VALENT BIOSCIENCES CORPORATION

Ergonomics Training Manuals

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Ergosystems

1.	**Ergonomics Principles, Foundations and Analysis**
2.	**A Practical Approach to Office Ergonomics**
3.	**Power Lift and Body Mechanics**
4.	**Personal Physical Performance**
5.	**Situational Awareness for a Healthy and Safe Place to Work**

Ergonomics

Foundations, Principles and Analysis

Workshop developed
and presented by
Mark A. Anderson, MA, PT, CPE
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Ergonomics

Principles, Foundations and Analysis

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Version ES02232015

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Mark A. Anderson is the president and founder of ErgoSystems Consulting Group, Inc., a Minneapolis, Minnesota based ergonomics consulting group.

ErgoSystems has provided ergonomics consulting and training services since 1997.

Anderson is board certified as a professional ergonomist by the Board of Certification in Professional Ergonomics. His background also includes licensure as a physical therapist. He has consulted in ergonomics for over 20 years.

Anderson has developed and implemented ergonomics strategies for a wide range of companies and organizations. (Tennant Company, General Electric, Emerson Process Management – Rosemount Division, TESCOM – Emerson Process Management, Medtronic, St. Jude Medical, DSI, Marvin Windows, ATK, Quaker Oats, Pepsi-Cola, General Mills, Fingerhut, Bluestem Brands, Inc., Boston Scientific Corporation, Bureau of Engraving and Printing, Panama Canal Commission, United States Navy and Marine Corps, United States Customs Service and state and local governments.)

With an emphasis on a systems approach to ergonomics, Anderson has worked with architectural and engineering design firms to integrate ergonomics principles into the design process. Adding the elements of ergonomics (including Work Physiology, Engineering Psychology, Epidemiology, Anthropometry and Occupational Biomechanics) as part of the design equation enhances the effectiveness of the overall process and final outcome.

He has written a number of publications and spoken nationally and internationally on ergonomics. He has been active in the Upper Midwest Chapter of the Human Factors and Ergonomics Society serving as the past President, Secretary and Co-program Chair.

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SETTING THE STAGE

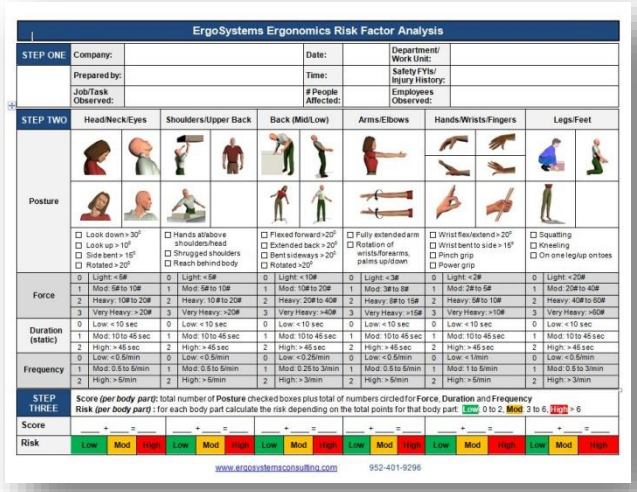
Course Content and Objectives

Ergonomics: Principles, Foundations and Analysis offers a framework to **perform ergonomics analyses** and **generate reasonable and feasible recommendations**.

Ergonomics Analysis Process

You will learn how to use an ergonomics process to identify ergonomics risk factors and develop reasonable and feasible recommendations to improve health, safety and productivity.

The ergonomics analysis process is based on a fundamental knowledge of ergonomics principles and applications.



ErgoSystems Ergonomics Risk Factor Analysis

STEP ONE						
	Company:		Date:		Department/ Work Unit:	
	Prepared by:		Time:		Safety FYIs/ Injury History:	
	Job/Task Observed:		# People Affected:		Employees Observed:	

STEP TWO	Head/Neck/Eyes	Shoulders/Upper Back	Back (Mid/Low)	Arms/Elbows	Hands/Wrists/Fingers	Legs/Feet
Posture	☐ Look down > 30° ☐ Look up > 10° ☐ Side bent > 15° ☐ Rotated > 20°	☐ Hands at/above shoulders/head ☐ Shrugged shoulders ☐ Reach behind body	☐ Flexed forward > 20° ☐ Extended back > 20° ☐ Bent sideways > 20° ☐ Rotated > 20°	☐ Fully extended arm ☐ Rotation of wrists/forearms, palms up/down	☐ Wrist flex/extend > 20° ☐ Wrist bent to side > 15° ☐ Pinch grip ☐ Power grip	☐ Squatting ☐ Kneeling ☐ On one leg/up on toes
Force	0 Light: < 5#	0 Light: < 5#	0 Light: < 10#	0 Light: < 3#	0 Light: < 2#	0 Light: < 20#
	1 Mod: 5# to 10#	1 Mod: 5# to 10#	1 Mod: 10# to 20#	1 Mod: 3# to 8#	1 Mod: 2# to 5#	1 Mod: 20# to 40#
	2 Heavy: 10# to 20#	2 Heavy: 10# to 20#	2 Heavy: 20# to 40#	2 Heavy: 5# to 15#	2 Heavy: 5# to 10#	2 Heavy: 40# to 60#
	3 Very Heavy: > 20#	3 Very Heavy: >20#	3 Very Heavy: >40#	3 Very Heavy: >15#	3 Very Heavy: >10#	3 Very Heavy: >60#
Duration (static)	0 Low: < 10 sec	0 Low: < 10 sec	0 Low: < 10 sec	0 Low: < 10 sec	0 Low: < 10 sec	0 Low: < 10 sec
	1 Mod: 10 to 45 sec	1 Mod: 10 to 45 sec	1 Mod: 10 to 45 sec	1 Mod: 10 to 45 sec	1 Mod: 10 to 45 sec	1 Mod: 10 to 45 sec
	2 High: > 45 sec	2 High: > 45 sec	2 High: > 45 sec	2 High: > 45 sec	2 High: > 45 sec	2 High: > 45 sec
Frequency	0 Low: < 0.5/min	0 Low: < 0.5/min	0 Low: < 0.25/min	0 Low: < 0.5/min	0 Low: < 1/min	0 Low: < 0.5/min
	1 Mod: 0.5 to 5/min	1 Mod: 0.5 to 5/min	1 Mod: 0.25 to 3/min	1 Mod: 0.5 to 5/min	1 Mod: 1 to 5/min	1 Mod: 0.5 to 3/min
	2 High: > 5/min	2 High: > 5/min	2 High: > 3/min	2 High: > 5/min	2 High: > 5/min	2 High: > 3/min

STEP THREE: **Score** *(per body part)*: total number of **Posture** checked boxes plus total of numbers circled for **Force**, **Duration** and **Frequency**
Risk *(per body part)*: for each body part calculate the risk depending on the total points for that body part: Low: 0 to 2, Mod: 3 to 6, High: > 6

	Head/Neck/Eyes	Shoulders/Upper Back	Back (Mid/Low)	Arms/Elbows	Hands/Wrists/Fingers	Legs/Feet
Score	___ + ___ = ___	___ + ___ = ___	___ + ___ = ___	___ + ___ = ___	___ + ___ = ___	___ + ___ = ___
Risk	Low Mod High	Low Mod High	Low Mod High	Low Mod High	Low Mod High	Low Mod High

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Ergonomics Principles and Foundations

We will define a set of **Ergonomics Principles and Foundations.** The principles can be applied to any ergonomics analysis. The foundations provide objective rationale to support the principles.

Ergonomics Analysis and Problem Solving

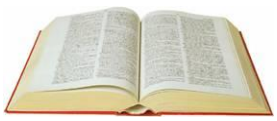
Next we delve into **ergonomics analysis and problem solving** with a look at problem solving principles and the components of an ergonomics 'Tool Box'. The Tool Box includes a list of recommended equipment, materials and forms to conduct and document the analysis.

Resources

Also included is a list of ergonomics related resources and references.

FIRST OF ALL . . . WHAT IS ERGONOMICS?

Definition of Ergonomics



The word '***ergonomics'*** was coined by a Polish scholar in 1857. In Greek 'ergon' means work and 'nomos' means the laws or study of. So, ergonomics is literally the ***"the laws or study of work."***

What is ergonomics and how can it make a difference?

Ergonomics and Gravity

Ergonomics is like throwing a ball into the air.

What happens?

Correct!

The ball comes back down.

Why?

Gravity works!

In fact, if it didn't come back down, we would be quite surprised! As we understand the laws of gravity, when we stand on the face of the earth and throw a ball into the air, it will come back down. In other words the **CIRCUMSTANCES DICTATE THE REPONSE.**

Now, imagine we **DON'T** want the ball to come back down. What do we need to do? How about throw the ball up and just tell it to stay in the air . . .

BALL - STAY UP!!

Everyone will agree this is **LUDRICOUS**. You can't get a ball to stay in the air just by telling it to.

Rather you need to change something . . . attach Velcro to it, throw it into a net, attach it to a string, launch yourself into outer space . . . you get the picture!

How does this relate to what ergonomics is all about?

Circumstances predict the response!

Well, rather than throw a ball into the air, let's say you bend over to assemble a component at a low level. The body position most likely used is to just bend over at the waist.

From a health and safety, as well as productivity standpoint, we recognize this work position can cause problems. But unfortunately it is a commonly observed work position.

How about this for a solution - whenever we see someone in this poor position we tactfully tap them on the shoulder and say,

'When you are in that bad position, be really, really, really careful you don't hurt yourself!'

That makes about as much sense as telling the ball to,

'Just stay in the air!'

A much better solution is to. . .

CHANGE THE CIRCUMSTANCES TO CHANGE THE RESPONSE!

We could reposition either the assembler or the work – for example use a rolling stool.

What are some other options?

1. _____
2. _____
3. _____

Given a certain set of circumstances, we will typically respond in a predictable way.

If we want to change the RESPONSE . . .
We need to change the CIRCUMSTANCES!

ERGONOMICS . . .

The optimization of all aspects of job performance - *safety, quality and productivity* - accomplished through the appropriate *design and use* of work stations, work processes and the overall organization of work.

Why does Ergonomics Work?

Ergonomics works because it:

- Uses strategies to identify and solve problems.
- Is design based; it addresses the true root cause not just the symptoms.
- Is cost-effective; it incorporates an incremental approach to interventions.
- Makes use of the best ergonomists in the world . . . people who actually do the work!

ERGONOMICS PRINCIPLES AND FOUNDATIONS

Based on our discussion we will develop a general set of **Ergonomics Principles**. Here is a summary of the Ergonomics Principles and Risk Level Index.

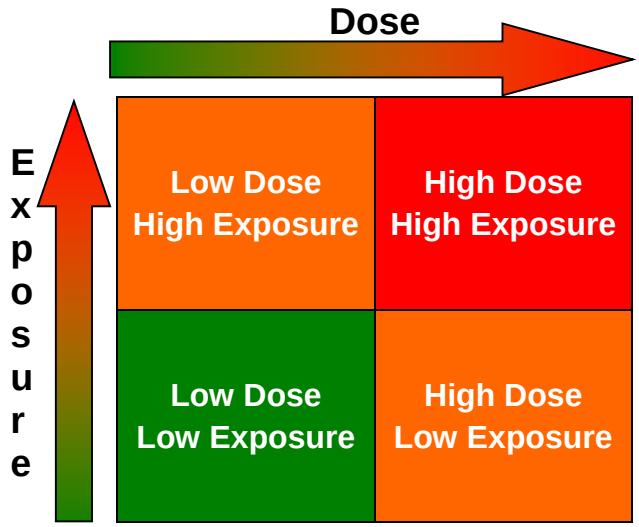
Ergonomics Principles

1. **PROCESS** – Promote effective work processes
2. **POSITION/SUPPORT** – Promote neutral body and limb position/support
3. **MOVEMENT** – Promote regular physical movement
4. **MATERIAL HANDLING** – Control manual material handling
5. **REACH** – Promote work in reach zone
6. **WORKSTATION/TOOLS/EQUIPMENT** – Provide correct workstation, tools and equipment
7. **TRAINING** – Provide competency based training
8. **ENVIRONMENT** – Control exposure to work environment
9. **HEALTH/WELLNESS** – Promote personal health and wellness
10. **FEEDBACK** – Provide on-going feedback for continuous improvement

Risk Level Index

The key establishes the **Risk Level Index** in terms of ergonomics issues (health, safety and productivity): **NOTE**: Ranking may be subject to change based on additional input.

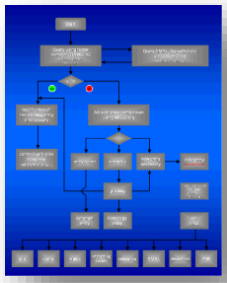
- LOW considered **low** risk with low priority to change.
- MOD considered **moderate** risk, recommend modification as feasible.
- HIGH considered **high** risk, recommend concerted effort to modify.



Risk Level Index takes into account Dose (severity/stress level of the ergonomics risk factors) in combination with Exposure (duration/frequency of the ergonomics risk factors).

The higher the values for Dose and Exposure the greater the estimated risk.

Promote Effective Work Processes



The overarching principle of ergonomics focuses on promoting the effectiveness of the work process itself. This principle is a wide ranging one that addresses the work process in total.

The goal is to take a step back and really examine why something is done as it is. If the answer is . . .

"***Because it has always been done that way!***"

It may be worth the effort to take a fresh look. Is there a better way to get it done?

What we see day after day becomes common place to use. We simply don't pay attention anymore. We can't see the forest because of the trees.

Recall we defined ergonomics as:

> **The optimization of all aspects of job performance - *safety, quality and productivity* - accomplished through the appropriate *design and use* of work stations, work processes and the overall organization of work.**

By optimizing job performance we have a dramatic impact on the effectiveness of the work. While buzz words come and go:

- Lean
- Continuous Process Improvement
- Value Stream Mapping
- Kaizen Events
- Six Sigma
- 5S+1

Work Process Design Checklist

"YES" response indicates potential problem area that should receive further investigation.

Is the task complex?			
1. Does worker have to evaluate data before taking action?	YES	NO	NA
2. Must operator sense and respond to information signals occurring simultaneously from different machines without sufficient time to do so?	YES	NO	NA
3. Must operator process information at rate that might exceed capability?	YES	NO	NA
4. Is job so complex it takes a long time to train workers?	YES	NO	NA
5. Does task require a great deal of accuracy?	YES	NO	NA
6. Does work situation require monitoring several machines?	YES	NO	NA
Is the task monotonous?			
7. Does the worker repeat same task without change for entire shift?	YES	NO	NA
8. Does the worker lose track of task at hand because it is overly monotonous?	YES	NO	NA
Design and Use Standards			
9. Are controls standardized on similar equipment?	YES	NO	NA
10. Does design of any instrument increase reading errors? (Dials and instruments difficult to read quickly and accurately)	YES	NO	NA
11. Are controls difficult to reach and operate?	YES	NO	NA
12. When all readings are correct, do pointers in a group of dials point in different directions?	YES	NO	NA
13. Are dials grouped inconveniently?	YES	NO	NA
14. Is dial too complex for level of information required?	YES	NO	NA
15. Is it difficult to see immediately how a control is set?	YES	NO	NA
16. Does reading instruments require a lot of head or body movement?	YES	NO	NA
17. Does worker's hand obstruct dial when operating controls?	YES	NO	NA
18. Is there a need to tell difference between parts by touch?	YES	NO	NA
19. Is it difficult to recognize controls and tools by touch and/or position?	YES	NO	NA
20. Does the task require fine visual judgments? (Includes need to detect small defects, judging distances accurately)	YES	NO	NA
21. Are controls, instruments and equipment placed where they are difficult to see?	YES	NO	NA
22. Are warning lights located out of center of field of vision?	YES	NO	NA
Training (Technical and Safety)			
23. Is the workforce inadequately trained in the technical aspects of the job process and demands?	YES	NO	NA
24. Is the workforce inadequately trained in the safe performance of the job tasks?	YES	NO	NA
25. Is the workforce inadequately trained in methods (breaks, stretching, and warm-up activities) to control job fatigue	YES	NO	NA

Promote Neutral Position and Support

The next principle is to position and support the body and limbs in neutral.

Neutral Position

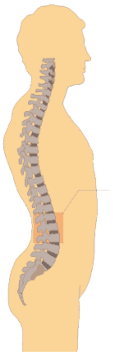
One way to think about the neutral position is to consider what really is the foundation of the body?

Is it the feet? Consider if you sprain an ankle . . . by using a pair of crutches you can still get around.

On the other hand what if you "sprain" your back? You might know someone who's been in this condition – they have a significant problem even getting out of bed to get to the bathroom.

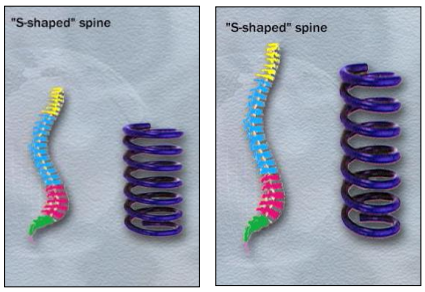
The foundation or core of the body truly is the spine and pelvis. This directly relates to the position of the body in general and to posture in specific. With the spine and pelvis in a good position this allows us to make good use of our legs and arms.

Spine neutral position



What is the neutral spine position?

A neutral spine is in an S-shape: inward curves in the low back and neck; outward curve in the midback.



The advantage is that the spring like shape is able to better deal with compression and shear stresses in the spine.

Benefits:

- Decreased biomechanical strain
- Increased respiratory function
- Improved range of motion

Arm/hand neutral position

What is neutral for the arms and hands? Neutral is the midrange of joint position. For the arms/hands this is with the shoulders relaxed, elbows at the sides flexed to about 90 degrees and the hands positioned with the thumbs pointing up.

Can you position yourself 100% of your time in neutral?

*Of course the answer is **NO**!*

But how about 15%?

In many situations it is very feasible to significantly improve the situation to increase neutral position and support by about 15%.

15% more time in neutral with good support can significantly decrease the level of stress into the body's tissue, enhance performance and increase comfort levels.

We encourage you to become a charter member of the 15% Club!

Support for Body Weight and Limbs in the Neutral Position

Seated

With the body and limbs positioned in neutral the second part of the principle is to provide suitable support for the weight of the body and limbs.

Inadequate and improper seated support creates problems. People sit on their legs on the chair. They cross their legs for extended times.

Compression of the soft tissues occurs with a decrease in blood flow and circulation. Proper seated support is critical.

In fact even well supported seated posture becomes uncomfortable quite quickly. How long do you sit in one position before your body gives you a signal to move?

Limbs

Proper support for the limbs (for example, chair armrests) removes the strain of weight bearing and also unloads the neck, shoulders and back.

Hold your arms half way out in front of you. How long can you do it before you experience discomfort and fatigue?

Standing

Unsupported standing for extended periods is not desired.

Joint compression occurs, actually decreasing the amount of joint space and not allowing adequate joint lubrication. Fluid tends to pool in the lower extremities.

The bottom line . . . it is tiring!

In fact as individuals we try very hard to eliminate sustained unsupported standing.

Look at people standing in a line. What do you see them do to obtain relief?

Promote Dynamic Physical Movement

This ergonomics principle promotes dynamic physical movement in the workplace on an on-going basis.

Stand or Walk?

Most people have carried a backpack at some point. Picture this scenario - you are with a group of friends going for an extended hike; your backpack weighs 50# and you have put it on your shoulders.

What would you rather do: stand in one place for the next 20 minutes OR take that same backpack and start to walk for a few miles?

To a person, everyone agrees that it is much better to walk – not to stand. We intuitively know that movement is superior to maintaining one position. In other words, we need to move to be comfortable.

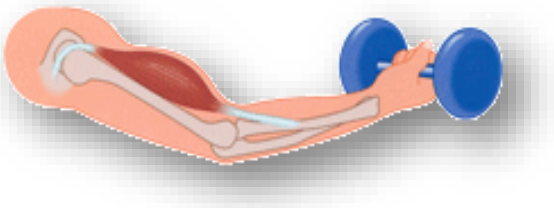
That is what this ergonomics principle is all about and there are sound physiological reasons why this is the case.

Metabolism (Work Physiology)

To accomplish work, the body is able to take in nutrients, convert them into chemical energy and then ultimately into mechanical energy (e.g., muscular contraction) and heat. This is called metabolism.

Glucose and oxygen are stored in relatively small amounts within the muscle tissue. Consequently, to sustain performance continuous flow of oxygen and energy-rich blood into the tissue in addition to removal of metabolic waste products is required.

Static Muscle Contraction



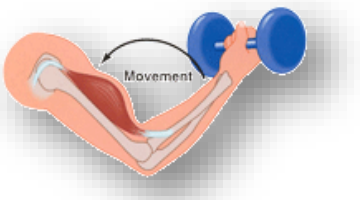
Type of muscular effort has been shown to have a profound impact on blood flow.

Static muscle contractions (the muscle shortens but no joint movement occurs) results in blood vessel compression due to internal muscle pressure.

At contraction levels of 60% and greater of the maximum voluntary contraction of the muscle, blood flow ceases.

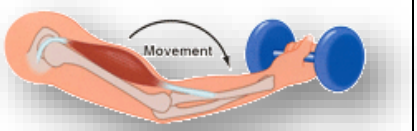
The muscle depends on the quite limited initial reserves stored internally. Waste products accumulate and only short duration contractions are possible.

Dynamic Muscle Contraction



On the other hand dynamic muscle contractions are the alternating contracting and relaxing of muscle groups to perform tasks.

In terms of enhancing performance and controlling fatigue, dynamic muscle contractions are a significant improvement over static muscle contractions.



Dynamic muscle activity promotes blood and fluid flow by acting as a pump to increase oxygen and nutrition to the working muscles and helps to remove the waste products of metabolism.

Position—Sustained/Awkward

Metabolic fatigue also occurs as the result of sustained position.

- Blood flow—both volume and rate of flow—decreases.
- Pooling of fluid in the extremities occurs.

The body's tissues require ongoing nutrition even at low or minimal activity levels. The position of the body when sedentary has impact. Sustained awkward positions result in:

- Muscular contractions to maintain the position.
- Potential decrease in blood flow due to internal impingement or external contact stress.

Metabolic/Work Physiology Synopsis

Movement/activity

- Promote dynamic not static muscle contractions
- Build-in adequate physical recovery times
- Incorporate movement into the work process

Position and support

- Design for neutral positions
- Design for body/limb support at work stations

Promote Work in Reach Zone

Hand Use

How much do you use your hands every day?

More than half the day? How about more than 75% of the day? Well in fact, most people will say they use their hands at least 99.9% of the day!

Where do we tend to use our hands?

For example does anybody work behind their back? Pretty hard to see what you're doing!

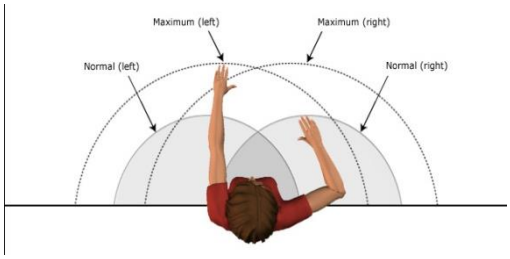
Because in most cases we need to see what we are doing we tend to use our hands in front of and to the sides of our body. We can define two reach zones:

1. **Comfort Reach Zone**
2. **Functional Reach Zone**

Comfort Reach Zone

Think of the comfort reach zone as that area in front and to the side where you'd like to use your hands when you're doing precise hand activity.

The dimensions of the Comfort Reach Zone will be determined by your forearm length. To get a feel for this, position your elbows at your sides with your elbows bent at about 90°, swing your hands from side to side.



