Human Factors
in Accident Prevention

People / Environment / Work
Force / Frequency / Posture

Advanced Course

WISHA Lifting Calculator

How to Evaluate Lifting Tasks Using the WISHA Lifting Calculator

ERGONOMICS PLUS
FPST-3213

WISHA

- Weight Limit
  - Answers, "Is this weight too heavy for the task?"

- Lifting Index
  - Answers, "How significant is the risk?"

FPST-3213   3

1.1 WISHA Lifting Calculator Outputs

- Lifting Index
  - Answers, "How significant is the risk?"
  - lifting Index= Weight of Object/Weight Limit
  - 1.0 - 1.5 = Potential Risk
  - > 1.5 Significant Risk
  - The goal is to design a job task with a lifting Index of < 1.0

FPST-3213   4

3.2 Determine Unadjusted Weight Limit

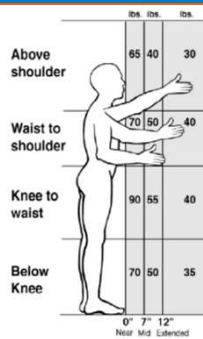**Unadjusted Weight Limit**
1. Horizontal Location
2. Vertical Location

Ergo-Plus.com

FPST-3213   6

3.3   Horizontal Location

Ergo-Plus.com

FPST-3213   7

3.3   Horizontal Location

Mid-point of hands grasping the object (load center):

Ergo-Plus.com

FPST-3213   8

3.3   Horizontal Location

Ergo-Plus.com

FPST-3213   9

3.4   Vertical Location
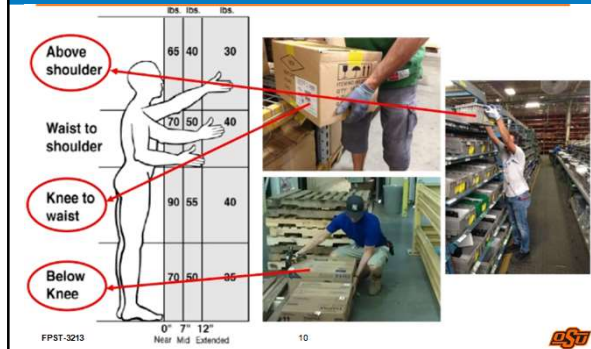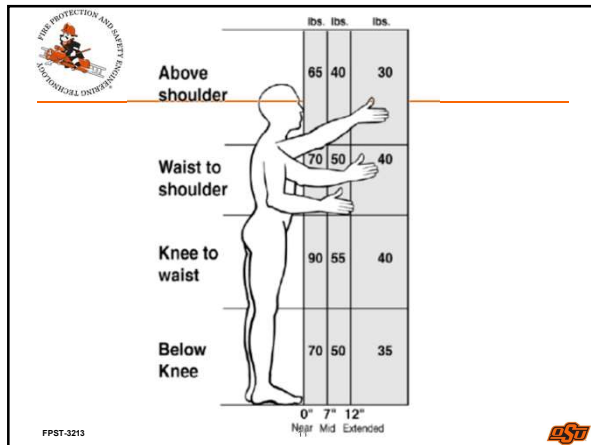
3.6   Limit Reduction Modifier

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 lifts 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

Ergo-Plus.com

FPST-3213

3.7 Twisting Adjustment

Twisting - 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

Ergo-Plus.com

FPST-3213   13

Example 1 Warehouse Picking

Origin
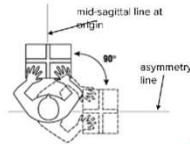
Destination
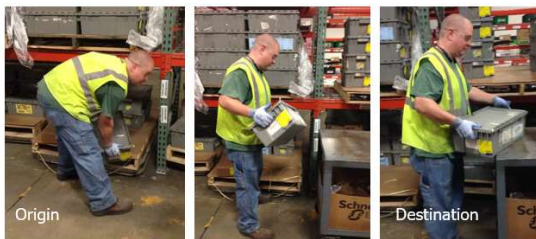
FPST-3213   14

Example 1 Warehouse Picking

- Determine & Record Task measurements:
  - The Horizontal Location (H) of the hands is 12.5" 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.
  - Vertical Location (V) is 42" at the destination, therefore the Travel Distance (D) is 30".
  - The Asymmetric Angle (A) is 50 degrees at the origin.
  - The container is of optimal design with handholds; therefore coupling is defined as "good".
  - 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.

