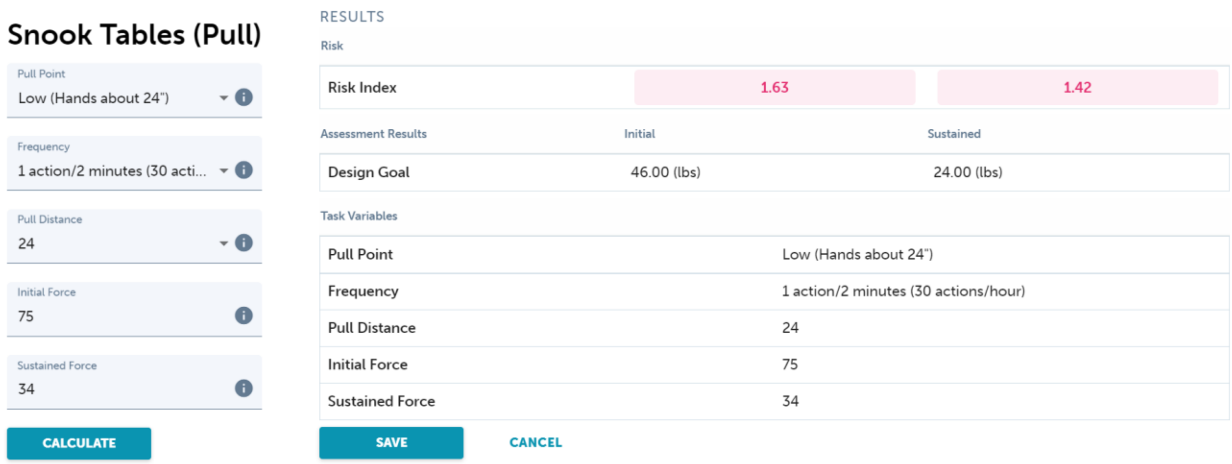
Pull Distance – 24’

Initial Force – 75 pounds*

Sustained Force – 34 pounds*

*A calibrated mechanical or an electronic digital force measurement dynamometer is needed to determine the forces required for pushing and pulling tasks. See our Snook Training Guide for detailed guidance.

## Step 2: Calculate Results



**Snook Tables (Pull)**

Pull Point: Low (Hands about 24")

Frequency: 1 action/2 minutes (30 acti...

Pull Distance: 24

Initial Force: 75

Sustained Force: 34

RESULTS

Risk

|  |  |  |
|---|---|---|
| Risk Index | 1.63 | 1.42 |

| Assessment Results | Initial | Sustained |
|---|---|---|
| Design Goal | 46.00 (lbs) | 24.00 (lbs) |

Task Variables

|  |  |
|---|---|
| Pull Point | Low (Hands about 24") |
| Frequency | 1 action/2 minutes (30 actions/hour) |
| Pull Distance | 24 |
| Initial Force | 75 |
| Sustained Force | 34 |

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## Example 5: Pushing

### Step 1: Determine and Record Task Variables

Variables determined by the assessment:

Push Point – Middle (Hands about 36”)

Frequency – 1 Push/5 minutes (12 per hour)

Push Distance – 97’

Initial Force – 24 pounds*

Sustained Force – 15 pounds*

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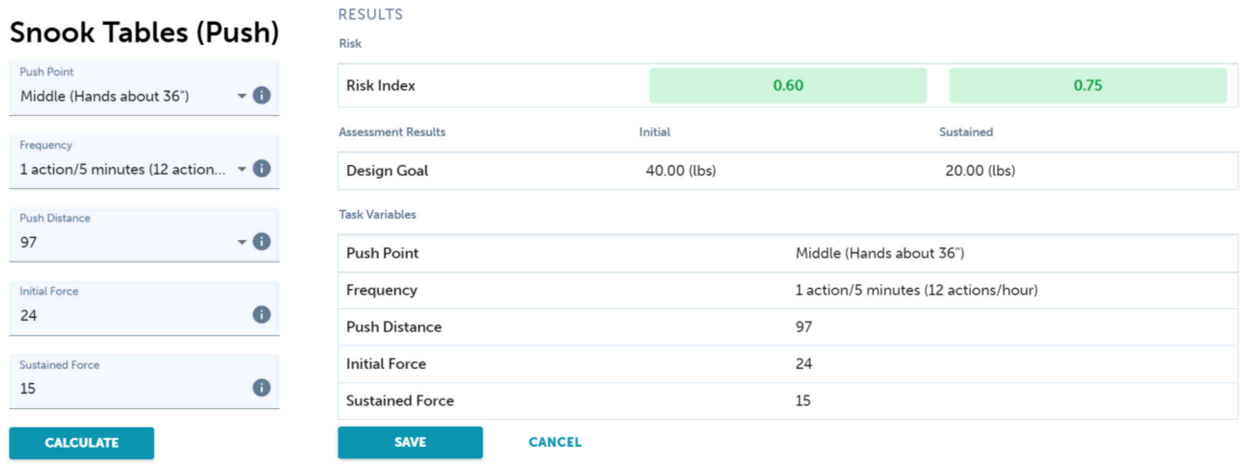
*A calibrated mechanical or an electronic digital force measurement dynamometer is needed to determine the forces required for pushing and pulling tasks. See our Snook Training Guide for detailed guidance.

### Step 2: Calculate Results



Snook Tables (Push)

Push Point: Middle (Hands about 36")

Frequency: 1 action/5 minutes (12 action...

Push Distance: 97

Initial Force: 24

Sustained Force: 15

RESULTS

Risk

| | | |
|---|---|---|
| Risk Index | 0.60 | 0.75 |

| Assessment Results | Initial | Sustained |
|---|---|---|
| Design Goal | 40.00 (lbs) | 20.00 (lbs) |

Task Variables

| | |
|---|---|
| Push Point | Middle (Hands about 36") |
| Frequency | 1 action/5 minutes (12 actions/hour) |
| Push Distance | 97 |
| Initial Force | 24 |
| Sustained Force | 15 |

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