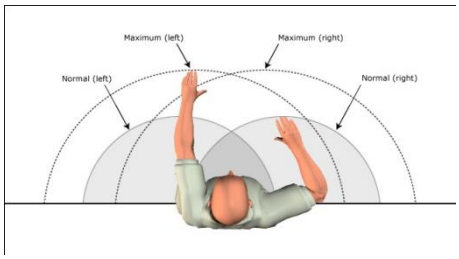
The height of this reach zone will be about three or 4 inches above and below double level. This is your Comfort Reach Zone.

Typical activities in the Comfort Reach Zone will include keyboard and mouse use along with handwriting. This also includes precision assembly in a manufacturing environment where you may exert a minimal downward force.

Functional Reach Zone

Think of the Functional Reach Zone as that area in front and to the side were you be able to comfortably reach to obtain parts and materials.

The dimensions of the Functional Reach Zone are determined by your arm length. An easy way to get a feel for this is to reach your arms out in front of your body with your elbows straight. From your shoulder to the middle of your hand is your forward functional reach.



Now swing your arms out to the side about 45° from the midline of your body. This is the side to side functional reach.

Drop your hands so they are relaxed at your sides. This is called knuckle height and is the bottom zone of the functional reach.

Finally with your arms extended raise them so they are about shoulder level. This is the upper zone of the functional reach.

Stature and arm's length determine the reach zones. Determine the individual reach zones and set up the work station to promote reaches in the appropriate zones.

Reach zone is really of function of lever arms. The longer the lever arm, the greater the force that is imposed on the body. How long can you hold 10 pounds at arm's length compared to the exact same 10 pounds held close to your body?

Control Manual Material Handling

How Much Can a Person Lift?

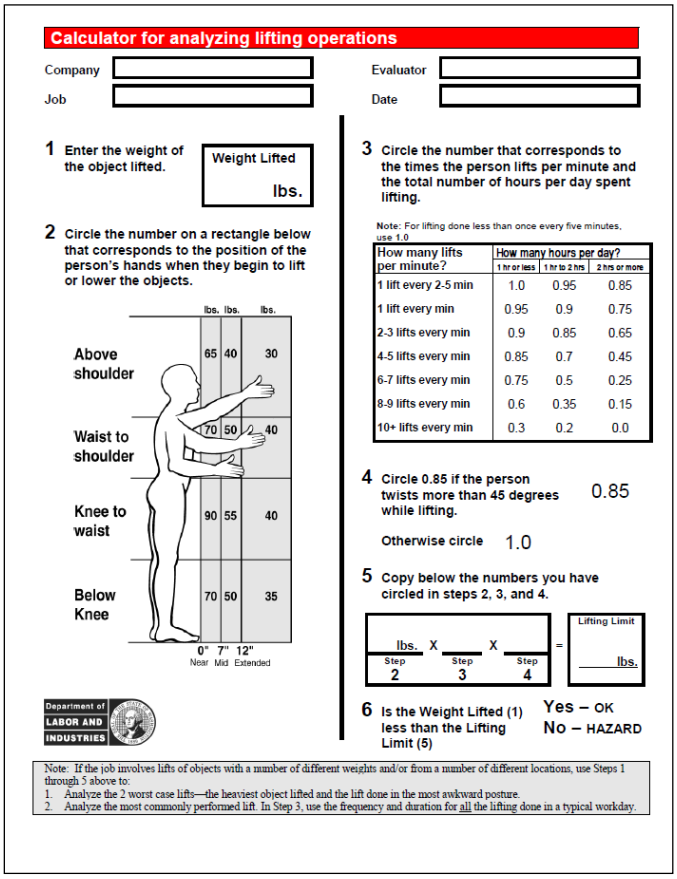
The next ergonomics principle details the specifics regarding manual material handling capabilities of individuals.

How much can a person lift in a safe and effective way? What are the factors involving the manual handling that need to be considered? These questions have been studied extensively over the past 30 years.

Lifting Calculator (State of Washington Department of Labor and Industries)

A simplified version of the NIOSH Work Practices Guide for Manual Lifting was developed by the State of Washington Department of Labor and Industries.

It is easy to use and provides valuable information.



Calculator for analyzing lifting operations

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" Near	7" Mid	12" 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 more than 45 degrees while lifting. 0.85

Otherwise circle 1.0

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

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

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

Department of LABOR AND INDUSTRIES

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 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.

Manual Material Handling Checklist

Use the ***Manual Material Handling Checklist*** as needed for the ergonomics analysis process.

Manual Material Handling Checklist

"NO" response indicates potential problem area that should receive further investigation.

1. Are the weights of loads to be lifted judged acceptable by the workforce?	YES	NO	NA
2. Are materials moved over minimum distances?	YES	NO	NA
3. Is the distance between the object load and the body minimized?	YES	NO	NA
4. Are walking surfaces:			
• Level?	YES	NO	NA
• Wide enough?	YES	NO	NA
• Clean and dry?	YES	NO	NA
5. Are objects:			
• Easy to grasp?	YES	NO	NA
• Stable?	YES	NO	NA
• Able to be held without slipping?	YES	NO	NA
6. Are there handholds on objects?	YES	NO	NA
7. When required, do gloves fit properly?	YES	NO	NA
8. Is the proper footwear worn?	YES	NO	NA
9. Is there enough room to maneuver?	YES	NO	NA
10. Are mechanical handling aids (powered or manual) used whenever possible?	YES	NO	NA
11. Are working surfaces adjustable to the best handling heights?	YES	NO	NA
12. Does material handling avoid:			
• Movements below knuckle height and above shoulder height?	YES	NO	NA
• Static muscle loading?	YES	NO	NA
• Sudden movements during handling?	YES	NO	NA
• Twisting at the waist?	YES	NO	NA
• Extended reaching?	YES	NO	NA
13. Is help available for heavy or awkward lifts?	YES	NO	NA
14. Are high rates of repetition avoided by:			
• Job rotation?	YES	NO	NA
• Self-pacing?	YES	NO	NA
• Sufficient pauses?	YES	NO	NA
15. Are pushing or pulling forces reduced or eliminated?	YES	NO	NA
16. Does the employee have an unobstructed view of handling the task?	YES	NO	NA
17. Is there a preventive maintenance program for equipment?	YES	NO	NA
18. Are workers trained in correct handling and lifting procedures?	YES	NO	NA

Provide Correct Workstations, Tools and Equipment

Providing the correct tools, equipment and facilities is a critical ergonomics principle. Safer, faster and more productive are the tangible results.

The correct workstation, tools and equipment can make the difference between getting the job done or not at all. And even worse, the wrong tool can result an injury to the use.

Work Station

The general design and set-up of the work station is an important factor. We will examine a number of factors to adequately assess the work station.

Stationary/Mobile

- Is the work station stationary - used primarily in one position? (See below for adjustability features.)
- Is the work station mobile - taken from job site to job site? If so, how is it transported?

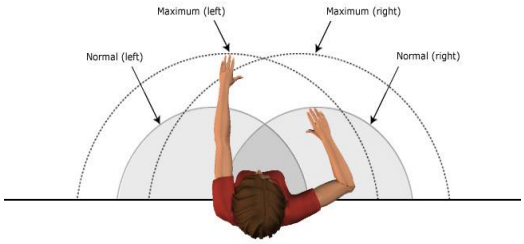
Adjustability features

Can the work station be adjusted to accommodate the needs of different workers and work processes?

Work height

- Does the height of the work surface permit a comfortable view of the job being done?
- Is the height of the work surface adjustable?
- Does the height of the work surface permit satisfactory arm posture? (Correct hand height depends on type of work performed and object worked on.)

Work reach envelope



- Can the worker keep horizontal stretches within the range of normal arm reach?
- Refer to the anthropometric data tables for additional details.

Chair/stool

- If a chair/stool is provided, is its design satisfactory? (Adequate back support, vertical adjustability, etc.)
-

Equipment controls

- Can equipment controls and machinery be adjusted to accommodate the needs of different operators?

Worker movement

- Is it possible for the worker to alternate sitting and standing when performing the task?

Space and clearance

- If containers are used, are they placed conveniently?
- Is there adequate space at the work station to perform the work comfortably?
- Does the positioning of equipment controls and work surface make it possible to maintain a comfortable posture?
- Is the workplace accessible to material handling equipment?
- Is clearance space in the workplace adequate for maintenance tasks?

Tools

Manual to Power

A switch from manual hand tools to power tools can reduce force levels. Power tools create their own set of issues, including vibration and torque reaction force.

Torque reaction forces

Torque reaction occurs when a fastener reaches the end of its travel, transferring the torque to the tool and operator. Employ clutches and torque reaction bars to reduce torque reaction forces.

Newer tools make use of pulse rather than impact technology. These tools significantly reduce power grip force requirements.

Handle size

Handle size should be monitored to provide optimum power grasps.

Trigger configuration should spread the required triggering force over a large area, rather than concentrated in a smaller area.

Preventive Maintenance

Preventive maintenance, based on manufacturer specifications, is critical to ensure proper operation of the tool. Sharp bits, blades, and un-clogged abrasives significantly reduce the force required to use manual or power tools.

Machinery/Equipment

Part of the work station is the machinery/equipment used in the operation. Look for a number of factors.

Foot pedals

- Are foot/knee control pedals used?
- Does the operator have to operate foot/knee pedals while standing?
- To operate foot pedals or knee switches, must the worker assume an unnatural or uncomfortable posture?
- Are pedals limited to two?
- Are pedals too small to allow the operator to alter the position of the foot/knee?
- Are pedals triggered at a high repetition rate?

Hand controls

- Are hand controls used?
- Placed to allow neutral hand/arm/body position?
- Difficult (require excessive force) to operate?
- Designed (shape and configuration) to take into account the amount and types of force required for operation?

Vibration

Whole body vibration

Truck and forklift drivers frequently encounter whole body vibration. Vibration of this type is suspected of weakening and disrupting soft tissue structures such as tendons and ligaments.

Questions:

- Is the body as a whole subjected to vibration?
- Is the level of vibration high enough to have adverse effects on the worker?

Segmental vibration

Segmental vibration is typically found in tasks that require the use of abrasive wheels, grinders, lathes, and power hand tools. Vibration from these sources has been shown to decrease sensitivity in the hand, resulting in an unnecessary increase in local muscle contractions.

Source control

When possible try to control vibration at the source. This is important whether the vibration is segmental or whole body in nature.

- Maintain and balance power tools on a regular basis.
- Evaluate the floor quality.
- Repair work, or even replacing vehicle seats, may be necessary to reduce exposure to whole body vibration.

Path control

In many situations, it may not be possible to control vibrations at the source. In this situation, obstruct and dampen the path of the vibration.

- Vibration attenuation covers that attach directly to the tools.
- Wear gloves with padded palms.
- When you add these coverings, be aware the effective handle diameter increases and tool control and grip strength may be adversely affected.
- Increasing the speed (RPM) at which the tool turns, frequently helps to reduce the amplitude of the vibration.
- Quick-cutting abrasives in grinding and sanding operations.

Contact Stress - Sharp edge

When you evaluate the type and severity of contact stress, look for any part of the body that is in contact with a sharp edge.

- Examine tool handle size and shape for prominences that promote increased pressure over any point of the grasping surface of the hand.
- Evaluate tools regarding the amount of localized pressure tools produce in the palm of the hand.
- Finger contours on handles or triggering devices of tools may also produce unnecessary stress on the digits.
- Examine the size and shape of any machine guards for potential contact stress. Identify and correct sharp edges or sustained pressure on the guard.

Control strategies - round edges

- Round work surface edges that come in contact with the worker.
- Tool handles and trigger switches should have rounded contours.

- Avoid the use of tools that require continuous or intermittent pressure on the fingers, palm, base of the wrist, forearm, and elbow.
- When possible, use self-opening tools such as pliers and scissors that are spring loaded. This reduces contact stresses required to open the tool.
- When contact stress itself cannot be avoided, the goal is to distribute the pressure over as large an area as possible by increasing the contact surface area.

Contact Stress – Sitting and Standing

Two areas of the body that are frequently not evaluated for contact stress are the feet of people who stand all day, and the buttocks and thighs of those who sit all day.

Evaluate chairs by observing pressure at the front of the seat pan and the position of the backrest. Evaluate the potential for pressure behind the knee or at the back of the thigh caused by the edge of the seat pan.

Floor surfaces can affect the comfort of workers who are required to stand for a large percentage of the day. This is a problem particularly when there is limited potential for movement.

Concrete, steel grates, uneven or vibrating floor surfaces may increase foot, leg or spinal fatigue and discomfort and can affect concentration and product quality. Anti-fatigue mats or shock absorbing shoe inserts can improve comfort levels.

Mental Demands

The mental demands of work can be just as demanding and stressful as the physical demands. They require a thoughtful examination.

Is the task complex?

- Does the worker have to evaluate data before taking action?
- Must the operator sense and respond to information signals occurring simultaneously from different machines without sufficient time to do so?
- Must the operator process information at a rate, which might exceed his or her capability?
- Is the job so complex it takes a long time to train workers?
- Does the task require a great deal of accuracy?
- Does this work situation require monitoring several machines?

Is the tack monotonous?

- Does the worker repeat the same task without change for the entire shift?

- Does the worker lose track of the task at hand because it is overly monotonous?

Design and Use Standards

- Are controls standardized on similar equipment?
- Does the design of any instrument increase reading errors?

Perceptual Demands

Our ability to properly perceive our environment exerts a major influence on our interaction with it.

Issues like illumination, auditory, touch and visual acuity fall into the realm of perceptual demand.

Illumination

Evaluate the quantity and quality of light. In many cases, today's office buildings have illumination levels approximately 25 to 30 per cent greater than desirable. Decreasing the amount of general overhead light and bringing in specific task lighting is effectively in selected areas.

Also, consider the overall quality and level of the light in relation to the color and reflectivity of the walls, floors, and ceilings. Glare is a commonly observed problem in office environments where it is apparent on video display terminals (VDT) screens.

Under-illumination facilitates forward bending of the trunk and head as individuals attempt to get closer to the material they are viewing. Task lighting can be effective to focus illumination where desired and at the same time control glare.

Illumination - General

- Is special lighting necessary to perform the job?
- Is the general work area including egress/ingress poorly lit?

Illumination - Task

- Is lighting inadequate for the job?
- Are controls, instruments and equipment poorly lit?
- Is the illumination not satisfactory for the task?

Illumination - Contrast

- Is contrast poor between the workspace and its surroundings?
- Is the workplace so poorly lit that there are great differences between brightness levels in panels, dials and surroundings?

Illumination - Glare

- Is glare present in the workplace?
- What is the source of the glare?
- Is glare from displays a problem?

Auditory

- Does the noise level prevent or impair verbal communication?
- Are there auditory signals?
- Are some auditory signals hard to hear in general?
- Are auditory signals difficult to distinguish from one another?

Touch

- Is there a need to tell the difference between parts by touch?
- Is it difficult to recognize controls and tools by touch and/or position?

Visual Acuity

- Does the task require fine visual judgments? (This includes the need to detect small defects, judging distances accurately, etc.)
- Are dials and instruments difficult to read quickly and accurately?
- Are controls, instruments and equipment placed where they are difficult to see? (At a bad angle, too high, too low.)
- If warning lights are present, are they located out of the center of the field of vision?
- Are dials grouped inconveniently?

Preventive Maintenance

Preventive maintenance of tools, equipment, work stations and the facility itself have a major impact on the workforce.

Regular schedule

- Is there a regular maintenance schedule?

Ease of maintenance

- Is the equipment designed or placed in such a way that cleaning and maintenance activities are difficult?
- Are containers designed for easy maintenance and repair?
- Does the design of the equipment allow for easy access for maintenance and repair?
- Are floors uneven?

Housekeeping

General

- Is the workplace floor clear of clutter and obstructions, which could create the risk of slips, trips or falls?
- Are floors slippery?

Work station

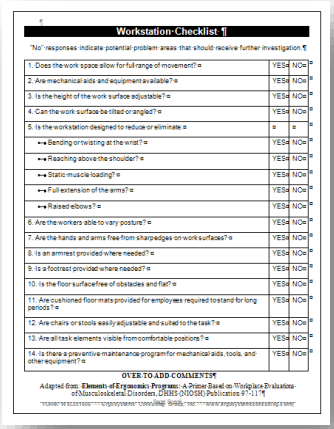
- Does there seem to be too much clutter in the work station?
- Is housekeeping at the work station poor?

Work Station, Tools and Equipment Checklists

Work Station

The general design and set-up of the work station is an important factor.

Use the ***Workstation Checklist*** as needed for the ergonomics analysis process.



Workstation Checklist

"No" responses indicate potential problem areas that should receive further investigation.

1. Does the work space allow for full range of movement?	YES	NO
2. Are mechanical aids and equipment available?	YES	NO
3. Is the height of the work surface adjustable?	YES	NO
4. Can the work surface be tilted or angled?	YES	NO
5. Is the workstation designed to reduce or eliminate:		
• Bending or twisting at the wrist?	YES	NO
• Reaching above the shoulder?	YES	NO
• Static muscle loading?	YES	NO
• Full extension of the arms?	YES	NO
• Raised elbows?	YES	NO
6. Are the workers able to vary posture?	YES	NO
7. Are the hands and arms free from sharp edges on work surfaces?	YES	NO
8. Is an armrest provided where needed?	YES	NO
9. Is a footrest provided where needed?	YES	NO
10. Is the floor surface free of obstacles and flat?	YES	NO
11. Are cushioned floor mats provided for employees required to stand for long periods?	YES	NO
12. Are chairs or stools easily adjustable and suited to the task?	YES	NO
13. Are all task elements visible from comfortable positions?	YES	NO
14. Is there a preventive maintenance program for mechanical aids, tools, and other equipment?	YES	NO

OVER TO ADD COMMENTS

Adapted from: **Elements of Ergonomic Programs**: A Primer Based on Workplace Evaluations of Musculoskeletal Disorders. (2001) (NIOSH) Publication #97-117

Tools

How much money do professional carpenters spend on tools?

In fact they may have one tool that does just one job!

Why is it worth the investment? That specific tool makes the job go faster and easier with less chance of injury.

Refer to the ***Tool Checklist*** for additional information.

Equipment

Part of the work station is the machinery/equipment used in the operation. Look for a number of factors including foot pedals, hand controls, whole body vibration, maintenance, etc.

Refer to the ***Equipment Checklist*** for additional information.

Workstation Checklist

"NO" response indicates potential problem areas that should receive further investigation.

1. Does the work space allow for full range of movement within the workstation?	YES	NO	NA
2. Is the height of the work surface adjustable?	YES	NO	NA
3. Can the work surface be tilted or angled to provide a comfortable view of the job being done?	YES	NO	NA
4. Is the workstation designed to reduce or eliminate:			
• Bending or twisting at the wrist?	YES	NO	NA
• Reaching above the shoulder?	YES	NO	NA
• Static muscle loading?	YES	NO	NA
• Full extension of the arms?	YES	NO	NA
• Raised elbows?	YES	NO	NA
5. Are the workers able to vary posture?	YES	NO	NA
6. Are the hands and arms free from sharp edges on work surfaces?	YES	NO	NA
7. Is an armrest provided where needed?	YES	NO	NA
8. Is a footrest provided where needed?	YES	NO	NA
9. Is the floor surface free of obstacles and flat?	YES	NO	NA
10. Are cushioned floor mats provided for employees required to stand for long periods?	YES	NO	NA
11. If a chair/stool is provided, is its design and adjustability satisfactory and suited to the task? (Back support, vertical adjustability, etc.)	YES	NO	NA
12. Are all task elements visible from comfortable positions (seated or standing)?	YES	NO	NA
13. Is there a preventive maintenance program for mechanical aids, tools, and other equipment?	YES	NO	NA
14. Is the worker able to work within the comfort and functional reach zones?	YES	NO	NA
15. Is it possible for the worker to alternate sitting and standing when performing the task?	YES	NO	NA
16. Is there adequate space at the workstation to perform the work effectively and comfortably?	YES	NO	NA
17. Can position of tools/equipment and controls be adjusted to suit the worker?	YES	NO	NA
18. If parts and materials containers/bins/tubs/carts are used, are they conveniently placed?	YES	NO	NA
19. Are mechanical aids and mechanical handling equipment available?	YES	NO	NA
20. Is the workstation accessible to material handling equipment?	YES	NO	NA
21. Is clearance space in the workplace adequate for maintenance tasks?	YES	NO	NA

Tool Checklist

"NO" response indicates potential problem areas that should receive further investigation.

1. Are power tools used and acceptable? *(If not acceptable what problems with power tools are noted?)*	YES	NO	NA
2. Are manual tools used and acceptable? *(If not acceptable what problems with power tools are noted?)*	YES	NO	NA
3. Are tools selected to limit or minimize:			
• Exposure to excessive vibration?	YES	NO	NA
• Use of excessive force?	YES	NO	NA
• Bending or twisting the wrist?	YES	NO	NA
• Finger pinch grip?	YES	NO	NA
• Problems associated with trigger finger?	YES	NO	NA
4. Are tools powered where necessary and feasible?	YES	NO	NA
5. Are tools evenly balanced?	YES	NO	NA
6. Are heavy tools suspended or counterbalanced in ways to facilitate use?	YES	NO	NA
7. Does the tool allow adequate visibility of the work?	YES	NO	NA
8. Does the tool grip/handle prevent slipping during use?	YES	NO	NA
9. Are tools equipped with handles of textured, non-conductive material?	YES	NO	NA
10. Are different handle sizes available to fit a wide range of hand sizes?	YES	NO	NA
11. Is the tool handle designed not to dig into the palm of the hand?	YES	NO	NA
12. Can the tool be used safely with gloves?	YES	NO	NA
13. Can the tool be used by either hand?	YES	NO	NA
14. Is there a preventive maintenance program to keep tools operating as designed?	YES	NO	NA
15. Have employees been trained:			
• In the proper use of tools?	YES	NO	NA
• When and how to report problems with tools?	YES	NO	NA
• In proper tool maintenance?	YES	NO	NA

Equipment Checklist

"YES" response indicates potential problem areas that should receive further investigation.

Foot/knee control pedals			
1. Does the operator have to operate foot/knee pedals while standing?	YES	NO	NA
2. To operate foot pedals or knee switches, must the worker assume an unnatural or uncomfortable posture?	YES	NO	NA
3. Are pedals too small to allow the operator to alter the position of the foot/knee?	YES	NO	NA
4. Are pedals triggered at a high repetition rate?	YES	NO	NA
Hand controls			
5. Hand controls placed to **not** allow neutral hand/arm/body position?	YES	NO	NA
6. Hand controls difficult (require excessive force) to operate?	YES	NO	NA
7. Hand controls not properly designed to take into account amount and types of force required for operation?	YES	NO	NA
8. Do workers have to exert high levels of power grip force to operate equipment?	YES	NO	NA
9. Do workers have to exert high levels of pinch grip force to operate equipment?	YES	NO	NA
Position - Sustained/Awkward			
10. To operate equipment, must worker maintain same body posture (either sitting or standing) all or most of the time?	YES	NO	NA
11. Is the pace of material handling determined by the equipment? (Feeding machines, conveyors, etc.)	YES	NO	NA
12. Does equipment operation require worker to repeat same movement pattern of arm/hand at a high rate of speed?	YES	NO	NA
13. Does equipment operation require continuous use (or nearly so) of both hands and both feet in order to operate controls or manipulate work object?	YES	NO	NA
Vibration - Whole body			
14. Is the body as a whole subjected to vibration from exposure to or operation of the equipment?	YES	NO	NA
Equipment Preventive Maintenance			
15. Is there **not** a regular maintenance schedule?	YES	NO	NA
16. Is the equipment designed or placed in such a way that cleaning and maintenance activities are **not** facilitated?	YES	NO	NA

Provide Competency Based Training

This ergonomics principle indicates that adequate workforce training is a critical part of the ergonomics process.

Results not Achieved?

A company spends thousands of dollars on tools, equipment and facility that are ergonomically designed but they don't achieve the desired results. What happened?