FPST-3213   15

Lifting Calculator

Company _____ Evaluator _____
Job _____ Date _____

1 Enter the weight of the object lifted. — Weight Lifted ____ lbs.

2 Circle the number on a rectangle below that corresponds to the position of the person's hands when they begin to lift or lower the objects.

	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" 7" 12"
Near Mid Extended

3 Circle the number that corresponds to the times the person lifts per minute and the total number of hours per day spent lifting.

Note: For lifting done less than once every five minutes, use 1.0

How many lifts per minute?	How many hours per day?		
	1 hr or less	1 hr to 2 hrs	2 hrs or more
1 lift every 2-5 min	1.0	0.95	0.85
1 lift every min	0.95	0.9	0.75
2-3 lifts 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	0.0

4 Circle 0.85 if the person twists 45 degrees or more while lifting.   0.85
Otherwise circle   1.0

5 Copy below the numbers you have circled in steps 2, 3, and 4.

lbs.	X		X		=	Lifting Limit
		Step 2		Step 3	Step 4	____ lbs.

6 Is the Weight Lifted (1) less than the Lifting Limit (5)   Yes – OK   No – HAZARD

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 3 above to:
1. Analyze the 2 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 frequency and duration for all the lifting done in a typical workday.

FPST-3213

WISHA

"Is this weight too heavy for the task?"

"How significant is the risk?"

*What can we do?*

FPST-3213   17

WISHA vs. NIOSH

WISHA Task variables
- Weight of Object
- H=Horizontal Location (Horizontal Hand Position)
- V=Vertical Location (Vertical Hand Position)
- A = Asymmetry angle or twisting requirement
- F= Frequency and duration of Lifting

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

Ergo-Plus.com

FPST-3213   18

WISHA vs. NIOSH

- The results of 2015 study highlighted a fair correlation between these two assessment methods
- The WISHA index is a simpler and easier method, but the assessment model of NIOSH equation is more comprehensive and probably produces more reliable and valid results

Naeimeh Asadi, Alireza Choobineh, Sareh Keshavarzi, Hadi Daneshmandi (2015). A Comparative Assessment of Manual Load Lifting Using NIOSH Equation and WISHA Index Methods in Industrial Workers of Shiraz City. J Health Sci Surveillance Sys January 2015; Vol 3; No 1

FPST-3213   19

Conclusion

- The greater the LI, the smaller the fraction of workers capable of safely sustaining the level of activity. Thus, two or more job designs could be compared.
- The LI can also help prioritize ergonomic redesign. The equation does have limitations, however. It only addresses two-handed lifts, for instance.

FPST-3213   20

Conclusion

- Material handling tasks should be designed to minimize the weight, range of motion and frequency of the activity, and using the equation allows you to get closer to optimal from the beginning
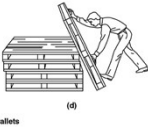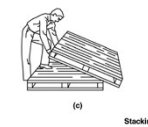
FPST-3213   21