In many situations the problem is that the workforce doesn't know how to make the most of the tool or equipment or furniture. Two sides of the coin emerge: you need to have the correct item AND you need to know how to use it properly. For the workforce to really get the benefits of ergonomics they need to be able to demonstrate competency in the setup and use of the tool or equipment.

To give you an example. A company purchased new fully featured ergonomics office chairs. They were delivered and put into use. A short while later during an ergonomics audit it was determined that no one had adjusted the chairs for their specific needs. They hadn't received any instruction in how to use the chairs - they just sat down and went to work. In fact a number of individuals reported they actually felt intimidated by the chair and all of its "bells and whistles"!

If you want to improve your golf game (or some other physical skill) what do you need to do? Right, you need to correctly practice the new technique to acquire the skill level to advance.

In the same way, ergonomics is all about learning new skills; provide training sessions that involve a hands-on approach. Over time, with proper feedback and practice, the desired result will be accomplished.

Control Exposure to Work Environment

Controlling exposure to the work environment includes light, noise, temperature and ventilation is the next principle.

(What do you think, can we set the thermostat at a level that everyone will agree to? The goal is to shoot for the middle and let individuals use personal controls based on their needs.)

Use the ***Environment Checklist*** as needed for the ergonomics analysis process.

Environment Checklist

"YES" response indicates potential problem area that should receive further investigation.

Illumination			
1. Is special lighting necessary to perform the job?	YES	NO	NA
2. Is the general work area including egress/ingress poorly lit?	YES	NO	NA
3. Is lighting inadequate for the job tasks?	YES	NO	NA
4. Are controls, instruments and equipment poorly lit?	YES	NO	NA
5. Is the illumination not satisfactory for task?	YES	NO	NA
6. Is contrast poor between workspace and surroundings?	YES	NO	NA
7. Is workplace so poorly lit that there are great differences between brightness levels in panels, dials and surroundings?	YES	NO	NA
8. Is glare present in workplace? (What is source of the glare?)	YES	NO	NA
9. Is glare from displays a problem?	YES	NO	NA
Auditory/Noise			
10. Does the noise exposure require a hearing conversation program?	YES	NO	NA
11. Does noise level prevent or impair verbal communication?	YES	NO	NA
12. Are there auditory signals?	YES	NO	NA
13. Are some auditory signals hard to hear in general?	YES	NO	NA
Air (Temperature, Quality, Flow, Humidity)			
14. Is the air temperature too cold?	YES	NO	NA
15. Is the air temperature too hot?	YES	NO	NA
16. Is it too humid in workplace?	YES	NO	NA
17. Are radiant heat sources placed near any workstations?	YES	NO	NA
18. Are there rapid changes in temperature in work environment?	YES	NO	NA
19. Is there so much air contaminant in the process that it settles on displays, making them difficult to see?	YES	NO	NA
20. Are suspended dust, mists and other particulates present in the air?	YES	NO	NA
21. Is air circulation too low?	YES	NO	NA
22. Is there too much air movement?	YES	NO	NA
23. Are workers exposed to rapid environmental changes?	YES	NO	NA
24. Is the humidity frequently uncomfortable enough to interfere with the job?	YES	NO	NA
25. Are there wet locations that may produce shock hazards for work with electrically powered equipment?	YES	NO	NA

Promote Health and Wellness!

What is the most important tool we all own?

This principle directly addresses our need to maintain the most important tool we have . . . our minds and our bodies; in other words our physical and mental health.

The goal is to provide a workplace where regular health and wellness concepts and practices are built into the course of doing business. Health and wellness factors include:

- Diet and nutrition
- Body weight control
- Stress management
- Smoking cessation
- Blood pressure control
- Fluid intake - don't get dehydrated
- Adequate rest/sleep

For example: movement helps to control fatigue by relieving awkward and sustained positions and promoting circulation to the body's tissues.

Who has dogs or cats at home? When they first get up from a little nap what is the first thing they do? We have an instinctive need to move . . . we just need to pay attention to it.

Provide On-going Feedback and Follow-up

The last ergonomics principle is to provide on-going feedback and follow-up regarding the ergonomics analyses and processes.

100% Correct the First Time?

In your experience does any new process work 100% correctly out of the gate? Even with the best up-front planning there will be unintended consequences, something will vary from the plan. This is why providing on-going feedback as part of the follow-up process is so critical.

Schedule formal follow-up sessions at regularly intervals; for example one week post-implementation and then one month, six months and one year. Document the outcome of the follow-up, very importantly alleviate the issues identified in a timely manner and publicize the lessons learned.

Continuous Process Improvement and Ergonomics

Applying ergonomics principles to the overall continuous process improvement effort is integral to the success of the process. Recalling that ergonomics is focused on optimizing performance (enhancing safety and quality and productivity) is made stronger when on-going feedback and follow-up is performed.

Ergonomics Principles

PROCESS – Promote effective work processes

POSITION/SUPPORT – Promote neutral body and limb position/support

MOVEMENT – Promote regular physical movement

MATERIAL HANDLING – Control manual material handling

REACH – Promote work in reach zone

WORKSTATION/TOOLS/EQUIPMENT – Provide correct workstation, tools and equipment

TRAINING – Provide competency based training

ENVIRONMENT – Control exposure to work environment

HEALTH/WELLNESS – Promote personal health and wellness

FEEDBACK – Provide on-going feedback for continuous improvement

ERGONOMICS PROBLEM SOLVING PRINCIPLES

If you like to solve problems, ergonomics is for you!

Identifying and solving problems is at the core of the ergonomics process. Here are a few important caveats to problem solving.

Caveats

Design dictates performance

Recall the toolbox on the floor scenario. Placing a toolbox on a floor promotes poor technique to remove the tools. Body mechanics training may be ineffective in promoting proper technique. The successful response involves repositioning the toolbox to waist height to promote the desired technique. You can apply this concept in any workplace for any ergonomics problem.

Understand and make productive use of human behavior

The study of human behavior is a most fascinating and frustrating field of study. There are reasons why we do what we do; sometimes we just cannot figure out what they are! It is possible, however, to understand human behavior at some level, and to use this knowledge in a productive way. If we offer a solution that is contrary to the nature of human behavior, the solution will not be effective.

Do not fix without adequate analysis!

Many novice analysts (and sometimes some experienced ones) cause themselves and others problems because they try to "fix stuff" without knowing why or what or when or who. Perform an adequate analysis before offering recommendations.

Always ask why!

Sometimes when we look at work, all we see is what is in front of us. It is imperative that we look both up and down stream to see the context of a single work station or job demand within the overall production scheme.

Don’t generalize from a sample of one!

A common error made is to make the assumption that just because it makes sense to me or works for a particular individual it will also work for the entire population. Be careful not to fall into the trap of population stereotypes. Recognize the diversity that exists in the user population and design to take this into account.

Scope of Influence

Know the scope of influence of the situation and the worker and not exceed the worker's scope of influence. If we offer a solution that is beyond the scope of influence of the individual, department, or organization, the solution will not work.

Overcome resistance to change

Most people do not like change. If we try to introduce change we have to do it in a very careful way, otherwise the solution will not work. How is change accomplished?

Creating positive change

Creating positive change is truly the core of any successful ergonomics process. Work through this exercise. Pull from your own experiences with change.

Why do people resist change?	How to facilitate change!
1.	
2.	
3.	
4.	
5.	
6.	

Why to do people resist change?

- They fear of change.
- They do not recognize the need for change.
- They do not know how to accomplish change.
- The change is forced on them.
- Was not their idea!
- Habit!
- No one else is changing!

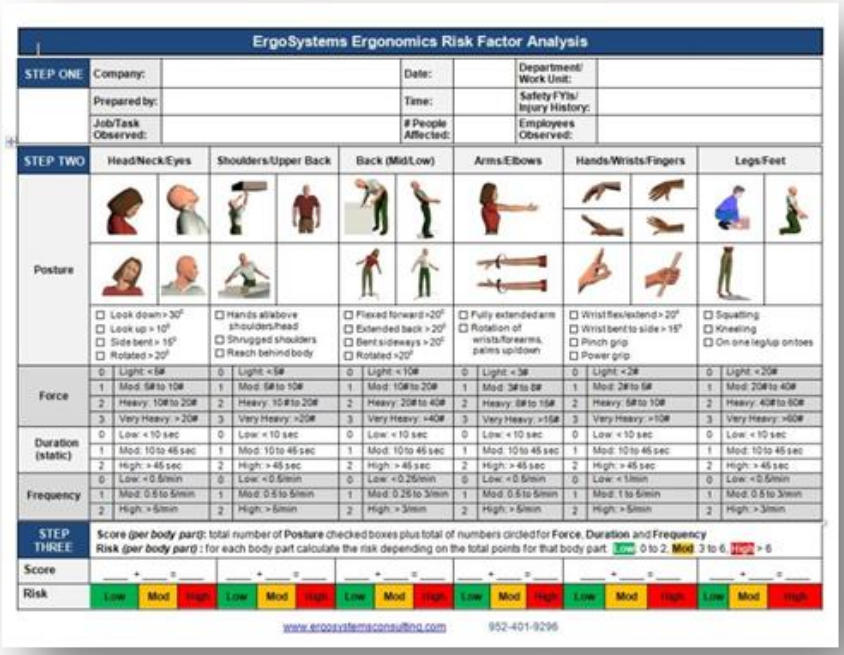
How to facilitate positive change?

- Show opportunity exists to change
- Show how to accomplish change
- Show what happens if you do change
- Show what happens if you do not change (hopefully this does not have to happen to elicit change)

ERGONOMICS ANALYSIS PROCESS

Ergonomics Analysis Process

Please refer to the **Ergonomics Analysis Worksheet** to conduct the analysis.



ErgoSystems Ergonomics Risk Factor Analysis

STEP ONE						
	Company:		Date:		Department/ Work Unit:	
	Prepared by:		Time:		Safety FYIs/ Injury History:	
	Job/Task Observed:		# People Affected:		Employees Observed:	

STEP TWO	Head/Neck/Eyes	Shoulders/Upper Back	Back (Mid/Low)	Arms/Elbows	Hands/Wrists/Fingers	Legs/Feet
Posture	☐ Look down > 30° ☐ Look up > 10° ☐ Side bent > 15° ☐ Rotated > 20°	☐ Hands at/above shoulders/head ☐ Shrugged shoulders ☐ Reach behind body	☐ Flexed forward > 20° ☐ Extended back > 20° ☐ Bent sideways > 20° ☐ Rotated > 20°	☐ Fully extended arm ☐ Rotation of wrists/forearms, palms up/down	☐ Wrist flex/extend > 20° ☐ Wrist bent to side > 15° ☐ Pinch grip ☐ Power grip	☐ Squatting ☐ Kneeling ☐ On one leg/up on toes
Force	0 Light: < 5# 1 Mod: 5# to 10# 2 Heavy: 10# to 20# 3 Very Heavy: > 20#	0 Light: < 5# 1 Mod: 5# to 10# 2 Heavy: 10# to 20# 3 Very Heavy: >20#	0 Light: < 10# 1 Mod: 10# to 20# 2 Heavy: 20# to 40# 3 Very Heavy: >40#	0 Light: < 3# 1 Mod: 3# to 8# 2 Heavy: 8# to 15# 3 Very Heavy: >15#	0 Light: < 2# 1 Mod: 2# to 5# 2 Heavy: 5# to 10# 3 Very Heavy: >10#	0 Light: < 20# 1 Mod: 20# to 40# 2 Heavy: 40# to 60# 3 Very Heavy: >60#
Duration (static)	0 Low: < 10 sec 1 Mod: 10 to 45 sec 2 High: > 45 sec	0 Low: < 10 sec 1 Mod: 10 to 45 sec 2 High: > 45 sec	0 Low: < 10 sec 1 Mod: 10 to 45 sec 2 High: > 45 sec	0 Low: < 10 sec 1 Mod: 10 to 45 sec 2 High: > 45 sec	0 Low: < 10 sec 1 Mod: 10 to 45 sec 2 High: > 45 sec	0 Low: < 10 sec 1 Mod: 10 to 45 sec 2 High: > 45 sec
Frequency	0 Low: < 0.5/min 1 Mod: 0.5 to 5/min 2 High: > 5/min	0 Low: < 0.5/min 1 Mod: 0.5 to 5/min 2 High: > 5/min	0 Low: < 0.25/min 1 Mod: 0.25 to 3/min 2 High: > 3/min	0 Low: < 0.5/min 1 Mod: 0.5 to 5/min 2 High: > 5/min	0 Low: < 1/min 1 Mod: 1 to 5/min 2 High: > 5/min	0 Low: < 0.5/min 1 Mod: 0.5 to 3/min 2 High: > 3/min
STEP THREE	**Score** *(per body part)*: total number of **Posture** checked boxes plus total of numbers circled for **Force**, **Duration** and **Frequency** **Risk** *(per body part)*: for each body part calculate the risk depending on the total points for that body part. Low: 0 to 2, Mod: 3 to 6, High: > 6					
Score	___ + ___ = ___	___ + ___ = ___	___ + ___ = ___	___ + ___ = ___	___ + ___ = ___	___ + ___ = ___
Risk	Low Mod High	Low Mod High	Low Mod High	Low Mod High	Low Mod High	Low Mod High

www.ergosystemsconsulting.com 952-401-9296

Step 1: Gather and document BACKGROUND INFORMATION.

Fill in the background information:

- Job/Task
- Area/Dept.
- Date
- Time
- Analyzed by
- Name (optional)
- Etc.

Step 2: IDENTIFY POSTURE, FORCE, DURATION and FREQUENCY issues

Observe the job. If it makes sense try the job yourself. Once you have a handle on the job, briefly describe the job/task as concisely as you can. Answer the basics questions of:

- Who?
- What?
- Why?
- When?
- Where?
- How much?
- How long?

Comments

- Compare experienced faster and injury-free workers with those who are inexperienced, fatigued, uncomfortable, or complaining of pain or injury.
- Determine if there are differences in work technique among these groups.
- If repetitive, note cycle time, capture a minimum of 5 cycles.
- Sketch the work area, if needed.
- Obtain weights and measures as needed.

Step 3: SCORE POSTURE, FORCE, DURATION and FREQUENCY issues

Calculate the score per body part.

Step 4: IDENTITY ANY OTHER FACTORS

Determine if other factors are pertinent.

Step 5: WORKER DISCOMFORT SURVEY and INPUT

Interview the person or persons performing the job to gain their insight and perspective. *(Involve all people who can provide input; you absolutely have to involve the operator/worker. After all, who is the very best ergonomist?)*

Document any discomfort they report.

Step 6: CALCULATE FINAL SCORE

Tally the scores in Steps 3, 4 and 5 to determine the final TOTAL score.

Step 7: GENERATE RECOMMENDATIONS and ACTION PLAN

Brainstorm on specific interventions.

- Be careful you don't recommend wholesale change.
- A "minimalist" approach may be much more palatable.

Implement Solutions

The goal is to accomplish controlled measurable change. If you change too many variables all at once you run the risk of not being able to recognize what did and did not work. Apply the principles but be careful of generalizations. In all likelihood, the "normal" person does not exist.

The modification itself is not the issue; the acceptance and integration of the modification is the issue. Introducing the job modification into the work place only begins the process.

Follow-up: Evaluate outcome and make needed changes.

Proper outcomes evaluation continues the process. On-going measures are compared to the initial performance measures.

- Compare at set intervals (1, 3, 9, and 12-month intervals).
- Determine changes in performance measures
- Detail lessons learned to modify the interventions.
- Reevaluate and repeat the analysis steps.

ERGONOMICS – A POTENT TOOL!

Ergonomics is a potent tool!

When the principles of ergonomics are applied the outcome is demonstrated improvements in quality, productivity, health and safety.

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Human Factors, Human Factors and Ergonomics Society.

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Professional Organizations

American Industrial Hygiene Association

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American Society of Safety Engineers
1800 E. Oakton St.
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Human Factors and Ergonomics Society
PO Box 1369
Santa Monica, CA 90406-1369
(310) 394-1811

International Ergonomics Association
Secretary General IEA
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SEARBO/Ergonomics
PO Box 2286
3500 GG Utrecht
The Netherlands
+31 30 2399455

National Safety Council
444 North Michigan Avenue
Chicago, IL 60611
(800) 621-7619

Web Sites

Many, many, many web sites have ergonomics related content.

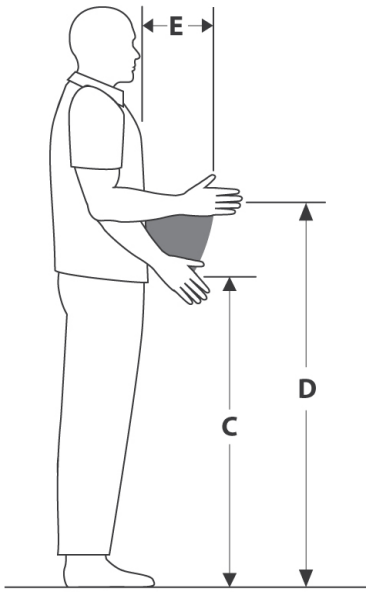
Here are a couple of the better ones:

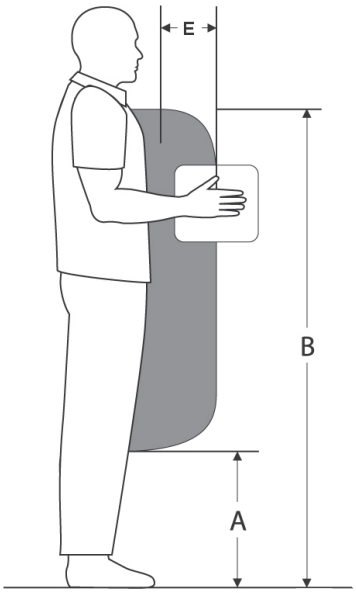
www.ergoweb.com

www.osha.gov

Engineering Ergonomics Reference Guide

Ergonomics Guide to Workstation, Tool, Task and Process Design





ErgoSystems Consulting Group, Inc.
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Version 5.0 (02232015)

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Introduction

Engineering Ergonomics Reference Guide provides ergonomics checklists, specifications and supporting information to assist in designing tasks, tools, equipment and workstations that enhance productivity and quality of the work product and reduce the risk of injury in the workplace. ***This information is provided within the context of professional judgment rendered on the part of reader.***

Applying ergonomics principles will help to ensure jobs are performed by workers in a safe, efficient and pain-free manner by:

- "Working smarter not harder."
- "Fitting the task (i.e. tools, equipment, facilities, etc.) to the worker rather than forcing the worker to fit the task."

Primary Ergonomics Risk Factors

Primary ergonomics risk factors in the workplace that contribute to decreased productivity and quality and increased work-related musculoskeletal disorders (WMSDs) include:

- Awkward and sustained postures
- Excessive forces imposed on the body or generated by the body
- Excessive frequency and duration of tasks
- Uncontrolled environmental factors (illumination, noise, thermal, ventilation, vibration)
- Uncontrolled perceptual demand factors (auditory, touch, visual)

Ergonomics is an established scientific discipline based on:

- Occupational Biomechanics
- Work Physiology
- Engineering Psychology
- Epidemiology
- Anthropometry

Primary Ergonomics Principles

- Promote neutral body and limb positions
- Provide support for body/limbs
- Promote physical movement
- Promote work in the user's reach zone
- Provide correct tools, equipment and facilities
- Promote effective work processes
- Provide competency based training
- Control exposure to work environment
- Promote health and wellness
- Provide on-going feedback and follow-up

Bottom line . . . incorporating ergonomics principles in the design and use of tasks, tools, equipment and workstations will improve productivity and quality and reduce or eliminate work related injuries.

A more comfortable, safe and productive working environment is the end result.

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Anthropometry

Defined

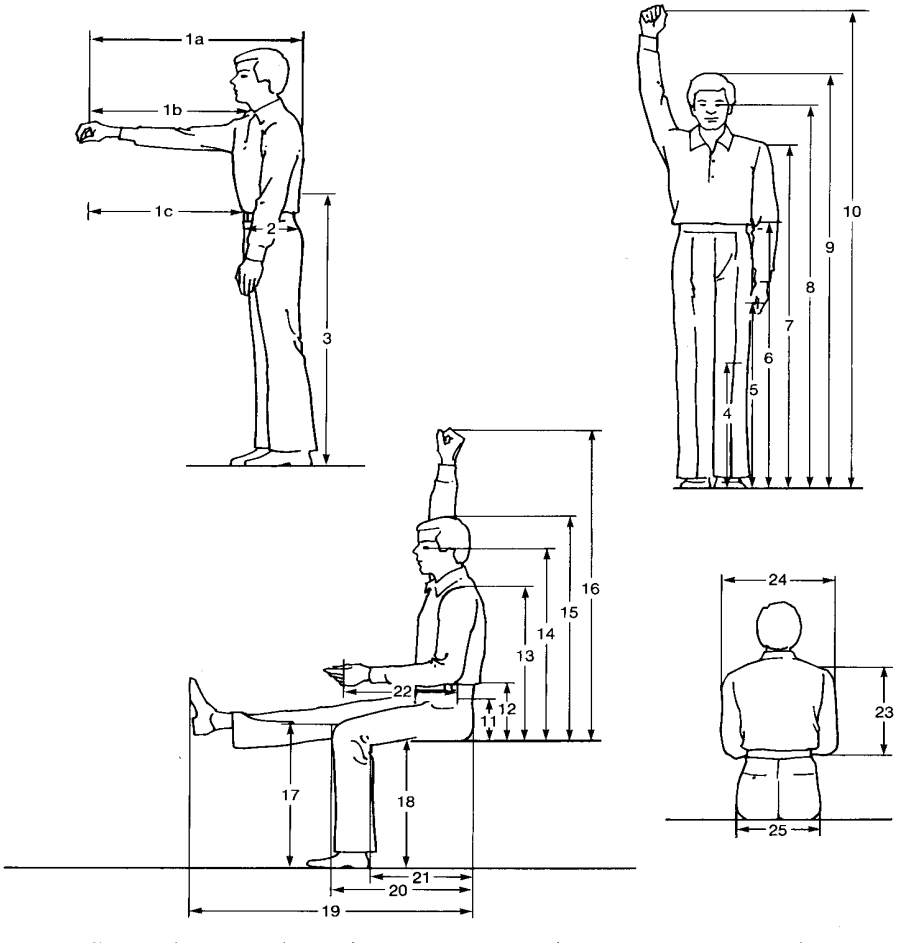
Anthropometry is the science that defines physical measures of a person's size, form, and functional capacities. In other words: how tall? . . . how short? . . . how big? . . . how small?

Data Bases

Anthropometric measurements are used to evaluate the interaction of workers with tasks, tools, machines, workstations, vehicles, and personal protective equipment.

Data bases have been developed that describe various populations typically in terms of percentiles based on statistical measures of mean and standard deviation.

For example, the drawing to the right indicates a number of measures that relate to body segment length. Measurements including stature, reach, height from floor, width, etc. are commonly used.



Design considerations

In overview, two primary anthropometric design considerations come into play:

1. Ensure taller individuals can fit
2. Ensure shorter individuals can reach

Ask any tall person trying to fit into an airplane seat or a short person trying to reach to a higher shelf and they will confirm the design considerations.

To make use of the data tables, the first design criterion is to define the user population. Is it predominately male or female? Northern European or Asian descent Or, more than likely, a diverse combination?

General anthropometric guidelines promote design that attempts ***accommodation from the 5th percentile female to the 95th percentile male.*** Going through an example will illustrate how to access the data base and interpret the results.

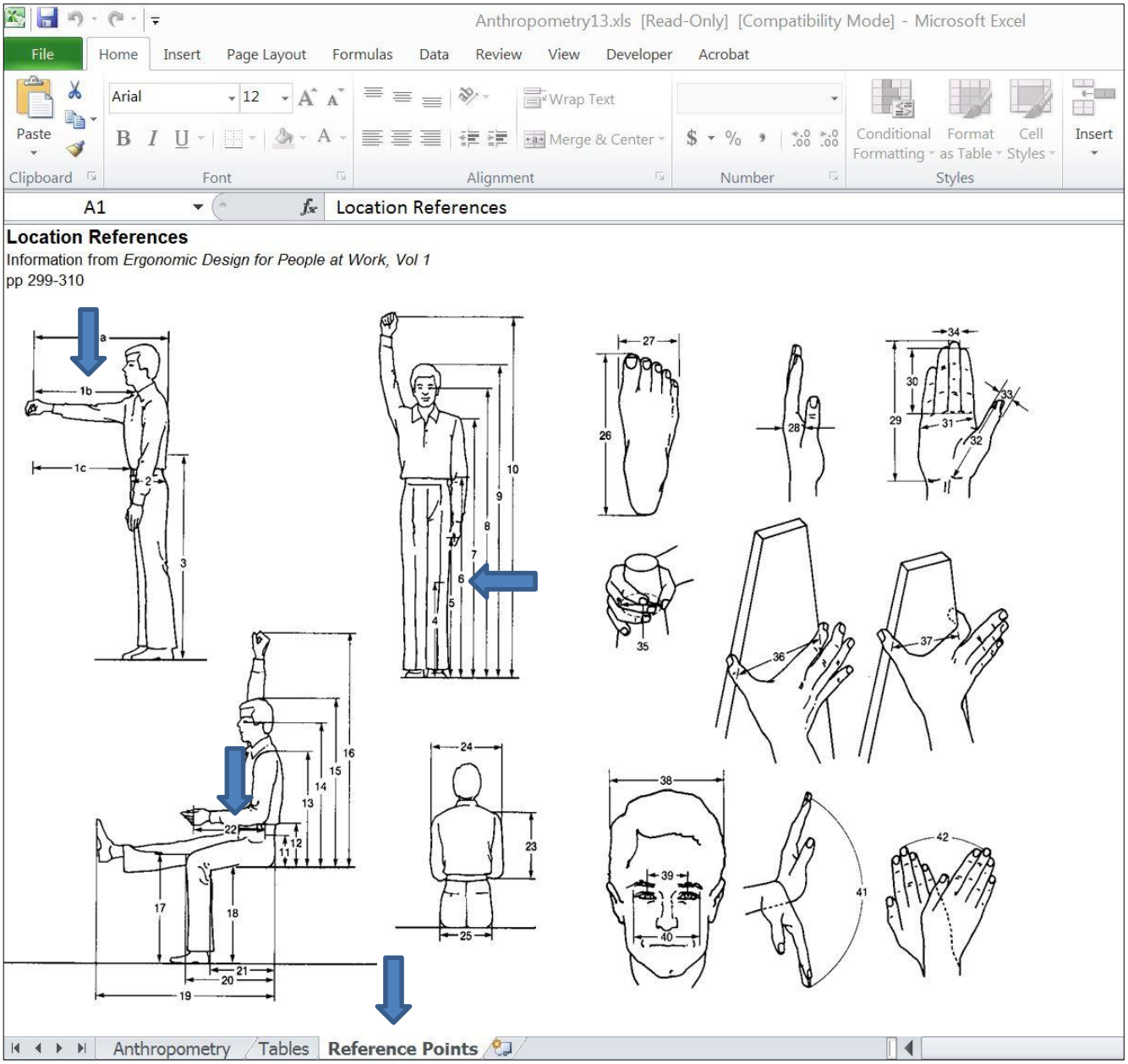
Anthropometric Case Study

A workbench is being designed for an assembly process. A diverse user population will perform light weight (up to 10#) repetitive assembly job tasks at elbow level from a standing position. ***Workbench height and worksurface front-to-back depth are the points of interest.*** Using anthropometric data we can develop the design specifications for the workbench.

Standing Workstation Guidelines and Standing Workstation Specifications are based on the anthropometric data, determined as follow.

Accessing the Anthropometric Data Base, in the *Reference Points* sheet in the Excel spreadsheet identify the metrics of interest:

- *Elbow height – Stand (6)* (used to determine workbench height)
- *Frwd Func Reach – acromial process to pinch (1b)* (used to determine workbench configuration for placement of parts bins, tools, etc.)
- *Elbow-to-Fist Length (22)* (used to determine workbench configuration for performance of assembly tasks)



Select the *Anthropometry* sheet in the Excel spreadsheet. In the *Select Dimesions of Interest* pull down menu select:

- *Frwd Func Reach – acromial process to pinch (1b)*
- *Elbow-to-Fist Length (22)*
- *Elbow height – Stand (6)*

5th Percentile Female calculation:

- In the *Adult Population Mix (%)* input 0 for Men, Women 100 will be automatically input
- In the *Design Exclusion (%)* input 5, this will calculate 5th and 95th percentiles
- Click *Find Values*

A1 | Anthropometric Measures -- Adult Population

Anthropometric Measures -- Adult Population

Job / Task Information -- Enter Useful Information in This Box -- See also comments in cells by placing curser over cells marked by red triangle in upper right corner.

Adult Population Mix (%): Men 0, Women 100

Design Exclusion (%): 5

in, lb | Find Values

Units: in, lb

If units are changed, push Find Values again.

Select Dimensions of Interest	Mean 50%ile	Limits (%ile) Minimum 5.0	Limits (%ile) Maximum 95.0	Range (%ile) Low 2.5	Range (%ile) High 97.5
Frwd Func Reach - acromial process to pinch {1b}	24.6	22.4	26.8	22.0	27.3
Elbow-to-Fist Length {22}	13.7	12.2	15.2	11.9	15.5
Elbow Height - Stand {6}	40.4	37.3	43.5	36.7	44.1

95th Percentile Male calculation:

- In the *Adult Population Mix (%)* input 100 for Men, Women 0 will be automatically input.
- In the *Design Exclusion (%)* input 5, this will calculate 5th and 95th percentiles
- Click *Find Values*

A1 | Anthropometric Measures -- Adult Population

Anthropometric Measures -- Adult Population

Job / Task Information -- Enter Useful Information in This Box -- See also comments in cells by placing curser over cells marked by red triangle in upper right corner.

Adult Population Mix (%): Men 100, Women 0

Design Exclusion (%): 5

in, lb | Find Values

Units: in, lb

If units are changed, push Find Values again.

Select Dimensions of Interest	Mean 50%ile	Limits (%ile) Minimum 5.0	Limits (%ile) Maximum 95.0	Range (%ile) Low 2.5	Range (%ile) High 97.5
Frwd Func Reach - acromial process to pinch {1b}	25.1	22.4	27.9	21.8	28.5
Elbow-to-Fist Length {22}	15.2	13.8	16.5	13.5	16.8
Elbow Height - Stand {6}	43.5	40.6	46.5	40.1	47.0

Interpretation

For the 5th percentile female and the 95th percentile male, we now have determined standing elbow height (*Elbow height – Stand (6)*), and two ranges of reach (Comfort (*Elbow-to-Fist Length (22)*) and Functional (*Frwd Func Reach – acromial process to pinch (1b)*).

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Workbench Height – Adjustable

So with the 5th percentile female standing elbow height at 37.3” and the 95th percentile male at 46.5” we can specify the recommended range of adjustment of the workbench. Ideally the workbench will be **height adjustable and controlled by the user in the range of 36” to 48”** (about 1” buffer added to minimum and maximum height).

See Caveats below for additional information.

Workbench Height - Fixed

If a height adjustable workbench is not an option, we have to consider what will be the most beneficial fixed height for all operators. We would like the operator to maintain a neutral upright body position as possible and operate within their power zone to handle tools, parts and materials. Here are some considerations:

- If the work bench height is set for the shorter individual at 37”, this will force the taller individual to bend at the waist to position their hands at the workbench. This places their hands lower than their recommended power zone and increases biomechanical stress into the spine and shoulders.
- If the work bench height is set for the taller individual at 47”, this will force the shorter individual to reach their hands up to the work bench. This places their hands higher than their recommended power zone and increases biomechanical and physiological stress into the shoulders and arms.

One option is to calculate the values for a mixed population of men and women. We can manipulate the *Adult Population Mix (%)* to consist of 50% men and 50% women.

A1 | Anthropometric Measures -- Adult Population

Anthropometric Measures -- Adult Population

Job / Task Information -- Enter Useful Information in This Box -- See also comments in cells by placing curser over cells marked by red triangle in upper right corner.

Adult Population Mix (%)		Design
Men	Women	Exclusion (%)
50	50	5

in, lb | Find Values

If units are changed, push Find Values again.

Units: in, lb

Select Dimensions of Interest	Mean 50%ile	Limits (%ile) Minimum 5.0	Limits (%ile) Maximum 95.0	Range (%ile) Low 2.5	Range (%ile) High 97.5
Frwd Func Reach - acromial process to pinch {1b}	24.9	22.4	27.5	21.9	28.0
Elbow-to-Fist Length {22}	14.4	12.5	16.2	12.2	16.5
Elbow Height - Stand {6}	42.0	38.0	45.8	37.3	46.5

The *Elbow Height – Stand* 50th percentile for the mixed group would indicate a 42” workbench height:

- Some shorter individuals would be working in the top end of their power zone range
- Some taller individuals would be working in the bottom end of their power zone range

So for a 50/50 Adult Population Mix, a 42” fixed workbench height could be a reasonable compromise.

We can also provide a foot platform for the shorter workers. Maximum recommended height of a single step foot platform is 6”.

For a fixed height workbench at 42”; a 6” foot platform would be comparable to a 5th percentile female working at workbench height of 36”.

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Honestly, we try to avoid the use of foot platforms based on issues of inadvertently stepping off the platform, need to move the platform in and out of position, etc.; but it can be a viable option when no alternative to a fixed height workbench exists.

Caveats

Higher Manual Handling Force Levels:

The case study was based on light weight (up to 10#) assembly activities. If higher force levels are required (> 10#) to manually lift parts/materials we have to be concerned about requiring shorter individuals to exert force in the upper part or even outside of their power zone, thereby compromising the arms and shoulders. We may need to ***lower the fixed workbench height or reconsider the need for a height adjustable workbench.***

Higher Downward Force Levels:

If a higher downward force is needed (e.g. using a torque wrench, pushing down on a part to get it to seat properly, etc.) ***the recommended workbench height would be 3 to 5" lower than elbow height*** and we would need to modify our interpretation accordingly; fixed height at 37" and adjustable height range of 32" to 44".

Task	Adjustable Height Workbench	Fixed Height Workbench
Precision	40" to 52"	45"
Light assembly	36" to 48"	42"
Heavy assembly	32" to 44"	37"

Precision Activities:

The case study was based on general assembly activities, not those that require a high level of precise hand and eye coordination. For these situations, we need to position the parts/materials at a high enough level to limit excessive tilting the head down to see the activity. We also may want to consider supporting the weight of the arms to unload the neck and shoulders.

In this case ***the recommended workbench height would be 3 to 5" higher than elbow height*** and we would need to modify our interpretation accordingly; fixed height at 45" and adjustable height range of 40" to 52".

Task	Adjustable Height Workbench	Fixed Height Workbench
Precision	40" to 52"	45"
Light assembly	36" to 48"	42"
Heavy assembly	32" to 44"	37"

NOTE: in all cases the actual size/placement of the object on the workbench needs to be considered.

We recognize that "hand work height" is the determining factor; this may be different from the actual workbench height. For example, the object may have 6" of height and the hands may actually be placed 6" above the workbench height to accomplish the task.

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Worksurface front-to-back depth

Now that we have determined specifications for the workbench height let's turn our attention to the worksurface front-to-back depth specifications. We determined two ranges of reach:

- *Frwd Func Reach– acromial process to pinch (1b)* Functional (used to determine workbench configuration for placement of parts bins, tools, etc.)
- *Elbow-to-Fist Length (22)* Comfort (used to determine workbench configuration for performance of assembly tasks)

Here are the metrics we determined for the 5th percentile female.

A1 | Anthropometric Measures -- Adult Population

Anthropometric Measures -- Adult Population

Job / Task Information -- Enter Useful Information in This Box -- See also comments in cells by placing curser over cells marked by red triangle in upper right corner.

Adult Population Mix (%): Men 0, Women 100

Design Exclusion (%): 5

in, lb | Find Values

If units are changed, push Find Values again.

Units: in, lb

Select Dimensions of Interest	Mean 50%ile	Limits (%ile) Minimum 5.0	Limits (%ile) Maximum 95.0	Range (%ile) Low 2.5	Range (%ile) High 97.5
Frwd Func Reach - acromial process to pinch {1b}	24.6	22.4	26.8	22.0	27.3
Elbow-to-Fist Length {22}	13.7	12.2	15.2	11.9	15.5
Elbow Height - Stand {6}	40.4	37.3	43.5	36.7	44.1

and the 95th percentile male

A1 | Anthropometric Measures -- Adult Population

Anthropometric Measures -- Adult Population

Job / Task Information -- Enter Useful Information in This Box -- See also comments in cells by placing curser over cells marked by red triangle in upper right corner.

Adult Population Mix (%): Men 100, Women 0

Design Exclusion (%): 5

in, lb | Find Values

If units are changed, push Find Values again.

Units: in, lb

Select Dimensions of Interest	Mean 50%ile	Limits (%ile) Minimum 5.0	Limits (%ile) Maximum 95.0	Range (%ile) Low 2.5	Range (%ile) High 97.5
Frwd Func Reach - acromial process to pinch {1b}	25.1	22.4	27.9	21.8	28.5
Elbow-to-Fist Length {22}	15.2	13.8	16.5	13.5	16.8
Elbow Height - Stand {6}	43.5	40.6	46.5	40.1	47.0

Considering the basic anthropometric principle of ensuring shorter individuals can appropriately reach, we can use the 5th percentile female data to develop the Comfort and Functional reach criteria.

- For performance of assembly tasks the keep placement of the materials within 14" of the workbench front edge.
- For placement of parts bins, tools, etc.) keep the materials within 22" of the front edge of the workbench front edge.

Caveats

"Jammed in"

Some taller individuals may feel "jammed in" attempting to work within the parameters for the shorter individuals; consideration of moveable parts bins, tool storage, etc. that can be

positioned per the use may be helpful. Also provide enough space on the worksurface that the taller individual can reposition materials manipulated on the workbench to increase the comfort reach zone range based on their particular reach.

Reach Zone Leeway

When comparing the guidelines for reach for standing vs. seated workstation configurations, there typically is greater leeway in establishing reach zones for standing configurations. It is easier to reach a greater distance when standing than when seated.

One Handed Reach

If the reach can be safely and effectively accomplished with one hand, the effective reach zone can be increased by 20 to 25%.

Task Frequency

For reaches that need to be accomplished only on an occasional basis (for example, only a few times an hour) the reach zone range may be able to be extended. With increasing task frequency, greater adherence to the recommended guidelines is needed.

Carts

Cart Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Dimensions: Cart width and depth appropriate to safely contain and transport materials.			
Cart load capacity: Cart capacity matched to loaded cart weight.			
Height – Fixed: Fixed height cart matches height of fixed height workstation. • If used to transport between fixed height workstations and/or stage materials at workstations.			
Height – Adjustable: Able to match cart height to varying height workstations; required cart height adjustment range has been determined. • Use manual height adjustment cart for lighter weight materials (20 lbs. or less) and when minimal height adjustment (less than 6") is needed. • Use powered height adjustable carts for heavier materials (greater than 20#) that require greater than 6" height adjustment.			
Height – Adjustable Spring Loaded: Automatically positions materials (of a consistent unit weight) at a predetermined unload height. • Spring tension of cart height adjustment mechanism calibrated based on product unit weight.			
Platform: Ensure cart platform allows for easy sliding of materials onto/off of the cart platform.			
Casters/wheels: Cart has the appropriate casters/wheels for floor type and use of the cart. **Additional information**			
Handles: Cart handle placement allows for upright body position when pushing/pulling cart. **Additional information**			
Lip: Cart has a lip or other method to contain the materials during transport.			
Cart loading: Cart is loaded in a safe manner (promote a stable cart center of gravity).			
Technique: User adequately trained in handling of cart. **Additional information**			
Shelves: If the cart has shelves, they are properly configured. **Additional information**			
Powered vs. manual cart transport: Determination made if cart needs to be a powered transport cart or if manual transport is adequate. • Consider powered cart when force to push/pull cart is greater than 40 lbs., distance is greater than 100 feet, cart is handled on a ramp, etc.			
Floor surface: Floor surface provides for easy moving of the cart on the surface. This is in conjunction with proper casters/wheels.			
Ramps: Determine if cart use will take place on ramps. • Ensure safe handling of carts of ramps.			

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Casters – Additional Information

Return to Cart Checklist

Required load capacity

- In general, each caster should have the capacity to support one-third of the total load weight; overloading, uneven floors and load distribution may place a heavier burden on one or more casters.

Mobility needs

- The larger the wheel size (and swivel radius), the greater the mobility.
- The type of bearing selected will also improve mobility and reduce rolling resistance.

Environmental conditions

- Check for dust, humidity and temperature extremes.
- Casters with sealed swivels are ideal in areas with sprays or wash-down requirements where there is lint or dust and where extreme quiet is essential.

Other application considerations

- Most casters are rated for "walking speed".
- Higher speed applications require specialized casters to maintain load capacity and dissipate heat buildup.

Determine if caster brakes are needed

- If the cart can roll away when being loaded or stored the caster should have brakes.
- Ensure the brakes are easy to engage and release.

Swivel or fixed position

- Determine if swivel or fixed position swivel casters are needed.
- All four casters with swivel feature will be needed for improved maneuverability in a confined area.
- Two swivel and two fixed casters will be needed for cart transport over longer distances – this allows the cart to be moved in a straight line while still allowing for maneuverability around corners. Position the swivel casters on the handle end of the cart.
- Some casters are able to be locked in a fixed position and then released to swivel.

Handles – Additional Information

Return to Cart Checklist

Cart handle placement allows for upright body position when pushing/pulling cart.

- Recommended fixed handle height is 36” to 38” – ideally needs to be suited to cart use and user population stature.
- Recommended adjustable handle height range is 36 to 46”.
- Ensure cart handle placement allows for normal stride when pushing/pulling cart (not in the way of the feet) – as possible, position the handle 6 to 8” away from the body of the cart.

Technique – Additional Information

Return to Cart Checklist

Line of sight

- Ensure the cart and materials loaded will not restrict the line of sight of the user.
- If line of sight will be restricted, ensure a “spotter” is used.

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One person vs. two person

Determine if the cart can be safely handled with one person or if two are needed.

- Based on force required to initiate and sustain cart movement.

✓ e.g. force to push/pull cart is greater than 50 lbs., cart is handled on a ramp, etc.

- Also consider if the cart should be powered.

Push vs. pull

Typically pushing carts enables improved body mechanics technique than pulling

- Able to make use of "power position" when pushing
- Pulling technique generally places body (spine) in an out-of-neutral position

Exceptions to the rule do exist

- May pull cart over a rough surface or threshold rather than push
- May pull pallet jack rather than push it when traveling for longer distances

Shelves – Additional Information

Return to Cart Checklist

If the cart has shelves, they are properly configured.

- For typical three shelf level cart: (assuming shelf levels at approximately 6", 30" and 54" from the floor):

✓ Place the heaviest items on middle shelf

✓ Place lighter items on bottom and top shelves

✓ As possible refrain from using bottom shelf on a regular basis – difficult to manually handle materials at this low level

Ensure carts are appropriately rated for expected load.

Loading of shelves must not make carts/shelves unstable.

Chairs/Stools

Refer to Office Ergonomics at Rosemount for more details regarding chair/stool use. (NOTE: link will leave current document, taking you to the Rosemount Office Ergonomics website.)

Chair/Stool Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Required: Determination made if a chair/stool is needed at the workstation. Refer to **Workstation Types and Characteristics** for guidelines.			
Height adjustment range: Seatpan height adjustment range matches the worksurface height.			

Worksurface height	*Seat pan height (approximate adjustment range from floor to top surface of seat pan)*
28" to 30"	16" to 22"
31" to 33"	19" to 25"
34" to 36"	22" to 28"
37" to 42"	25" to 35"

Adjustment features: Needed adjustment features have been determined. Features typically include: • Seatpan height, tilt (including rocking tension) and depth. • Back support height and angle. • Armrest height, side-to-side and rotation (if armrests are included). • Foot ring height adjustment for stools.			
Casters: Appropriate casters for floor surface and use. • Hard shell casters for carpeted floors. • Softer, rubberized castes for hard surface floors (concrete, tile, etc.) • Braking casters – if needed to limit chair from "scooting" away from user as they sit down. (Note: casters engage when the chair is NOT in use; in other words when the user is in the chair it WILL roll.			
Base: Five leg base to minimize possibility of chair tipping.			
Foot rest: Foot rest (separate from foot ring on the chair) available for foot support if feet are not on the floor once the seat pan height has been adjusted based on worksurface height. • Typically the Lyon Industrial Foot Rest is used (source: Staples).			
Chair size: Overall chair size suitable for user body stature and size. • May require petite or large/tall chairs for some users.			
ESD and/or Clean room: Determination made if chair/stools needs to be ESD and/or clean room certified.			
Training: User has been adequately trained in adjustment and use. • Critical point – the best chair in the world has limited value with inadequate training.			

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Computer Workstation Guidelines

Refer to Office Ergonomics at Rosemount for more details regarding computer workstation use. (NOTE: link will leave current document, taking you to the Rosemount Office Ergonomics website.)

Computer Equipment (keyboard, mouse, monitor, touch screen) Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Keyboard: Positioned to allow for neutral body and extremity position within reach zone of user. • Seated (height adjustable keyboard support surface): range of 23" to 32" from floor. • Seated (keyboard height not adjustable): fixed height between 28 and 30" from floor. • Standing (height adjustable keyboard support surface): range of 35" to 47" from floor. • Standing (keyboard height not adjustable): fixed height between 40 and 42" from floor.			
Mouse: Positioned to allow for neutral body and extremity position within reach zone of user. • Keyboards available with integrated mouse (roller ball or touch pad). • Range of 23" to 32" for height adjustable mouse support surface (if seated with feet on floor.) • If mouse height is not adjustable, locate it between 28 and 30" high (if seated with feet on floor.)			
Tray – Keyboard/Mouse: Support for keyboard/mouse positioned to allow for **neutral body** and extremity position within **reach zone** of user. • See recommendations above for keyboard and mouse placement.			
Monitor: Able to be positioned by user to allow for neutral head and neck position when the monitor is viewed. Refer to **Displays** for details.			
Eyeglasses: Impact of eyeglasses (bifocals, progressive lenses, etc.) has been taken into account. • e.g., use of bifocals where bottom part of lens is used to view the monitor can result in significant head tip up position with significant stress into neck. • Solutions include: ✓ Lowering monitor. ✓ Progressive lenses, bottom part of lens is for reading hard copy material, middle for monitor viewing and top for distance viewing. ✓ Computer glasses where prescription of entire lens is set for monitor viewing ✓ Bifocals where bottom is set for reading and top is set for monitor viewing.			
Touch Screen: Positioned to allow for neutral head/neck position when viewed and within reach zone (height and distance) of the user: • If accessed when the user is standing, position fixed height touch screens so the middle of the screen is about 60" from the floor. • If accessed when seated, position fixed height touch screens so the middle of the screen is 44" from the floor.			

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Contact Stress:

Contact Stress Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Sharp edge contact stress: Identified and eliminated, solutions include: • Ensure correct position relationship between user and workbench: ✓ Workbench that is too high or low in relation to user can result in sharp edge contact stress. ✓ Adjust position of user or workbench to alleviate the issue. • Radius edge of workbench: ✓ Minimum 1/8th inch is typical recommendation for edge radius to eliminate sharp edge contact stress.			
Hard surface contact stress: Identified and eliminated, solutions include: • Use anti-fatigue mats to reduce impact of hard surface contact stress. • Use of proper foot wear is needed to reduce hard surface contact stress. • Monitor condition of chair seatpan and back support cushions for wear and tear that reduces ability of cushion to provide relief from hard surface contact stress. • Limit exposure to hard surface contact stress through job rotation strategies.			