Special Considerations

Manual handling of pallets

(a) (b)
Unstacking Pallets

(c) (d)
Stacking Pallets

FPST-3213   22

Drum Handling

Drum dolly

https://www.youtube.com/watch?v=_0BBViyDbDk

FPST-3213   23

Drum Handling

Drum dolly

WESCO

https://www.youtube.com/watch?v=2jYBOUzOIyc

FPST-3213   24

Drum Handling

Overhead hoist

https://www.youtube.com/watch?v=6VF-leJ8dCg

FPST-3213　　　　25

Drum Handling

Overhead hoist

https://www.youtube.com/watch?v=hTFUh9P1nlU

FPST-3213　　　　26

Drum Handling

Forklift drum grabber

https://www.youtube.com/watch?v=uNKVdoAyOWg

FPST-3213　　　　27

Pail and Drum Pouring

FPST-3213   28

Bag Handling

https://www.youtube.com/watch?v=ZOTE5zU_uzY

1:15-2:35

FPST-3213   29

Large-Size Sheet or Wallboard Handling

FINISH SIDE

PANEL LIFTER

FPST-3213   30

Large-Size Sheet or Wallboard Handling

FPST-3213   31

Custom Lifting Devices and Custom Lifting Tools

https://www.youtube.com/watch?v=fyK2Mw_ho10

FPST-3213   32

NIOSH Lifting Equation

Practice Problems

FPST-3213   33

Step 1. Gather Tools

- Data Collection Sheet, Pen, Clipboard
- Camera (video or photo)
- Tape Measure
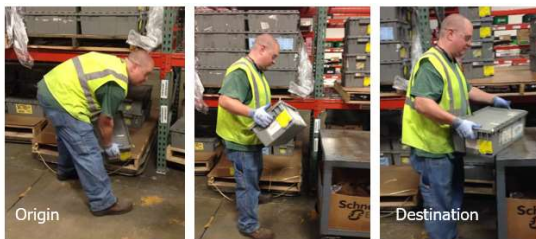- 70" string with 2 small washers
- Goniometer
- Scale
- PPE

FPST-3213　　　　34

Example 1 Warehouse Picking

Origin

Destination

FPST-3213　　　　35

Example 1 Warehouse Picking

- Determine & Record Task measurements:
  - The Horizontal Location (H) of the hands is 12.5" 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.
  - 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".
  - 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.

FPST-3213　　　　36

Example 1 Warehouse Picking

- Determine & Record Task measurements:
  - H = 12.5" at the origin
  - V = 12" at the origin and 42" at the destination D=30"
  - A = 30° at the origin
  - C = good - container is of optimal design with handhold cutouts)
  - 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)

FPST-3213   37

Step 2. Determine Task Variables

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

H	V	D	A	F	C

HM	VM	DM	AM	FM	CM

FPST-3213   38

NIOSH Lifting Equation

"Is this weight too heavy for the task?"

"How significant is the risk?"

What can we do?

FPST-3213   39

Significant Control

- Significant control is a condition of the task that requires precision placement of the load at the destination of the lift.

- For example, when an object is fragile and careful placement is needed to protect the object from damage.

- Or, the worker needs to change grip or hold or guide the object at the lifting or lowering destination

Destination

FPST-3213   40

Example 1 Machine Fixture Lifting

- The machine operator is required to lift a heavy tool fixture during the set-up process.
- Significant control of the object is required at the destination, so task variables will need to be determined at both the origin and destination.

Origin   Destination

FPST-3213   41

Example 1 Machine Fixture Lifting

- Significant Control Lift"? - yes
- H = 10" at the origin, 19" at destination
- V = 38" at the origin and 50" at the destination D = 12"
- A= 0° at the origin and destination
- C = 3 (poor -an irregular object that requires a pinch grip and is hard to handle) F =<.2 lifts/minute (1 lift every 2 minutes)
- L = 26.5 lb. average load and 26.5 lb. maximum load
- Dur= Short (Frequency (F) is < 0.2 and duration is less than 1 hour)

Origin   Destination
H = 10"   H = 19"
V = 38"   V = 50"
A = 0°   D = 30"

FPST-3213   42

Step 2. Determine Task Variables

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

	Load	H	V	D	A	F	C
origin							
destination							

	HM	VM	DM	AM	FM	CM
origin						
destination						

FPST-3213　43

NIOSH Lifting Equation

"Is this weight too heavy for the task?"

"How significant is the risk?"

What can we do?

FPST-3213　44