Contact stress – sharp edge

When the edge of a workstation, tool guard, etc. is in contact with the body in a concentrated manner contact stress – sharp edge is evident. Result can be damage to soft tissue at the area of contact stress due to decrease in blood flow to the area and to increase in mechanical pressure on soft tissue – muscle, tendon, nerve, blood vessel, etc.

Contact stress – hard surface

Sustained contact of a body part with a hard surface such as sustained standing sitting on a hard surface is defined as contact stress – hard surface. Result can be damage to the compressed tissue due to decreased blood flow to the area.

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Controls – Hand and Foot

Refer to Checklist below and **Recommended Specifications for Controls** for additional details.

Hand and Foot Controls Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Foot Controls			
Seated: Foot controls operated from a seated position. Avoid repetitive foot control use from a standing position.			
On floor: Foot controls positioned on floor (rather than foot rest or other platform). • If footrest is used, footrest large enough to allow for foot control and foot on footrest. • Avoid having one foot higher than other.			
Operator controlled: Operator controls positioning of footrest to provide optimal positioning and alternating use between right and left feet.			
Hand Controls			
Precision: Controls requiring precision or high-speed operation assigned to hands, rather than feet.			
One major control: When only one major control operated by either hand or both hands, place in front of operator, midway between hands.			
Handedness: Handedness is important only if the task requires skill or dexterity. If control requires fine adjustment, place control on right, most people (about 90% of population) are right-handed.			
Valves: Locate manually operated hand control valves from 20 to 50 "(range of 30 to 40"is preferred) above floor whenever possible so valve is accessible from a standing position and optimize the force that can be applied to operate the valve.			
Levers: Levers requiring significant force (greater than 5 lbs. force) located at chest level for standing work (range of 46" to 56" from floor) and elbow level for seated work (seated with feet on floor, range of 26" to 32" from floor).			
Levers: Levers installed so they move toward axis of body (rather than away from body) to reduce amount of tension on body.			
Fine adjustment: When controls require fine adjustment, provide support for hand being used.			
Finger operated: For finger-operated controls, provide an armrest, either as part of the seat or on the panel itself.			
Emergency Controls (E-Stops)			
Separate location: Emergency controls and displays physically separate from those used during normal operations.			
Accessibility: Emergency controls placed in locations that are easily accessible.			
Line of sight: Emergency controls and displays placed within 30^0 of the operator's optimal line of sight.			
Special measures: Special measures (guards, color coding, etc.) provided for emergency controls to aid in identification and to prevent inadvertent operation.			

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Recommended Specifications for Control Location

Return to Controls – Hand and Foot

Hand Control Location *(seated workstation)*	Specification		Description
	Max	Min	
Vertical location of infrequently used controls.	55”	21”	Measurement is from floor to centerline of control.
Vertical location of infrequently used but critical controls (e.g. emergency stop).	39”	21”	Measurement is from floor to centerline of control.
Vertical location of frequently used controls.	42”	30”	Measurement is from floor to centerline of control.
Horizontal reach to infrequently used controls.	22”	9”	Horizontal reaches measured from shoulder joint to center of the hand.
Horizontal reach to frequently used controls.	14”	9”	Horizontal reaches measured from shoulder joint to the center of the hand.
Hand Control Location *(standing workstation)*	**Specification**		**Description**
	Max	Min	
Vertical location of infrequently used and/or critical controls (e.g. emergency stop).	65”	33”	Measurement is from standing surface to centerline of control.
Vertical location of frequently used controls.	50”	37”	Measurement is from standing surface to centerline of control.
Horizontal reach to infrequently used controls.	22”	9”	Horizontal reach measured from shoulder joint.
Horizontal reach to frequently used controls.	14”	9”	Horizontal reach measured from shoulder joint.

Conveyors

Conveyor Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Configuration: Conveyor configuration (dimensions) based on amount and size of materials transported on conveyor to adequately convey and contain materials.			
Height and reach: Conveyor height and reach allows operator to work from neutral position while standing: • Fixed height: 30" (need to consider influence of height and shape of material conveyed on the final actual conveyor height). • Adjustable height: range from floor 30" to 40", accommodates 5th percentile female to 95th percentile male (need to consider influence of height and shape of material conveyed on the final actual conveyor height). • Reach zones for repetitive reaching to the conveyor within 18" of the front of the operator's body.			
Foot clearance: Adequate clearance for feet at floor level. • Commonly known as a "toe kick", allow for 6" of vertical and horizontal clearance at floor level.			

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Displays/Monitors

Return to Computer Workstation Guidelines

Refer to Office Ergonomics at Rosemount for more details regarding display/monitor use.
(NOTE: link will leave current document, taking you to the Rosemount Office Ergonomics website.)

Displays/Monitors Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Displays (montiors, touch screens, etc.) positioned to allow for neutral head, neck and arm position.			

Recommendations for Display Location – Seated and Standing

Return to Computer Workstation Guidelines

Display Location (seated station)	Specification	Description
Height of monitors (single monitor)	Maximum: 50" Minimum: 37"	Measured made from floor to top of screen.
Height of video display terminal (stacked monitors)	Maximum: 55" If 55", tilt downward 15° Minimum: 37" Primary monitor in vertically stacked configuration is bottom monitor	Measured from floor to top of screen.
Height of touch screen monitor	Maximum: 44" If < 40", tilt upward 30^0	Measured from floor to middle of screen.

Display Location (standing station)	Specification	Description
Height of video display terminal (single monitor)	Maximum: 66" Minimum: 52"	Measured from floor to top of screen.
Height of video display terminal (stacked monitors)	Maximum: 72" The primary monitor in a vertically stacked configuration is the bottom monitor.	Measured from floor to top line of screen
Height of touch screen monitor	Maximum: 60" If > 55" allow for 20^0 of downward tilt If < 52" allow for upward tilt of 30° If < 45" allow for upward tilt of 45°	Measured from floor to middle of the screen.

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Environment

Auditory, Temperature and Visual Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Hearing protection: Need for hearing protection has been determined.			
Noise level: Noise level has been measured and is in the recommended range for a productive work environment (54-59 dBA).			
Temperature: Ambient temperature is acceptable for work being performed. Refer to *Type of Work* table below.			
Illuminance: Illuminance level is suitable for type of work performed. Refer to *Guidelines for Illuminance* table below.			
Glare: Glare has been identified and controlled.			

Auditory

Noise levels above 70 dB make verbal communication difficult. Noise levels between 54-59 dBA is the recommended range for a productive work environment. This range will, to some extent mask conversations of others, while speech communication between two employees remains undisturbed.

Noise Exposure Limits

Refer to EHS DP for noise exposure limits.

Temperature

Recommendations for Temperature

Refer to EHS DP for temperature exposure limits.

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Fixtures

Fixtures Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Appropriate use of fixtures has been identified.			
Method of how the fixtures will be stored has been determined.			
Method of conveying the fixtures to and from the workstation has been determined.			
Method of mounting fixtures at the workstation been determined.			
Fixtures position units with user reach and height zones.			
Fixture allows free and clear access to insert/remove parts physically and visually (if needed).			

A fixture is a work-holding or support device used in the manufacturing industry. What makes a fixture unique is that each one is built to fit a particular part or shape. The main purpose of a fixture is to locate and in some cases hold a work piece during either a machining operation or some other industrial process. A jig differs from a fixture in that it guides the tool to its correct position in addition to locating and supporting the work piece.

The primary purposes of jigs and fixtures are to:

- Reduce the cost of production
- Maintain consistent quality
- Maximize efficiency
- Enable a variety of parts to be made to correct specifications
- Reduce operator errors

Types of Fixtures:

- General Purpose - They are usually relatively inexpensive and can be used to hold a variety and range of sizes of work pieces (examples: vices, chucks, split collets).
- Special Purpose - They are designed and built to hold a particular work piece for a specific operation on a specific machine or process.

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Floor: Anti-Fatigue Mats/Shoe Insoles

Return to Contact Stress Checklist

Anti-Fatigue Mats/Insoles Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Need for anti-fatigue mats has been identified and incorporated into the workstation.			
Appropriate anti-fatigue mats have been identified and obtained. Criteria for anti-fatigue mats includes: • Sized to provide full coverage for area of standing and walking • Do not have one foot on and one foot off mat – both feet need to be positioned on mat • Thickness and density that provides for cushioning of the feet • Stays in position – does not slide around on floor • Beveled edge – need to limit trip hazard • Suitable for environment of the area ✓ ESD (electro static discharge) ✓ Chemical resistance (surface) ✓ Water drainage ✓ Slip resistance (coefficient of friction)			
Need for anti-fatigue shoe insoles has been identified and incorporated into the shoe program. Criteria for insoles includes: • Proper cushioning for the foot • Shoe size allows enough space for the insoles • Insoles are removable and replaced as they wear out			
A combination of anti-fatigue mats and shoe insoles has been determined to provide the best combination of controlling compression and improving foot comfort when standing/walking. • Shoe insoles used in traffic areas where carts are employed • Anti-fatigue mats used at workstations that involve primarily stationary standing			

What are anti-fatigue mats?

- Anti-fatigue mats are compression absorbing mats placed on the floor surface designed to minimize the impact on the body of sustained standing.

What is the impact on the body of long-term standing?

- Long term standing (greater than 15 minutes of sustained standing with cumulative 2 hours or more over 8 hour period) may result in:
- Potential for increased joint wear and tear due to compression of the weight bearing joints– feet, ankles, knees, hips and spine
- Decreased blood flow to the lower extremities, which in turn increases muscle fatigue
- Blood/lymph fluid tendency to pool in the lower legs, potentially leading to varicose veins
- Subjective reports of discomfort in the feet, legs, back and shoulders

When should anti-fatigue mats be used?

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Sustained standing:

- Area: sustained standing confined to 2 to 3 steps within the area
- Time: 15 minutes and longer
- Cumulative: 2 hours or more over an 8 hour period

Hard floor surface:

- Concrete
- Linoleum tile
- Ceramic tile
- Etc.

Can an anti-fatigue mat be too soft?

- Standing and walking foot stability can be negatively influenced by mats that are too soft.
- Mats that are too soft don't provide enough support and stability for the foot and subsequent joint stability for the ankles, knees, hips and back.

How long do anti-fatigue mats last?

- Depends on usage
- With heavy use may need to be replaced every 1 to 2 years
- Eventually the mat will compress and lose its cushioning capability
- A simple way to assess the need to replace mats is to compare the cushioning effect of the old mat to a new mat; If a significant difference is evident, it is time to replace the mat

Can carts be rolled on anti-fatigue mats?

- Generally carts do not roll well on anti-fatigue mats
- Some mats are designed to be compatible with carts
- These mats tend to be more firm and provide less cushioning benefit
- Refer to mat vendors for additional information

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Grip and Hand Strength

Grip and Hand Strength Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Level of grip and hand strength required to perform the tasks has been identified and is within acceptable limits.			

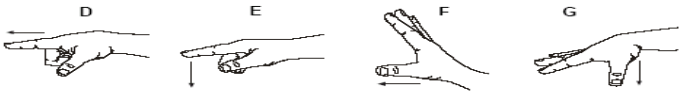
Grip and hand strength criteria

The following guidelines provide criteria for various grasps and hand motions. The values assume neutral postures and easy to grip surfaces. Note: Repetitive – 2 or more times per minute, Infrequent – less than 2 times per minute.

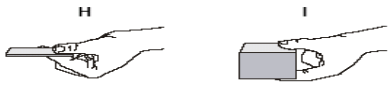
Grip and Hand Strength Illustrations

Criteria	Freq	Force (Max)	Description
A. Power Grip	Rep	4 lbs.	Grasp with full hand, typically with thumb overlapping the first finger.
	Inf	20 lbs.	
B. Pinch Grip	Rep	2 lbs.	Grasp with finger tips only, typically with fingers and thumb not touching.
	Inf	9 lbs.	
C. Key Grip	Rep	2 lbs.	Grasp with thumb and side of the first finger.
	Inf	10 lbs.	
D. Push forward with Index Finger	Rep	3 lbs.	Push forward with pad of index finger.
	Inf	15 lbs.	
E. Push down with Index Finger	Rep	3 lbs.	Push down with pad of index finger.
	Inf	15 lbs.	
F. Push Forward with Thumb	Rep	4 lbs.	Push forward with pad of thumb
	Inf	21 lbs.	
G. Push Down with Thumb	Rep	2 lbs.	Push down with pad of thumb.
	Inf	10 lbs.	
H. Pull with Pinch Grip 0.1"	Rep	2 lbs.	Pull toward body with pinch grip using thumb and index finger.
	Inf	10 lbs.	
I. Pull with Pinch Grip 1.6"	Rep	2.5 lbs.	Pull toward body with pinch grip using thumb and index finger.
	Inf	13 lbs.	

Grip and Hand Strength Measures (Gripping)



Grip and Hand Strength Measures (Finger and Thumb Pushing)



Grip and Hand Strength Measures (Pinch-Pull)

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Hand Tool Design and Selection

Tools: Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Tools selected to limit or minimize:			
• Exposure to excessive vibration.			
• Use of excessive force.			
• Bending or twisting wrist.			
• Finger pinch grip.			
• Problems associated with trigger finger (prolonged flexion with forceful exertion).			
Tools powered where necessary and feasible.			
Tools evenly balanced in the hand during use.			
Heavy tools suspended or counterbalanced to facilitate use.			
Tool allows adequate visibility of work.			
Tool handle			
Tool grip/handle prevents slipping during use.			
Equipped with handles of textured, non-conductive material.			
Different handle sizes available to fit a wide range of hand sizes.			
Handle designed to NOT dig into palm of hand.			
Tool used safely with gloves.			
Tool used by either hand.			
Preventive maintenance program to keep tools operating as designed.			
Employees trained:			
Proper use of tools.			
When and how to report problems with tools.			
Proper tool maintenance.			

General tool guidelines

Refer to NIOSH Guide to Selecting Non-Powered Hand Tools

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Machine Clearance and Maintenance Accessibility Guidelines

Machine Clearance and Maintenance Accessibility Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Accessibility			
• Provide openings to components that need maintenance.			
• Provide visual access to permit a view of the maintenance activity.			
• Minimize the number of parts that must be removed to perform maintenance.			
• Consider the physical clearance required for the operator, tool, and equipment components based on anthropometric constraints			
• Locate access on the front, rather than the back, of equipment.			
Machine Guards			
• Guards must provide protection from moving parts and other machine hazards.			
• Guards must require use of a tool for removal.			
Access Doors/Ports			
• Provide access ports that are easy to remove - if possible hinge the covers.			
• Ensure doors/ports do not expose maintenance operators to hot surfaces, electrical currents or sharp edges.			
• Place where the operator can monitor necessary display(s) while making adjustments.			
• Port doors mounted so that the user's hand will not be injured if he or she opens the door too far.			
• Locate the handles of adjacent doors so that they cannot coincide during an opening procedure.			
• Provide stops on sliding doors so that people will not pinch their fingers as they slide a door against another part of the port.			
• Design hinged covers to swing completely out of the way when open.			
• Provide props or locks to secure hinged covers in the open position.			
• Round the corners of covers if they present a hazard.			
Fasteners			
• Use quick-opening fasteners that open with (in order of preference): ✓ Hand (wing nuts, cam latches) ✓ Standard tools (nuts, screws) ✓ Specialized tools • Note: Any machine guards used to provide protection from moving parts or other machine hazards must use a tool for removal.			
• Use captive fasteners; avoid loose nuts and washers whenever possible.			
• Use fasteners that release in fewer than 10 turns.			

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• Design fasteners for covers so that they are easily visible and accessible.			
• Fasteners on access covers easy to operate with gloved hands.			
• Keyhole slots to release screw-type fasteners without completely removing the screw.			
• Mounting bolts and screws that can be turned with either a screwdriver or a wrench.			
• Design cases to be lifted off equipment, rather than equipment to be lifted out of cases.			
• Minimum number of fasteners used.			
• Minimum number of standard fastener sizes used to reduce tool needs and search times.			

Accessibility for Maintenance

- Openings are large enough to permit access of both hands and offer visibility of components.
- Access ports are located so that operators are not exposed to hot surfaces, sharp edges, or electrical currents.
- Access ports are easy to remove, with visible and accessible cover fasteners while still providing adequate machine safe-guarding.
- Circular Hatch, Horizontal Clearance: Min. 30" diameter.
- Horizontal Hatch Clearance: Min. 20" high x 24" wide.

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Manual Material Handling Guidelines

Manual Material Handling Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Weights of loads to be lifted judged acceptable by the workforce.			
Materials moved over minimum distances.			
Distance between the object load and the body minimized.			
Walking surfaces: • Level • Wide enough • Clean and dry			
Objects: • Easy to grasp • Stable • Able to be held without slipping			
Handholds on these objects.			
When required, gloves fit properly.			
Proper footwear worn.			
Enough room to maneuver.			
Mechanical aids used whenever possible.			
Working surfaces adjustable to the best handling heights.			
Material handling avoids: • Movements below knuckle height and above shoulder height • Static muscle loading • Sudden movements during handling • Twisting at the waist • Extended reaching			
Help available for heavy or awkward lifts.			
High rates of repetition avoided by: • Job rotation • Self-pacing • Sufficient pauses			
Pushing or pulling forces reduced or eliminated.			
Employee has an unobstructed view of handling the task.			
Preventive maintenance program for equipment.			
Workers trained in correct handling and lifting procedures.			

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Oregon OSHA Interactive Lifting Calculator

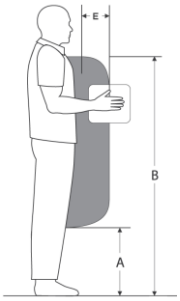
Link to Washington State Labor and Industries and Oregon OSHA lifting calculator.
http://www.orosha.org/interactive/lifting/lift_safety.html

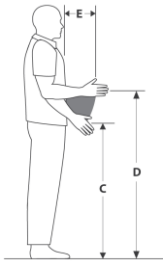
General Manual Material Handling Guidelines

- Load weight should be less than 51 pounds for a single person lift.
- Handle load within the maximum comfort zone.
- Handle load at a horizontal distance less than 12 inches from the body.
- Ideally, the frequency of lifting is once every five minutes or less, and a maximum frequency of 15 lifts per minute.
- Perform lifts without twisting.
- Provide a stable load to reduce balance shifting while lifting or carrying.
- Standing surfaces should be stable and high-friction.
- The load dimensions should allow a comfortable grasp, adequate handles are preferred.
- An optimal handle design has a 0.75 inch diameter, 4.5 inches or more in length, a 2 inch clearance, and has a cylindrical shape with a smooth, non-slip surface.
- An optimal handhold cutout should have a height of 3 inches or more, 4.5 inches in length, and have a semi-oval shape.
- Containers should be 16 inches or less in width and less than 12 inches in height for manual material handling purposes.

Illustration of the lifting zone

(Left=Maximum Lifting Zone, Right=Optimal Lifting Zone)





Recommended dimensions for lifting comfort zone

Criteria	Dimension	Description
A. Maximum Zone bottom	Min. 20"	Minimum height
B. Maximum Zone top	Max. 60"	Maximum height
C. Optimal Zone bottom	Min. 30"	Minimum height in optimal zone
D. Optimal Zone top	Max. 50"	Maximum height in optimal zone
E. Distance from body to hand placement	Max. 10"	Optimal distance in front of the body.

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Microscopes/Magnifiers

Microscopes/Magnifiers Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
User training in microscope/magnifier set-up has been accomplished and user can demonstrate proper set-up.			
Chair has the features needed to allow for neutral body position and support. • Seatpan height and tilt • Back support height and angle • Armrest height and side-to-side • Foot ring to provide for easy access to get onto the chair (if working at bench height worksurface, greater than 30").			
Foot rest available and adjusted to provide for foot support (if working at bench height worksurface, greater than 30")			
Microscope/magnifier eyepiece adjusted to allow for neutral head and neck position.			
Foot pedal (if in use) positioned to allow for comfortable foot and leg position.			

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Neutral Posture

Return to Computer Workstation Guidelines

Question:

What is the foundation of the body?

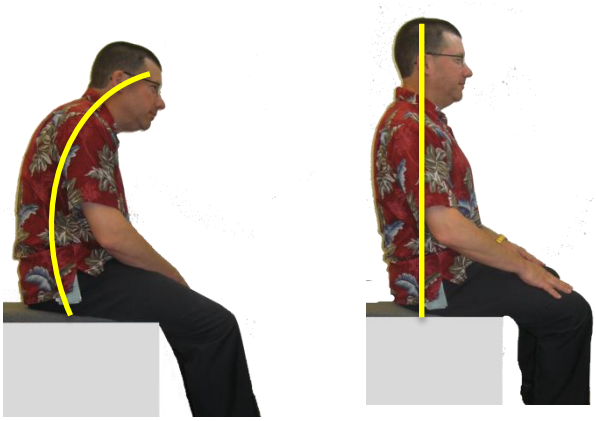
Answer:

Is it your feet? If you sprain an ankle can you still get around? Pair of crutches and away you go!

How about if you "sprain" your back? Now it's a whole different story - a back problem really limits your function.

The foundation or core of the body is the pelvis and spine. How we position ourselves - in other words, our posture - is critically important.

Slouched vs. neutral posture



Consider a person who stands or sits in a slouched posture - putting undue stress and strain into the ligaments, joints, nerves, muscles and tendons. The body is out alignment.

On the other hand, neutral posture provides position and support for the body and limbs in a well-balanced, well aligned position.

True, you can't spend all of your time in neutral but the goal is to spend as much time as you can in this beneficial position.

In fact if you can spend 15% more time in an improved neutral posture for many individuals this can make all the difference in the world!

Spine neutral position

A neutral spine is in an S-shape: inward curves in the low back and neck; outward curve in the mid-back.

The advantage is that this spring like shape is able to better deal with compression and shear stresses in the spine.

Arm/hand neutral position

Neutral is the midrange of joint position. What is neutral for the arms and hands?

For the arms/hands this is with the shoulders relaxed, elbows at the sides flexed to about 90 degrees and the hands positioned with the thumbs pointing up.

Again, it isn't possible to spend all your time in this arm/hand neutral position; but 15% more can help.

Maintaining and supporting reasonable neutral posture for your arms, legs and spine is one of the most important goals of ergonomics!

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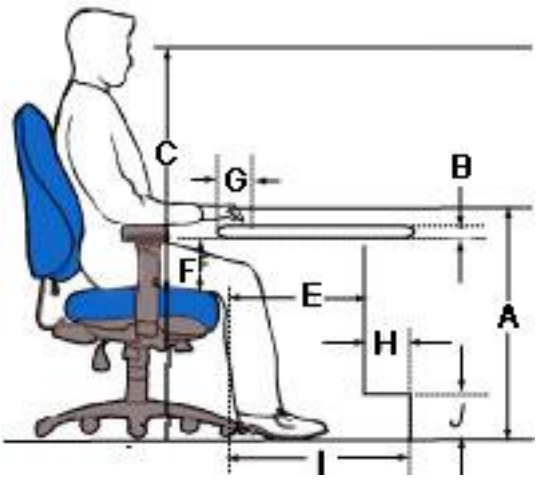
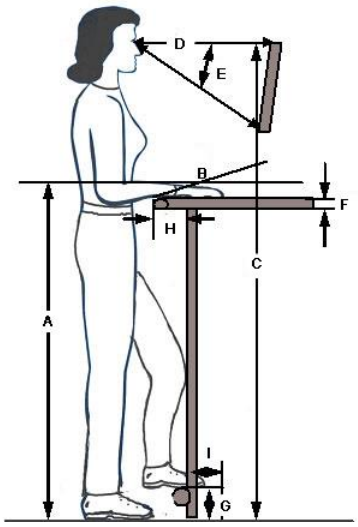
Neutral posture is when the body is in a balanced position or posture with the least amount of effort to function. Each body part has an ideal neutral position:

- Head balanced over shoulders in line with the shoulders and hips.
- Back straight (supported when sitting) with normal curves maintained. When viewed from the side inward curves in the low back and neck and an outward curve in the mid-back where the ribs attach to the spine.
- Hips and knees at a 95^0 to 105^0 angle when seated.
- Hips and knees straight when standing.
- Arms at sides, elbows close to the sides and bent at a 95^0 to 105^0 angle.
- Hands, wrists, and forearms in a straight line; bent no more than 10^0 up or down.
- Feet on floor or supported by a foot rest.

Illustration of Neutral Position at Sitting and Standing Workstations





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Reach Zones (Comfort and Functional)

Return to Computer Workstation Guidelines

We define two Reach Zones: Comfort and Functional.

Comfort Reach Zone

The Comfort Reach Zone is the area that can be easily be reached within the length of the forearm, with the elbow at the side.

The vertical aspect of the Comfort Reach Zone is from waist to mid-chest height with elbows at the sides within reach of the forearms.

Hand activities like keyboard use, assembly and forceful exertions are accomplished in the Comfort Reach Zone.

- Keyboard/hand writing, etc.: at elbow height.
- Precise assembly requiring good visual access: 4 to 6” above elbow height.
- Forceful downward exertion: 4 to 6” below elbow height.

Functional Reach Zone

The Functional Reach Zone is the area that can be reached by extending the arm from the shoulder to the center of the hand allowing for functional grasp.

- Reach arms forward, from middle of hands to chest is **forward functional reach**.
- Hold arms out in front about shoulder level; this is the **upper limit**
- Hands at sides are the **bottom limit** of reach zone**.**
- Hold arms out to sides to form about a 90 degree angle from the mid line; this is the **side-to-side** reach zone.

All materials, tools, controls, and containers, should be arranged within the Functional Reach Zone whenever possible:

- Place frequently used items near the place of use.
- Store infrequently used items away from the place of use.
- Store items together if they are used together and store them in the sequence in which they are used.

NOTE: refer to the Anthropometry Section for specific information regarding reach zones.

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Shelves and Racks

Shelves Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Shelf and rack configuration (height and depth) has been determined based on shelf access and shelf content size/weight. Typical guidelines include: • ***Lowest shelf:*** no lower than 20" from the floor • ***Highest shelf:*** no higher than 60"from the floor • ***Most frequently accessed shelves:*** between 30" and 50" from floor • ***Least frequently accessed shelves***: between 20" to 30" and/or 50" to 60" from the floor • ***Heaviest materials:*** shelves between 30" and 40" if materials handled manually; NOTE: This places the item in the power range of the operator (about waist level) **OR** heaviest materials stored on lowest shelf if items can be slid off the shelf onto a cart at that height • ***Content size:*** shelf size (width and height) allows free movement of materials on/off shelf			
Weight of materials stored on shelving determined and is within recommended weight capacity of the shelving system.			
Shelves secured to eliminate any possibility of tipping over.			
Gravity flow shelving/rack systems used appropriately to position materials at front of the shelf for easy access. Pay particular attention to loading height of the shelf as it will be higher than the unload height.			
Based on changing circumstances, shelf systems designed to be easily re-configured to minimize excessive lifting, carrying, and awkward postures.			
Labels on shelves used to readily identify items stored on the shelves. • Sans Serif fonts recommended (does not have the small projecting features called "serifs" at the end of strokes) • At a recommended reading distance of 14" to 18" and visual acuity of 20/30, font size of at least 14 points. • High contrast between label letters and background (e.g. black letters on white background) • Use of colored labels considered to improve visual discrimination between different materials stored on the shelves			
Any lip on the edge of the shelf safely contains material on the shelf but does not significantly limit movement of materials on/off the shelf			
The material of the shelf itself allows for easy, friction free movement on/off the shelf. For example, shelves covered with high density polypropylene sheets.			
Wheeled shelving allows for easy movement and maneuverability. See Carts for additional information.			

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Workstation Types and Characteristics

Workstation Checklist			
"NO" answer indicates need for additional investigation.	YES	NO	NA
Configuration			
Workstation configuration has been determined (sit, stand or sit/stand). **Workstation Selection Characteristics**			
Seated workstation guidelines have been identified and incorporated into workstation design. Includes seated worksurface heights and seated workstation dimensions.			
Standing workstation guidelines have been identified and incorporated into workstation design. Includes standing worksurface heights and standing workstation dimensions.			
The work space allows for full range of movement.			
Mechanical aids and equipment are available.			
Height of the work surface adjustable.			
Work surface can be tilted or angled to provide improved access.			
Is the workstation designed to reduce or eliminate: • Bending or twisting at the wrist? • Reaching above the shoulder? • Static muscle loading? • Full extension of the arms? • Raised elbows?			
Workers able to vary posture.			
Hands and arms free from sharp edges on work surfaces.			
Armrest provided where needed.			
Footrest provided where needed.			
Floor surface free of obstacles and flat.			
Cushioned floor mats provided for employees required to stand for long periods.			
Chairs or stools easily adjustable and suited to the task.			
Task elements visible from comfortable positions.			
Preventive maintenance program for mechanical aids, tools, and other equipment.			

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Workstation Selection Characteristics for Sitting and Standing Workstations

In terms of worker position, the type of work performed generally determines workstation design: *seated or standing*.

Apply the specific workstation characteristics noted in the table to help select the appropriate working posture for various tasks. When both seated and standing conditions apply, design according to the standing workstation criteria.

Return to Chair/Stools Checklist

Workstation Characteristic	Configuration	
	Sitting	**Standing**
		
Side-to-Side Movement	Within seated workspace	Frequent movement outside of comfort zone
Task Duration	Sustained, > 5 minutes at one time	Intermittent, < than 5 minutes at one time
Hand Heights	< 6” above surface	> 6” above surface
Weight Handled	< 5 lbs	> 5 lbs
Reaches	Within Comfort Zone (within 12”)	Forward reaches of ≥ 12”
Forces Exerted	< 5 lbs	Downward forces of > 5lbs
Clearance	Seated clearances for legs and feet are met	Knee clearance < 18” or foot clearance < 22”
Manipulation	Fine manipulation	Fine manipulation not required
Use of Feet	Foot pedals are used	No foot pedals are used

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Seated workstations	Standing workstations
• A high degree of precision is required (fine manipulation and visual attention). • Feet are used for control operations. • All tools and materials can be easily supplied and handled within the reach envelope. • The job consists of long work periods (over 5 minutes). • Hands are not required to work more than 6 inches above the work surface. • Low forces are exerted (weights are less than 10 lbs.).	• The work requires frequent high, low, or extended reaches outside of the comfortable arm reach envelope (more than 12 inches). • Frequent walking is required. • Large forces are exerted or heavy weights are handled (objects weighing >10 lbs). • It is impossible to provide leg room for a seated operator (less than 18 inches of knee clearance and less than 19-24 inches of foot clearance). • Frequent movement between various workstations (every 5 minutes or less). • Intermittent task duration. • Items are handled more than 6 inches above the work surface. • Downward forces of more than 10 lbs are required.

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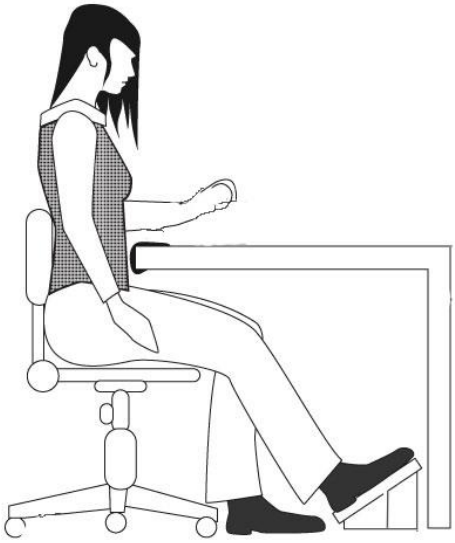
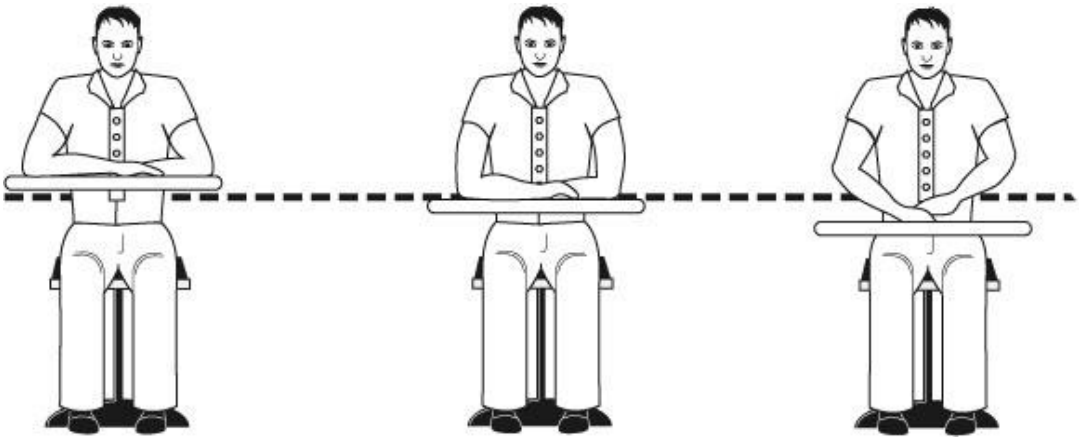
Seated Workstation Guidelines



- All items required for the work should be located within the reach zones (not on the floor).
- Handling of items should be limited to no more than 6 inches above the work surface.
- Large forces (> 10#) should not be required.
- A good chair with a high degree of adjustability should be provided.
- Proper clearance beneath the work surface for legs and toes is necessary.
- Sufficient thigh clearance between the seat pan and the underside of the work surface is required.
- Reaches above shoulder level should be kept to a minimum.
- Padded forearm rests should be provided along the edge of the table.
- Foot rests, preferably adjustable, should be provided.
- Workplace layout should minimize twisting at the waist.
- Seated work height should be based on resting elbow height with relation to the work surface.

Illustration of seated work surface heights

(Left to right: precision work, light assembly, manual work)



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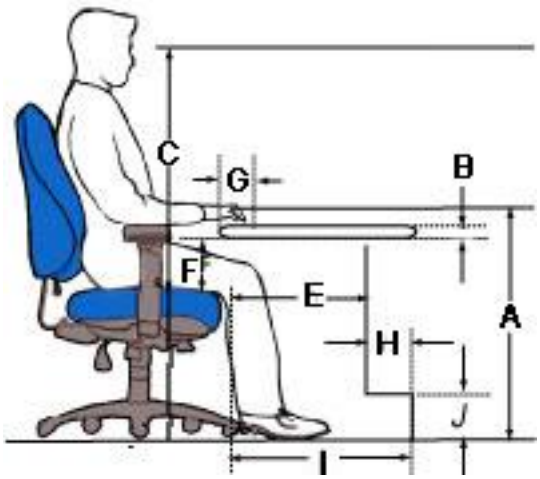
Seated Workstation Specifications

Illustration of seated workstation dimensions



Seated workstation dimensions

Criteria	Dimension		Description
A. Worksurface height	Adjustable Worksurface	Fixed Height Worksurface (with chair/ footrest)	Distance from the floor to placement of hands on the work surface.
• Precision work	26” to 36”	34”	NOTE: This may not be the actual worksurface height - it reflects the hand work height based on size of the object.
• Light assembly	22” to 32”	29”	
• Manual work	20” to 28”	26”	
B. **Work surface thickness**	Fixed: 46”		Allows for thigh clearance.
C. Screen height	Maximum of 2”Adjustable: 44” to 50”		Distance from floor to top of screen.
D**. Knee space - width**	Minimum of 20”		Side-to-side clearance for legs.
E**. Knee space - front to back**	Minimum of 16"		Allows for knee clearance. .
F. Thigh clearance	Minimum of 8”		Seatpan top to undersurface of the worksurface.
G. Distance to work	up to 4”		Front of worksurface to hand work position.
H. Foot space depth	Minimum of 4”		Allows for foot clearance.
I. Distance for toe clearance	Minimum of 20"		Allows for foot clearance with legs extended.
J. Foot space	Minimum of 4”		Allows for foot clearance.

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Standing Workstation Guidelines

Illustration of standing workstation features

If the same workbench will be used by a variety of workers, then apply one of these approaches:

- Provide a height adjustable workbench.
- Design the height of the work surface to accommodate the taller worker and provide platforms for the others to stand on.
- Adjust the height of the work on the workbench with a lift or platform.
- Work height should be based on resting elbow height and the type of work being performed.
- Provide footrests, preferably adjustable, to reduce low back fatigue.
- Locate the foot rail 6 inches off the floor.
- Minimum foot rail length of 24 inches.
- Provide anti-fatigue mats if standing on hard surfaces for long periods of time is required.
  - At least ½ inch thick.
  - Interlocking edges for securely joining adjacent edges.
  - Beveled edges to eliminate trip hazards, prevent curling, and easy cart access.
  - Cleanable.
- Avoid the use of foot pedals. If necessary, then provide a support stool to avoid over use of one leg for support.
- If large forces must be exerted, then design to allow pushing rather than pulling. The standing worker's arms have more power when pushing.
- Even though the standing operator is free to move about, design the workplace to eliminate:
  - Strained head positions because of visual requirements.
  - Stooping and bending.
  - Twisting of the body.
  - Excessive reaches.
- Provide at least 5 inches for knee clearance, with an additional 6 inches for toe clearance.

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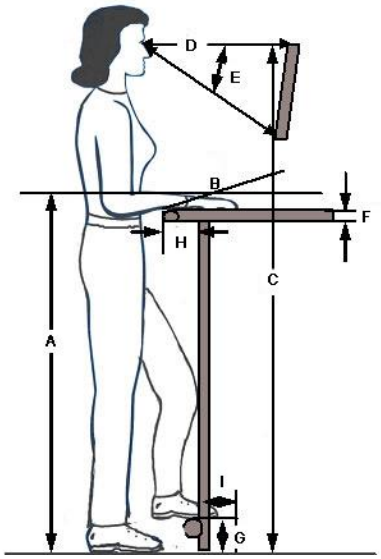
Standing Workstation Specifications

Illustration of standing workstation dimensions



Criteria	Dimension		Description
A. Height	Adjustable Height Workbench	Fixed Height Workbench	Distance from floor to height on the workbench at which the hands will accomplish the task. NOTE: This may NOT be the actual height of the worksurface. Dependent on size and placement of the object, etc. on the worksurface. Defined as the 'hand work height"
• Precision	38" to 48"	44"	
• Light assembly	36" to 46"	40"	
• Heavy assembly	26" to 40"	36"	
B. Inclination	Adjustable from -5° to 35° (-) = away from operator (+) = towards operator		Inclination of work surface. Inclined work surface will present the materials closer in the user's reach zone.
C. Screen height	Adjustable screen: 56"-72" Fixed: 54"		Floor to top of the screen.
D. Viewing Distance	18-30"		Distance from eyes to screen.
E. Viewing Angle	0° - 35°		Adjusted by user as indicated
F. Worksurface edges	At least 1/8" radius on the worksurface edge		Eliminate any issue of contact stress.
G. Foot rest height	Min 4"" off the floor		Floor to foot position.
H. Knee clearance	Minimum of 5"		Allows for knee clearance.
I. Foot clearance	Minimum of 4"		Allows for foot clearance.

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Sit/Stand Workstation Guidelines

Guidelines for sit/stand workstations are similar to those for standing workstations with a few modifications listed below.

Sit/Stand Workstation Adjustability:

- Minimum height range from floor to top of work surface or keyboard is 36 to 48 inches.
- The recommended height for tasks involving large-size products or drawings is 44 inches above the floor.
- For tasks that can be done while sitting or standing, the recommended work surface height is 42 inches above the floor.
- Work surface should be height adjustable in 1 inch increments or less.
- Height should be easily adjusted by multiple users (crank, pneumatic, etc.).
- Adjacent work surfaces should have the same range of height adjustability.
- Furniture legs, supports, or posts should not impair movement between these surfaces.
- Computer and work surfaces should be free standing and easily height adjustable by each user.
- Enough clearance should be allowed between adjoining surfaces to avoid pinching fingers during adjustment.
- If computer work surface is not easily height adjustable:
- Computer monitors should be on articulated monitor arms for easy adjustability.
- Keyboards should be on adjustable keyboard trays or articulating arms.
- Use a height adjustable chair at high workstations when adequate leg room is provided and when the task can be performed while either sitting or standing.
- The support stool is designed for use at high workstations with inadequate leg room to support standing or where regular changes in work position are required.

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Appendix A: Glossary

Anthropometry: The measurement of the dimensions, and certain other physical characteristics such as weight and centers of gravity, of the human body as a whole or of its segments.

Clearance dimensions: The dimensions of a workspace required to provide appropriate space for body members to maneuver without interference from surrounding structures or equipment.

Contact point or Pressure point: A body site at which an item of workplace equipment or a tool exerts pressure on the tissues. Soft tissue sites are of most concern to ergonomics since the compression of the tissue can occlude blood vessels, irritate nerves and tendons, or damage the muscle tissue itself.

Dynamic work: Work activities involving movement and thus requiring the muscles to both contract and relax during the activity.

Elbow height: The anthropometric dimension referring to the height of the elbow above the floor when the arm is hanging relaxed at the side of the standing individual.

Elbow rest height: The anthropometric dimension referring to the elbow above the seat surface when the upper arm is hanging relaxed and the elbow is bent so that the forearm is parallel with the floor.

Ergonomics: The scientific study of the relationship between humans and their working environment.

Extended reach radius: The area that can be reached by extending the arm from the shoulder.

Fixed work posture: A work posture that does not permit the operator to freely change position so as to relieve postural stress. Fixed postures tend to statically load muscle groups since movement of the body segments and/or trunk is inhibited.

Foot-candle: A unit measure of illumination striking a surface. On foot-candle is equivalent to one lumen per square foot.

Functional reach or "dynamic" reach: An anthropometric dimension representing the arm reach capability when the body is allowed to bend and/or rotate at the shoulder and hips so as to extend the reach beyond that obtainable when the body is in a static or fixed posture.

Normal reach radius: The area that can be conveniently reached with a sweep of the forearm, with the upper arm hanging in a natural position vertically at the side. All materials, tools, controls, and containers should be arranged within the normal reach radius whenever possible.

Normal work area: The area in front of the worker which can be used for work with a normal expenditure of effort.

Power grasp/grip: A grasp in which the hand wraps around the handle being grasped. In the power grasp the thumb aligns the hand with the long axis of the forearm and the wrist assumes a slight ulnar deviation. The power grip provides more than five times the gripping strength of a precision grip.

Precision grasp/grip: A grasp in which the object is held by the force of the thumb vs. the first (or first and second) finger(s). It provides precise aim but has limited strength.

Reach envelope: The surface in space centered on the left/right midline plane of the body representing the reach capability of the population percentile of interest. The envelope may be described as a functional reach envelope.

Viewing angle: The angle, either vertical or horizontal, at which the worker views the task measured from the center line of the horizontal line of sight when the operator is looking straight ahead.

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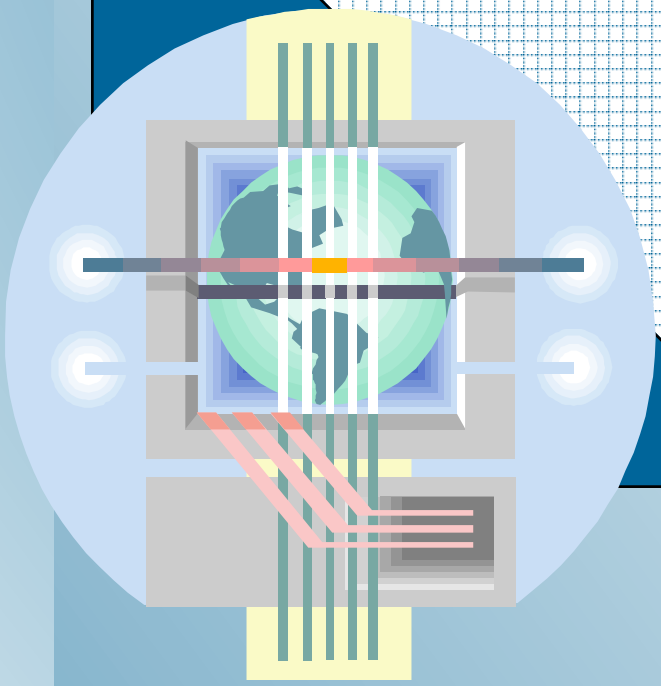
Office Ergonomics

A Practical Approach to Office Ergonomics



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A Practical Approach to Office Ergonomics

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INSTRUCTOR'S BIO

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Mark Anderson is certified as a professional ergonomist by the *Board of Certification in Professional Ergonomics (www.bcpe.org).*

His background also includes licensure as a physical therapist. He has consulted in ergonomics for over 20 years.

Anderson has developed and implemented ergonomics strategies for a wide range of companies and organizations. *(Tennant Company, Emerson Process Management, General Electric, Alliant Techsystems, Quaker Oats, Pepsi-Cola, General Mills, Bluestem Brands, Bureau of Engraving and Printing, Panama Canal Commission, United States Navy and Marine Corps, United States Customs Service and state and local governments.)*

With an emphasis on a systems approach to ergonomics, Anderson has worked with architectural and engineering design firms to integrate ergonomics principles into the design process.

Adding the elements of ergonomics (*Work Physiology, Engineering Psychology, Epidemiology, Anthropometry and Occupational Biomechanics*) as part of the design equation enhances the effectiveness of the overall process and final outcome.

Anderson has written a number of publications and spoken nationally and internationally on ergonomics. He is active in the Upper Midwest Chapter of the Human Factors and Ergonomics Society serving as the secretary and past co-program chair.

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CHAIR

Objectives of chair

- Support body and limbs to provide relief from weight bearing.
- Provide a stable base or platform for the body and limbs.
- Position the user at the correct height and reach relationship to the worksurface and tasks at hand.
- Allow for easy change in position/movement of the user.

Types of seating systems

A number of seating systems are available in the office workplace and include office chairs, stools, lean platforms and other miscellaneous seating.



Without question the traditional office task chair is the most commonly used seating system in the office workstation.

Chair criteria

In the office environment, the type, use and efficiency of the chair are critical elements. The acceptable chair criteria is determined by the type of job activities performed, the size and shape of the user and the duration of time spent in the chair. These criteria are typically considered necessary for an adequate office task chair (Note: First we will discuss the chair's feature and then will go through chair feature adjustment based on the user's specific needs.):

Legs

Minimum 5-point support system for the chair legs. This is specifically intended to reduce the likelihood of inadvertently tipping over the chair.

Casters

Appropriate casters for the floor surface – hard caster on a soft surface such as carpet, soft caster on a hard surface such as tile.

Seatpan

Height, tilt and tension adjustability needs to be suited for the individual user's body segment length and size.

- If the height of the seatpan is not fixed, the type of mechanism to raise or lower the seatpan could be spin up/down but in a modern chair will be a gas pneumatic cylinder.
- A seatpan slide is also a recommended feature. This allows for the apparent depth of the seatpan to be changed to fit the user.
- The seat pan height and angle establishes the relationship between you, your work surface and the floor
- The seat pan tension allows you to adjust the seat so that you are stable in your chair. The seat pan tension provides a balance between adequate support and movement in the chair.

Back support

Adjustable back support height and angle needs to be suited for the individual user's body segment length and size.

- The back support angle and height influence the angle between your upper and lower body as well as your relationship to your work surface.
- The back support angle allows you to adjust the lumbar support built into the back support so that it can comfortably support your upper body weight.

Cushion

Suitable cushion - in terms of foam density, wearability and breathability, type of material (fabric or rubberized) - for the seatpan and back support should be in the chair. A number of chairs have introduced web or mesh fabrics in place of the traditional cushion.

Armrests

Armrests may be used to support the weight of the arms and upper body. If used, the armrests need to be adjustable in height, lateral position and axial rotation. (Non-adjustable armrests on office task chairs are essentially non-functional.)

- The armrest adjustments allow you to position the armrests where they will provide adequate support for your arms and shoulders in neutral postures.

Adjustment levers/knobs/controls

Adjustment levers/knobs/controls for the chair should generally be within easy reach of the user when seated in the chair. The levers should be easy to manipulate and not be so complicated that they discourage use.

Cervical support

Additional modifications are possible for chairs. In some situations the user may require cervical and head support in addition to mid and low back support.

Exercise ball chairs

Therapeutically, exercise balls have been used in clinical settings as treatment modalities to improve spinal stability. Over the past several years, the use of exercise balls in the workplace in place of or in addition to task chairs has taken place. At this point, primarily only anecdotal evidence exists to support the full-time use of them. Most ergonomists continue to advocate for properly sized and properly adjusted office task chairs rather than the use of ball chairs.

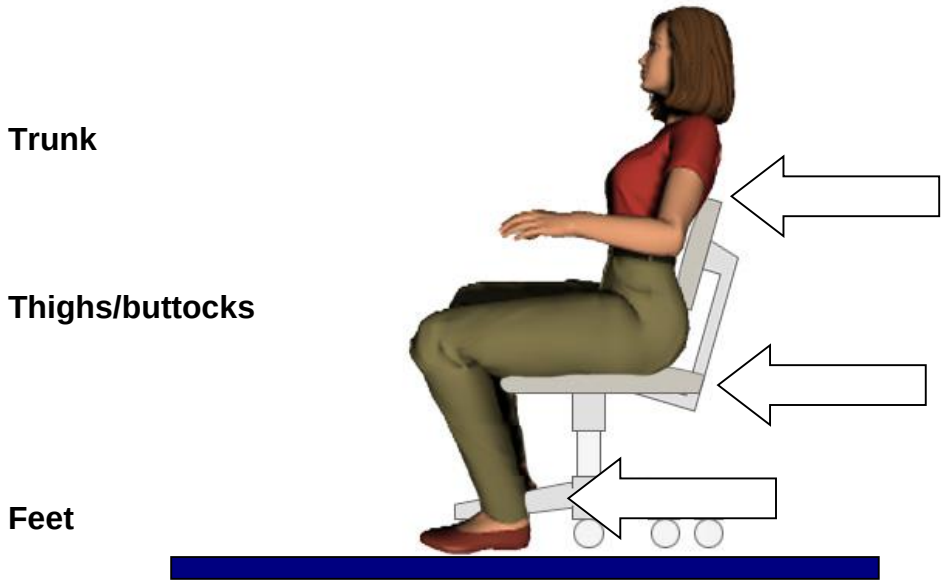
Micro-breaks

Recalling that frequent and regular body movement is one of the ergonomics principles the 30/30 Rule of Physical Movement (physically active micro-breaks 30 seconds in length taken about every 30 minutes) is supported by research to reduce tissue compression and joint stiffness, enhance circulation and overall improve comfort levels.

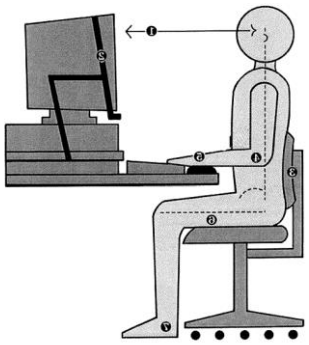
Art of sitting

The body is not designed to sit - particularly for long periods of time. Studies have determined that even when seated in well-supported postures, individuals want to move to gain relief within a few minutes. Let's cover the art of sitting.

Three point contact



90/90 seated posture?



You probably have seen illustrations of an office workstation where the person is seated at the chair with their hips and knees at 90 degrees.

In all practicality very few people actually sit this way.

A much more commonly accepted seated posture is 105 to 110 degrees at the hips and knees. Let's take a look at how people sit.

Sitting styles

Sitting styles can be quite varied from person to person. Let's look at some potentially problematic sitting styles:

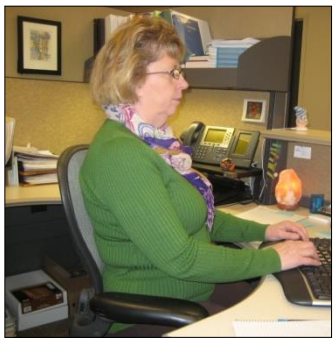
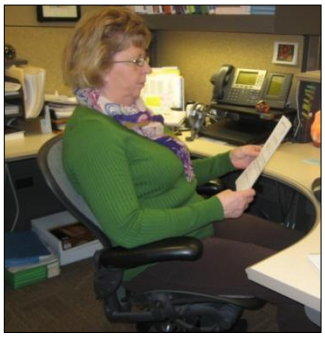
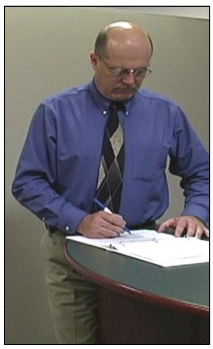
 **Percher**	 **Sloucher**
 **Sit crossed leg**	 **Sit on leg**

The particular sitting style observed needs to be assessed to determine why it is being used. It may be a habit that has been developed over time; it may be in response to a poor workstation setup or a combination of both.

What drives the problem is the frequency and duration of the seated position. If the individual only occasionally sits in an undesirable position it may not be a concern; however if that is their habitual manner of sitting it could lead to problems.

Functional seated positions

A general guideline in the art of sitting is to provide for different acceptable seated postures that a person can rotate throughout the day on a regular basis. They can include:

		
Upright Keyboard Position	**Semi-reclined Conversation Position**	**Standing***

(* We recognize this is not a seated posture but it makes the point that an individual needs to get out of the chair and either stand or walk around the work place on a regular basis.)

Adjustment anxiety

Chairs can be pretty expensive. They can have all kinds of bells and whistles. So, let's see what this baby will do! It seems that the answer is nothing until we do something to the chair.

Sometimes we overemphasize what a chair can do, and forget to emphasize what it is we need to do to make it work. The truth is that a chair is only as good as what we choose to do with it.

Some people have never adjusted their chair? They just sit down and go to work. The bottom line is people need to be able to adjust their chair to fit them as well as throughout the day to provide the body with a break.

Chair solutions

Manual

Look for the chair manual for specific information about the chair or to talk to someone who handles chairs in the work area. Better yet, just start playing with the adjustments. Most people learn best by the "hands-on" approach anyway.

Position and support body in neutral

Here is a series of steps along with tips and techniques when adjusting chairs:

- Adjust the seat pan/back support tension to hold body in a solid neutral position.
- Adjust the pan seat height to get feet on the floor with even pressure on hips and thighs.
- If feet do not touch the floor adjust the seat pan height to get feet on the floor with even pressure on hips and thighs – if still not possible to get the seatpan low enough a footrest will be needed. Another option is replace the chair with one that will go low enough.
- Adjust the height and angle of the back support to fill in the low back curve.
- Add a back cushion to provide better support for spine – *although many times this means the chair does not fit right and a replacement chair may need to be considered.*
- If needed, add a seat cushion to elevate the user to a more appropriate height – *although many times this means the chair does not fit right and a replacement chair may need to be considered.*
- If the back of knees run into the front of the chair see if a back cushion to move the body forward on the chair and still have adequate back support, will work. Firmly fix the cushion to the chair, one way to do this is with Velcro tape. A*lthough many times this means the chair does not fit right and a replacement chair may need to be considered.*
- For the case where hips and thighs don't fit on the seat - the seat pan is too short or too narrow; see if you can find a chair that better fits.
- If the armrests are adjustable, see if they can be adjusted to provide neutral support for .the arms based on particular job tasks.
- Build up the armrests by putting pads on them if more height is needed.
- If you identify maintenance problems with the chair make sure you contact the appropriate people in your organization to get them taken care of.

Remember, no matter how perfectly you can adjust your chair to fit you; it still comes down to the fact that you need to move on a regular basis to keep your body healthy and safe.

Chair		Issue	Comment	Recommendation
Chair ID		No Yes	❑ Chair fit/adjustment OK ❑ Chair not properly adjusted ❑ Back support not OK ❑ Armrests not OK ❑ Chair too small ❑ Chair too large ❑ Maintenance issue (comment) ❑ Other (comment)	❑ None ❑ Chair adjusted with instructions provided ❑ Replace chair - refer to Recommended Specifications ❑ Repair chair (comment) ❑ Other (comment)
Legs	4 / 5 / 6			
Casters	Carpet/Hard surface			
Seatpan	Ht/Tilt/Tension/Slide			
Back	Ht/Angle			
Armrest	Ht/Side/Rotate			
Fit	OK No/Yes			
Maint Issue	No/Yes			

WORKSURFACE

Worksurface objectives

The objectives of the worksurface include:

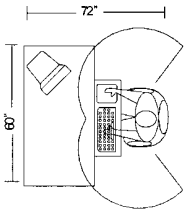
- Provide functional workspace (depth, width)
- Support and position equipment
- Provide access to work materials
- Achieve the desired relationship match between user/work

Types of workstation layouts

Three types of workstation layouts are typically recognized.

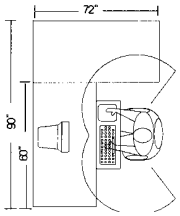
Straight line (desk/table)

The **straight in-line** configuration is suited for single task activities with minimal reach requirements for other office equipment and materials.

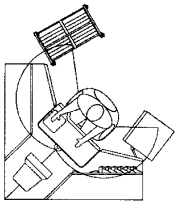


L-shape (two work surfaces)

The **L-shaped** configuration is suited for single to multitask activities that require two or more separate workspaces. For example, one workspace may be used as the computer workstation and another as a writing or collating workstation.



Corner/Cockpit (middle with two side pieces)



The **corner/cockpit** configuration is well suited for multitask activities in the same workspace with significant requirements to frequently reach other office equipment and materials.

Worksurface adjustability (height and angle)

Height and angle adjustability of the worksurface can be a critical component. In general terms, three different types of worksurface adjustability are recognized:

Fixed

We admit by definition ***fixed*** means nonadjustable, but we need to include it in our discussion. An example is the traditional desk at a fixed worksurface height of 29 inches. There are literally millions of these types of worksurface in workstations. In this case ***fixed*** means that they are not designed to be changed in height or angle.

We should note that it is generally possible to raise a fixed height worksurface on supports but also generally very difficult to lower it. (Although we have been known to actually cut off legs off traditional desks!)

Fixed/adjustable

An example of a ***fixed/adjustable*** worksurface is a wall panel mounted systems where the worksurface is hanging on the wall panel or a worksurface on legs where the height can be adjusted by loosening screws and sliding sleeves up or down in the legs.

These worksurfaces are termed ***fixed/adjustable*** because they can be adjusted within a given range but once adjusted they are fixed in that position and not readily moved.

Adjustable/adjustable

Adjustable/adjustable indicates that the user – as needed throughout the day - can readily and easily adjust the worksurface.

Examples of these worksurfaces are sit/stand workstations that are controlled by mechanical springs or powered mechanisms.

Other Considerations

Other considerations for the worksurface include:

- Eliminate a sharp edge by specifying a rounded or radius edge of the worksurface
- Reduce glare by providing a non-glare surface of the worksurface
- Enhance durability through proper construction and use of materials.

Worksurface solutions

Wrong desk height

Here are some possible solutions if the issue is the wrong desk height in relation to the position at desk:

- If work height is adjustable, adjust it. For example modular work surfaces that can be adjusted on the wall panels or a stand-alone desk that can be adjusted.
- A simple option is to raise the height of the work surface by putting it up on a couple of blocks. (Just make sure that the desk or work surface is solidly placed on the blocks and won't fall off.) It may be advisable to get maintenance or someone else to help do it safely.
- An option is to adjust chair height. Once again, make sure the feet are supported either on the floor or with a footrest.
- Add a height adjustable keyboard tray mounted underneath the work surface.

Not enough layout space

Occasionally, or possibly quite frequently, there is not enough space on the worksurface to lay out materials. Now, one option is to get a bigger desk, and a bigger office.

Assuming that this is probably not a realistic option, we may need to be a bit more creative.

- Try a little house cleaning and see if this frees up more available space on the desk.

- Look around to see if there are other worksurfaces available for use, for example a file cabinet at a standing height to review documents or perform other work. If there is available space, see if any more worksurface can be added to the workstation. This can be a small worktable.
- If it doesn't need to be readily available, relocate some of the equipment on the desk to see if it provides more space.
- Make use of any pullout drawers already in the desk.
- A computer monitor stand can be added to provide more clearance on the desk.

Sit/Stand Workstations

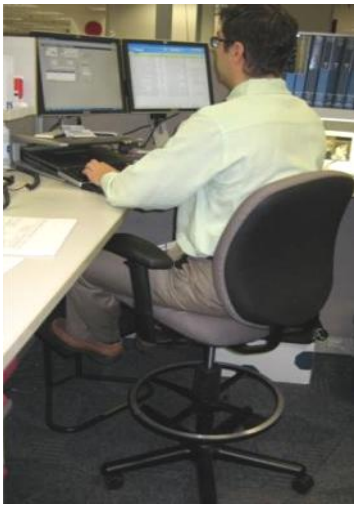
Sit/stand workstations are becoming more and more prevalent in offices these days. Office jobs are very sedentary in nature with resulting negative impact on general health and wellness.

Several options exist for creating sit/stand workstation that range all the way from makeshift ones created by putting boxes on the desk to full-fledged powered sit/stand workstations and other options in between. The same setup principles for office ergonomics in general remain in effect: neutral body position and support, reach zones, control exposure to sustained positions by promoting movement throughout the day, etc. Here are some ways to create a viable sit/stand workstation.

Fixed worksurface at standing height

The correct height of the worksurface when the user is standing at it is determined.

A stool and footrest are provided to allow for an elevated seated position.



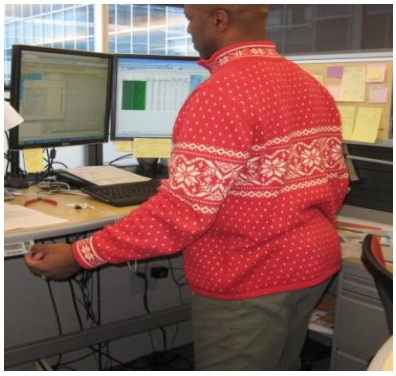
Portable system placed on desk

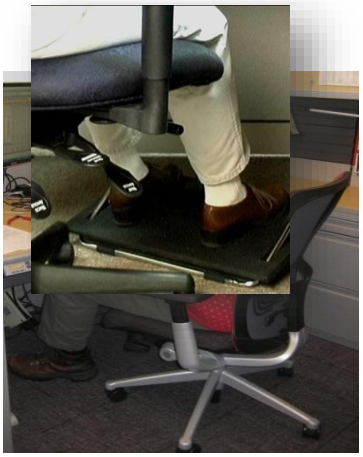
Portable desktop systems are now available to be placed on the worksurface. The system can be height adjusted to alternate

between a seated and standing position.

Sit/Stand workstation

The entire workstation is height adjustable allowing for seated and standing height work positions.





Worksurface		Issue	Comment	Recommendation
Config	Straight/Corner/ L-shape/U-shape	No Yes	❑ Worksurface is appropriate ❑ Worksurface is too low ❑ Worksurface is too high ❑ Worksurface does not have enough work area. ❑ Other (comment)	❑ None. ❑ Lower worksurface - see Recommended Specifications ❑ Raise worksurface - See Recommended Specifications. ❑ Reorganize to provide additional worksurface area. ❑ Other (comment)
Type	Fixed/Adjust			
Height	Sit/Stand: (“)			

FOOT SUPPORT/CLEARANCE

Foot Support

In the ideal world, the best foot support when seated in the chair is the floor.

However, based on work at a fixed height worksurface where the chair needs to be adjusted upwardly or work at a standing height workbench where a stool is used, a foot support will be needed.

Clearance

A real common issue is not enough access or clearance under the worksurface. For example file drawers that are in the way or boxes piled under the desk.

Survey the work area and determine what is blocking access. For example it may be a pencil drawer that needs to be removed to make that space accessible for the legs.

Determine what is really needed in the immediate work area. Move what is not needed to some other storage position or get rid of it.

Use vertical files or other stands to get materials off the worksurface. Use secondary shelf or other platform on the worksurface to free up primary worksurface.

Foot support/clearance		Issue	Comment	Recommendation
Feet	Dangling/Supported/ Clearance	No Yes	❑ Foot support is appropriate ❑ Feet dangling – not supported ❑ Inadequate foot/knee clearance ❑ Other (comment)	❑ None. ❑ Add footrest ❑ Lower worksurface - see Recommended Specifications ❑ Raise worksurface - See Recommended Specifications. ❑ Remove foot/knee obstruction (comment). ❑ Other (comment)
Footrest	No/Yes			

KEYBOARD TRAYS

Historical use

Keyboard and mouse trays have been used historically to modify a fixed height desk to accommodate addition of a computer keyboard and mouse to the desk. Most desks were a standard height of 29” and this was too high to allow for comfortable hand and arm position when using the computer equipment. The tray allowed for improved placement of the equipment.

One of the downsides was the extended reach for some individuals as they attempted to reach to materials on their desk.

Current use

As height adjustable workstations are becoming more prevalent, the use of keyboard trays is on the decline.

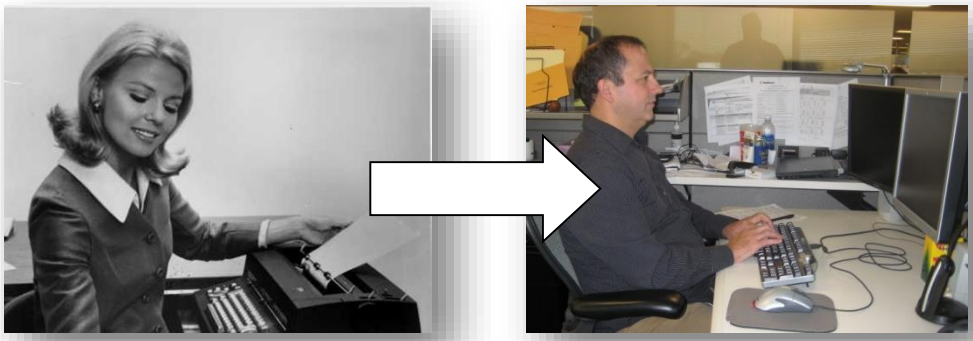
However, they remain a viable option if the need still exists to adjust the height of the keyboard and mouse. This is especially true for multi-user workstations.

Keyboard tray criteria

- Generally the tray should be height and angle adjustable by the user to allow specific position adjustment based on user preference.
- The tray should provide a stable platform and be wide enough to accommodate both the mouse and keyboard on the tray.
- The mouse platform should be at the same height as the keyboard platform of the tray.
- The tray should allow for either right hand or left hand mouse placement.

Keyboard Tray		Issue	Comment	Recommendation
Tray	No/Yes	No Yes	❑ Keyboard tray appropriate ❑ Keyboard tray limits reach access to worksurface ❑ Keyboard tray type does not allow neutral arm/hand position ❑ Keyboard tray location does not allow neutral hand/arm position ❑ Other (comment)	❑ None ❑ Adjusted keyboard tray position and provided user instruction ❑ Remove tray - place keyboard directly on worksurface ❑ Other (comment)
Ht adjust	No/Yes			
Angle adjust	No/Yes			
Size fits	Keyboard only Keyboard-mouse			

KEYBOARD



To put this into perspective, let's take a brief look at the differences between modern keyboards and old-style typewriters. In the "olden days" you had to actually insert paper, hit the shift bar and physically stop what you were doing to correct mistakes.

Not only that, but you also couldn't go too fast or the keys would stick together. In essence, the task had built in breaks that kept it from becoming too much of a problem.

Now it is possible with a modern keyboard to come in at 7 in the morning, start keying as fast as you can, never take a break, and keep this up until 5 o'clock without a break.

Because we have lost a lot of the natural breaks and position changes that were associated with the old style typewriter we have to actively make good choices during our day.

Keyboard types

Keyboards come in a variety of configurations. While intuition may indicate that keyboard configuration influences hand/arm position and consequently physical stressors, studies have indicated that proper position of the keyboard in relation to the user (height and reach) has been shown to be more important than the configuration. Personal preference and specific issues also can drive the type of keyboard used.

Straight line

Curved

Articulated

Keyboard solutions

Neutral positioning

If your keyboard position does not allow neutral hand/arm/shoulder/ neck and upper back positioning, remember your goal is to work in as neutral a position as feasible. Identify your particular keyboarding style or technique.

This may be the:

Free float piano playing style

Use of the worksurface for forearm support

Now, based on your technique, you need to obtain correct height, reach and angle of the keyboard so that you are able to work in neutral.

If you can, adjust the keyboard height and position, either by adjusting the worksurface height itself or through the use of a keyboard tray. If you cannot adjust your keyboard height, you will need to position your chair height to place your hands in neutral posture in relation to the keyboard. This may require support for your feet if they no longer touch the floor.

NOTE: A wrist rest can be a good addition to a keyboard. Remember that it is called a wrist 'rest' not wrist 'anchor'. In other words it should provide some weight-bearing supports for your arms, as you need rest. You should NOT anchor your wrists to the rest and then move your hands and fingers side to side out of a neutral wrist position.

Poor Technique

If you have really bad technique, you may want to consider investing in one of the computer training programs that teach improved technique.

Take a break

One of the biggest problems with the modern computer is that it does not cue you to take a break. There are a number of human movements, such as reaching your arms over your head, arching your back or rotating your neck, that are normal human movements, but are not a normal part of your day. The computer

workstation is notorious for discouraging much movement. For that reason people need to recognize the need for adding stretching to your day.

Create some type of system to key you or remind you to stop and stretch. Or change positions. Or work on a different activity that does not involve use of the keyboard. This could be:

- A little post it note put on your computer monitor
- Software is also available to load on your system or network that reminds you to stretch
- Team up with someone else in the office to remind each other to stretch and change positions.
- Take advantage of natural breaks between activities. And if it makes sense, create breaks at regular intervals to give your body a chance to move and stretch.

Keyboard		Issue	Comment	Recommendation
Type	Straight/Curved/ Articulated/Other	No Yes	❑ Keyboard type and location appropriate ❑ Keyboard type does not allow neutral arm/hand position ❑ Keyboard location does not allow neutral hand/arm position ❑ No wrist rest in use for support ❑ Other (comment)	❑ None ❑ Adjusted keyboard position and provided user instruction ❑ Replace keyboard - see comments ❑ Add gel keyboard wrist rest ❑ Other (comment)
Location	Work surface/Tray			
Shortcuts	Used: No/Yes			
Maint	No/Yes			

MOUSE

No . . . not that kind of mouse!

The type of mouse we are talking about is one of a number of different types of pointing devices used to navigate through software programs.

In all practicality the best way to use a mouse is to use it as little as possible. In other words make full use of keyboard shortcuts as possible for navigation purposes. (Dual control – mouse and/or keyboard – are often incorporated as part of the software.)

Emphasis on use of the keyboard limits the amount of time spent reaching to the mouse and also has a positive impact on productivity.

Pointing device solutions

Neutral positions

The pointing device should be positioned so it is in the same plane as the keyboard. Here are some simple solutions to make it easier to work with your mouse. If your mouse position does not allow neutral hand/arm/shoulder/neck and upper back positioning, remember your goal is to work in as neutral a position as feasible. Identify your particular mousing style or technique. This may one of the following.

- Free float piano playing style
- Use of the worksurface for forearm support

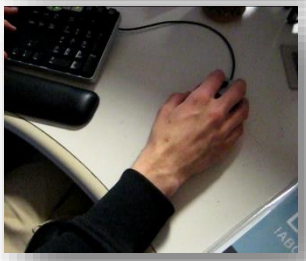
Based on your technique, adjust your position to get the correct height, reach and angle of the mouse so that you are able to work in neutral. If you can, adjust mouse height and position (either by adjusting the worksurface height itself or through the use of a mouse tray)

Based on proper chair position, position the mouse so that shoulder/hands/wrists are in neutral. If you cannot adjust mouse height and position, position the chair height to place your hands at the proper height and position in relation to the mouse. This may require support for your feet if they no longer touch the floor.

Mouse wrist rests

While wrist rests for keyboard use (if used correctly) are often a good idea in most case use of wrist rest for mouse use is not. The wrist rest tends to “anchor” the wrist with excessive deviation of the hand side-to-side.

Generally recommended use of the mouse is to allow straight in access allowing the forearm, wrist and hand moving as unit to manipulate the mouse. Think of the mouse as an extension of the arm NOT just an extension of the wrist.



Variety of pointing devices

There is no doubt that the traditional mouse is by far the most commonly used pointing device. When properly positioned and setup it works well.

However, there are a wide variety of pointing devices available with different shapes and styles that include touchpads, rollerballs, joysticks, pens and so on.

Multiple buttons can be programmed to minimize keying. There are some even specifically designed for lefties. Workers should try different models and choose one that suits their needs.

The type of pointing device that works the best is based on the setup of the workstation, the job task and the personal preference of the user. With many mouse designs available here are general suggestions for selection:

Size - The mouse should fit into the hand and the fingers should be able to curl around it comfortably.

Shape - Find a mouse that reduces the need to place the heel of your hand on the desk. Some mice are larger, especially at the rear, and can support your entire hand.

Buttons - The location of the buttons is important. They should not be cramped nor too spread out. The pressure needed to click the buttons should not be so great that it tires the fingers but neither should it be so sensitive that it is too easy to activate the buttons

Scroll wheel – allows for easy scrolling within a document.

Don't squeeze the mouse. Hold it loosely in your hand and relax your grip. A tight grip will not help to position the pointer any more accurately or quickly.

Program your mouse to manipulate the speed at which the cursor moves or the sensitivity of the buttons.

Wireless - a number of pointing devices are wireless, which increases the flexibility of where it can be positioned.

Optical – rather than a mechanical ball that rolls on a surface an optical mouse depends on a laser to detect movement.

A button that is too sensitive can force you to keep your fingers slightly elevated off the buttons and for some people this can lead to eventual fatigue and discomfort in the muscles and tendons of the forearm.

If your mouse is sticking, you may need to clean it. Your owner's manual will instruct you how to do this without causing any damage to the mouse.

Mouse Pros and Cons

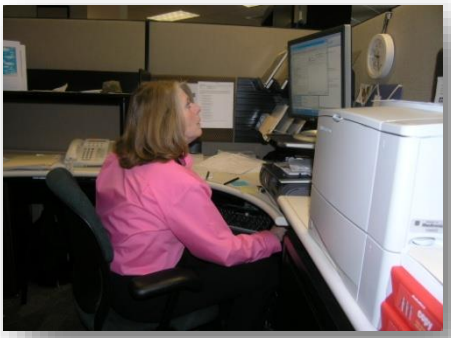
Pros and cons for each type of pointing device are outlined in the table below.

Pointing Device	Pros	Cons
Shell mouse 	Relatively easy to learn how to use. Installed base is huge with most computer users first exposed to traditional mouse. Inexpensive.	Promotes "skating" of the mouse with subsequent out of neutral hand/wrist/arm/shoulder positions. Hand size is important to consider matching the correct size shell with hand size. Often poorly positioned in relation to user and keyboard.
Roller ball/Track ball 	Can provide a stable platform for the hand that eliminates 'skating' of the traditional mouse. May be very effective in controlling wrist and elbow problems. Available in a variety of configurations with ball controlled by either the thumb or fingers or in some cases either.	Acceptance curve is quite steep. Minimum of one week trial basis to determine benefit is recommended. Some users never accept it. Hand size is important to consider matching the correct size shell with hand size. Typically more expensive than a traditional mouse.
Touch pad 	Provides an alternative to the traditional and roller ball styles.	Learning curve may be quite steep for some users. Typically more expensive than a traditional mouse.
Pen/Tablet 	Often used by graphics designers who require the ability to 'draw' on the tablet.	Can be cumbersome for some users. Typically more expensive than a traditional mouse.

Joystick 	Designed to place the hand in neutral position during use.	Limited acceptance to date. If frequent reach to the keyboard is part of the job task may result in excessive hand/arm movement.
Vertical 	Designed to place the hand in neutral position during use.	If frequent reach to the keyboard is part of the job task may result in excessive hand/arm movement.

Mouse		Issue	Comment	Recommendation
Type	**Shell/Rollerball/ Vertical/ Joystick/ Touchpad/Other**	**No** **Yes**	❑ Mouse type and location appropriate ❑ Mouse type does not allow neutral arm/hand position ❑ Mouse location does not allow neutral hand/arm position ❑ Mouse wrist rest in the way ❑ Other (comment)	❑ None ❑ Adjusted mouse position and provided user instruction ❑ Replace mouse - see comments ❑ Remove mouse wrist rest ❑ Other (comment)
Location	**Work surface/Tray**			
Scroll	**No/Yes**			
Maint	**No/Yes**			

COMPUTER (CPU, COMPUTER CASE, HARD DRIVE)



Many people tend to put the computer underneath the monitor. In some cases this may be appropriate but in a lot of cases, it's not – it may position the monitor at too high a level. When you decide where to position your computer think about your particular needs.

Do you need to keep the computer close in terms of the on-off switch and access to the disk drives on the computer? In that case you may want to position the computer on your worksurface or maybe on the floor on a computer stand with easy reach. On the other hand, if it really doesn't make much difference then position it so it is out of your way.

Remember that the computer does generate heat and has vents on the case. Make sure you don't block ventilation around the computer – this could result in overheating problems.

Computer		Issue	Comment	Recommendation
Type	Desktop/Laptop	No Yes	❑ Computer type and location are appropriate ❑ Computer in the way ❑ Other (comment)	❑ None ❑ Reposition computer out of way ❑ Other (comment)
Location	Work surface/Floor			

MONITOR

Things have changed dramatically from the days when we used to spend our day reading/writing reports on paper. Now, for most of us, everything we need access to can be viewed through the monitor on our desks.

While this has made our lives a bit easier, the demands of looking at a monitor all day long can create some problems if not used appropriately.

Ever watch people when they are sitting looking at their monitors. It's almost like the monitor is a vacuum cleaner. They turn it on and it sucks their head right in!

LCD Monitors

Having an adequate monitor is critical to success of the computer user. At this point in time one primary monitor type is in place - the flat panel **liquid crystal display (LCD).**

Physical Size

One of the biggest advantages of LCD monitors is that they are compact and lightweight. An LCD monitor is based upon a very thin screen as opposed to the bulky tube of a CRT monitor.

This means that not only do they take up less desktop space; they can also be used in many places where a larger CRT monitor cannot fit.

Resolution

An important issue with LCD monitors is resolution. Resolution is the number of pixels (picture elements) displayed. CRT monitors are usually capable of running multiple resolutions. LCD monitors, however, will usually work well in only one resolution. Other resolutions can be sometimes be displayed, but either the image may not be full-screen or the image quality may be poor. Smaller LCD monitors up to 12" are normally capable of 640 x 480 or 800 x 600 resolution, and most LCD monitors 14" and above are normally cable of 1024 x 768 resolution or higher.

Typically the LCD resolution should be set at the highest resolution possible. This will make images appear smaller on the screen, creating a potential of visual issues. Options to increase viewing size are to set the DPI of the monitor to 120 rather than the default 96 DPI. Also view size can be increased or decreased by using the keyboard shortcut CTRL + mouse scroll wheel. Another keyboard shortcut is CTRL + (+ or -).

Brightness

LCD monitors are backlit and have different levels of brightness. The brightness rating for an LCD monitor is commonly referred to as 'nits', and commonly range from 70 to 250 nits. The higher the nits, the brighter the display.

Viewing Angle

Another issue with the LCD monitor is the viewing angle; an LCD monitor has a much smaller viewing angle, needing to be viewed more directly from the front. From the side, the image on an LCD screen can seem to disappear, or invert colors.

Monitor solutions

Alignment

When you think about the alignment of your monitor in relation to your body position, the first thing to recognize is the importance of directly facing your primary work task.

If you are doing primarily data creation or manipulation, it makes sense to have your monitor directly in front of you.

If, on the other hand you are doing primarily data entry and your main focus is on paper documents, you would want your monitor slightly off to the side and utilize a copy stand to place your paper documents directly in front of you.

Glare

Ways to control glare are to position the monitor so that a light source is not behind you or at an angle that can be reflected by the monitor.

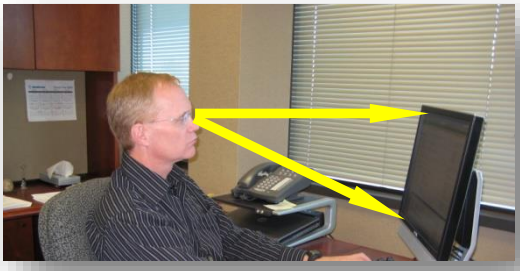
Ideally the light should be overhead, or perpendicular to the monitor. If an overhead light is a bit behind you and can be seen in the monitor, you may want to place a glare hood on top of your monitor to shield it from the light.

A glare screen added to the monitor will also control glare. In this case you truly get what you pay for. An inexpensive glare screen is generally just wire mesh; it will cut the glare but also will make it harder to read the text on the screen. Look for a good quality optical glass glare screen. (Also privacy screens are available that limit viewing of the screen from the side as well as control glare.)

You don't want to have a light source such as window directly behind the monitor. Your eyes try to adjust to the level of light coming in, and your eyes have trouble adjusting to the light coming in from outside and the light generated from your monitor. If you can't place the monitor perpendicular to the light source, close the shades when working on the computer.

Adjust the monitor screen brightness and contrast based on your perception of the overall quantity and quality of light in the workstation and the need to see what's on your monitor clearly and comfortably

Height



A general guideline for the height of the monitor screen is to position it so that it is at eye level or slightly lower.

Trying to look at a screen higher than eye-level is uncomfortable because it forces you to open your eyes wider than usual causing discomfort as well as a tendency for your eyes to become drier.

Also with a monitor that's too high, your tendency will be to tip your head back putting an additional strain into your neck and shoulders.

Remember that it's all about relationships. Make sure you have set your chair at the correct height and that you are in your typical seated posture as a guide to position the height of your monitor screen.

Lower monitor

Most monitor are on adjustable height stands or arms that can be adjusted. If not on an arm if the monitor is too high, you may try either tipping the monitor forward a bit which in effect lowers the viewing area, or raise your chair slightly (as long as this doesn't affect your ability to have adequate foot support.).

Remember, as a final option you may need to consider actually lowering the surface that the monitor is on. This is particularly true as monitors of larger size are more commonly in use. Recall this will influence the relationships you have established between yourself and your workstation. For example you may need to re-examine your chair height keyboard location and so on.

Raise monitor

There are a number of methods for raising your monitor including monitor stands.

There are a variety of types including those that come in 1" increments, stands that have a space to put your keyboard when not in use, and monitor arms that actually suspend your monitor above your desk and allow you to place it in an infinite number of positions.

A simple and effective solution for raising your monitor, is to place it on an old phone book or other material that places it at the desired height

Distance

Here's a general guideline for monitor screen distance: get the screen as far away from you as you can and still be able to read it clearly with good posture. Either move the monitor closer or increase the character size.

To demonstrate this, focus on a finger at arm's reach, slowly bring your finger toward your nose maintaining focus and notice the increase in stress in eyestrain the closer your finger gets to your eyes. The same thing will be true the closer your monitor gets to your eyes.

Accommodation

Accommodation is when the lens capsule in your eye changes shape to focus on a close object. The eyes have a default accommodation distance, called the resting point of accommodation (RPA). That is the distance at which the eyes focus when there is nothing to focus on.

In total darkness our eyes are set to focus at a particular distance, so that if the lights were turned on, an object at that distance would be in clear focus. The RPA averages 30 inches for younger people and gets farther away with age.

Convergence

Convergence is when the eyes turn inward toward the nose when we view close objects. Convergence allows the image of the objects to be projected to the same relative place on each retina. Without accurate convergence, we see double images. The closer the objects, the greater the strain on the muscles that converge the eyes. Recent studies have shown the stress of convergence contributes more to visual discomfort than the stress of accommodation. (The visual system also has a resting point of vergence (RPV). It is similar to the resting point of accommodation, but it's the distance at which the eyes are set to converge when there is no object to converge on.)

How close is too close?

It is difficult to set an exact limit for a minimum viewing distance. If sustained viewing closer than the resting point of vergence contributes to eyestrain, perhaps we should say that eye-screen distance should not be closer than the resting point of vergence. (On average, about 45 inches away at horizontal eye level and 35 inches away with a 30-degree downward gaze angle.)

How far is too far?

The reality is that there is no limit, based on visual fatigue considerations, to maximum viewing distance at computer workstations. From what we know about visual strain, farther viewing distances are better, at least up to the RPV. For example, if the RPV is 35 inches, an eye-to-screen distance of 25 inches is preferred to 20 inches. Thirty-five inches is better than 25 inches. Viewing distances beyond 35 inches (the RPV in this case) should neither increase nor decrease eyestrain.

Adjustments

Bringing your monitor closer is generally as simple as sliding the screen towards your body. Moving it farther is generally a bit more complicated if simply sliding it farther away isn't an option.

First, figure out why you can't get your monitor farther away. It may be that you can reorganize what's on your worksurface and get the monitor farther away.

If it's not possible to reorganize your worksurface, consider reconfiguring how you place your monitor on the desk. For example you might be able to place the monitor more in a corner of the worksurface to gain greater distance.

Another option you may have is to add a keyboard tray to the existing worksurface; this will let you to sit more comfortably at a greater distance from the monitor. Remember also that a keyboard tray will push you farther away from the rest of your worksurface and may put some items out of a comfortable reach.

If you have a freestanding desk that is backed up to a wall, another option is to actually pull the desk a few inches away from the wall and slightly overhang the base of the monitor off the worksurface. If you do this, make very sure that the monitor will not fall off the worksurface.

At a minimum, when you're not doing a great deal of keyboard data entry but are primarily reviewing documents on your monitor, simply push your chair farther back from your worksurface to give your eyes a bit of a break

Clean screens

Dirty monitor screens are a lot like dirty eyeglasses, it isn't until you clean them that you realize they needed to be cleaned.

On a regular basis get into the habit of cleaning your monitor screen. There are a variety of sprays/cloths that are commercially available that are made specifically to safely clean the monitor screen.

Dual Monitors

More and more use of dual monitors is coming into play. The second monitor provides for open programs to be viewed concurrently and comparison between two documents is much easier. Typically the monitors are positioned as Primary/Primary or Primary/Secondary setups. Also maintain a consistent viewing distance to the monitors by positioning the monitors in an array fashion as opposed to a straight-line manner.

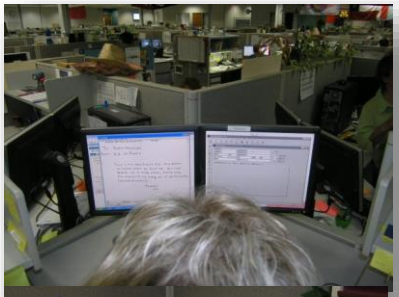
Primary/Primary

In a Primary/Primary setup both monitors are viewed about 50% of the time each. The monitors should be positioned so they are centered on the user.

Primary/Secondary

In the Primary/Secondary setup one monitor is viewed most of the time with the second monitor viewed only occasionally.

The primary monitor should be positioned directly in front of user and the secondary monitor positioned off to the side directly next to the primary monitor.



Eye Examinations

If you do a lot of computer work you want to make sure you have periodic eye examinations. When you do so make sure you tell the examiner the amount and type of computer work you do.

You may even think about taking a measurement of the distance from your eyes to the screen and take that into the person performing the examination.

This will allow them to have information needed to provide a proper prescription for computer glasses.)

Presbyopia

During middle age, usually beginning in the 40s, people experience blurred vision at near points, such as when reading, sewing, or working at the computer. There's no getting around it — this happens to everyone at some point in their life, even if they never had a vision problem before.

When people develop presbyopia, they find they need to hold books, magazines, newspapers, menus and other reading materials at arm's length in order to focus properly. When they perform near work, they may have headaches or eyestrain, or feel fatigued.

Presbyopia is caused by an age-related process, rather than the way light is refracted, or bent, by the eye. Presbyopia is caused by a slow loss of flexibility within the lens inside the eye.

Glasses with bifocal or progressive addition lenses (PALs) are the most common correction for presbyopia. Bifocal means two points of focus: the main part of the spectacle lens contains a prescription for nearsightedness or farsightedness, while the lower portion of the lens holds the stronger near prescription for close work. Progressive addition lenses are similar to bifocal lenses, but they offer a more gradual visual transition between the two prescriptions.

Always be aware that bifocals may result in awkward head and neck position when viewing a computer screen. Options are to reposition the monitor to a lower level, trifocals where the middle of the lens is set for monitor viewing and separate computer glasses used only when at the computer.

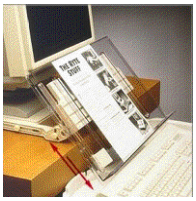
Reading glasses are another choice. They may be worn just while doing close work, and may even be prescribed to wear over top of contact lenses (usually worn for distance correction). These glasses may be purchased over-the-counter at a retail store, or higher-quality versions may be prescribed by your eye care practitioner.

There are contact lenses for presbyopes, called multifocal lenses. Multifocal contact lenses in gas permeable or soft lens materials are available.

Another type of contact lens correction for presbyopia is monovision, in which one eye wears a distance prescription, and the other wears a prescription for near vision. The brain learns to favor one eye or the other for different tasks. But while some people are delighted with this solution, others complain of dizziness or nausea, or miss the depth perception they once had.

Monitor		Issue	Comment	Recommendation
Type	CRT/LCD	No Yes	❑ Monitor type and location appropriate ❑ Monitor too low ❑ Monitor too high ❑ Monitor too close ❑ Monitor too far away ❑ Monitor resolution not appropriate. ❑ Other (comment)	❑ None ❑ Adjusted monitor position and provided user instruction ❑ Adjusted monitor resolution and provided user instruction ❑ Add monitor riser (comment) ❑ Other (comment)
Number	Single/Dual/More			
Adjustable Stand	No/Yes			
Resolution	OK No/Yes			
Position	OK No/Yes			

DOCUMENT HOLDER



If material is read from hard copy, the hard copy should be placed on a document or hard copy holder. This can be placed either directly in front of the user between the monitor and keyboard if enough room is available or can be placed on a hard copy stand placed adjacent to the monitor.

It is not essential that the document be the exact same distance from the user. In fact many times if you try to put a holder right next to the monitor you put it out of the desired reach zone.

Document holder		Issue	Comment	Recommendation
Holder	No/Yes	No Yes	❑ No document holder in use - not needed ❑ No document holder in use - awkward head/neck position ❑ Other (comment)	None ❑ Add landscape holder between keyboard and monitor ❑ Add landscape holder off to side of monitor ❑ Add portrait holder between keyboard and monitor ❑ Add portrait holder off to side of monitor ❑ Other (comment)
Type	Portrait/Landscape			
Location	Side/Front			

LAPTOPS

Design of laptops violates a basic ergonomic requirement for a computer, namely that the keyboard and screen are separated. The reason is simple - with a fixed design, if the keyboard is in an n optimal position for the user, the screen isn't and if the screen is optimal the keyboard isn't.

This means that you need to pay special attention to how you use your laptop because it can cause you problems.

Laptop User Type

Are you an **occasional user** who works on your laptop for short periods of time or are you a **full-time user** with the laptop as your main computer? Occasional users will have less risk of problems than full-time users. All users should pay some attention to how they use their laptop, but full-time users may have more problems.

Occasional Users

Because large muscles control the neck/head position, you are better off sacrificing neck posture rather than wrist posture. For occasional use:

- Find a chair that is comfortable and that you can sit back in.
- Position your laptop in your lap or table for the most neutral wrist posture that you can achieve.
- Angle laptop screen so that you can see this with the least amount of neck deviation.

Full-time Users

If you use your laptop at work as your main computer you should:

- Use a separate keyboard and mouse. You should be able e to connect a keyboard and mouse directly to the back of the laptop or to a docking station. A port replicator is used.
- Position this on your desk/worksurface in front of you so that you can see the screen without bending your neck. This may require that you elevate the laptop off the desk surface using a stable support surface, such as a computer monitor pedestal.
- Follow the postural guidelines for working at a computer workstation.

Laptop weight

If you frequently transport your laptop think about the weight of the system. Many lightweight portables can become as heavy as regular laptops when you add the weight of all of the components together. If your laptop and components weighs 10 lbs or more then you should certainly consider using a carry-on bag that you can pull along. If you want a smaller bag and can comfortably carry your laptop consider a good shoulder bag or wheeled case.

TELEPHONE

Frequency and duration

There is no doubt that the telephone is an essential part of our offices. Think for a moment about how much time you spend on the telephone and how important is it for you to have a proper telephone set up? If you make only a few calls a day, it really doesn't have much of an impact.

On the other hand, if you spend hours on the phone every day or if you make frequent short calls here are some things to consider. The position of your head/shoulder/hand can be an issue with telephone use. If you use a telephone handset how do you hold it? Do you hold the handset between your ear and shoulder forcing you to crane your neck?

Headsets

To improve head/shoulder/hand position, more and more people who use a telephone on a frequent and regular basis are switching to headsets. This frees up both your neck and your hands and allows a good neutral position.

Several different types of headsets are available and you'll want to find one that works the best for you. Over-the-head and over-the-ear versions are available either in wired or wireless formats.

It does take a little while to get used to headsets, so give it some time.

Think about where you want to store your headset when you're not using it. Sometimes a small hook on the wall or on your computer monitor for example, can be a good storage place. This keeps it off your worksurface and also keeps it in ready reach.

Cradle

You could add a phone cradle onto your telephone handset. This does help to put your head and neck in a better position but it still requires you to maintain tension in your neck and shoulder to position the telephone handset. Our recommendation is to not use phone cradles on a regular basis. A headset is a much better solution in most cases.

Sound quality

Poor sound quality and low-volume are problems in the effective use of your telephone. If you identify either the sound quality or volume as an issue see if there are any adjustments you can make to improve it. If not you may want to consider replacing or exchanging your telephone handset or headset.

Telephone		Issue	Comment	Recommendation
Type	Handset/Headset/ Speaker	No Yes	❑ Telephone type and location appropriate ❑ Telephone located in awkward position ❑ Awkward head/neck position with handset use ❑ Other (comment)	❑ None ❑ Add headset to allow for hands-free operation ❑ Reposition telephone to left side worksurface ❑ Reposition telephone to right side worksurface ❑ Other (comment)
Location	Left/Right			

OFFICE EQUIPMENT

Make use of the principles we have discussed to place the office equipment. Includes:

- Calculator
- Printer
- Fax
- Writing utensils
- Scissors
- Paper clips
- Stapler
- Storage
- Etc

It's amazing sometimes how much stuff we can accumulate in our offices. So what we store on our desktops, some would put in our file cabinets and sometimes on shelves and in overhead cabinets.

The old adage, "a place for everything and everything in its place" makes good sense.

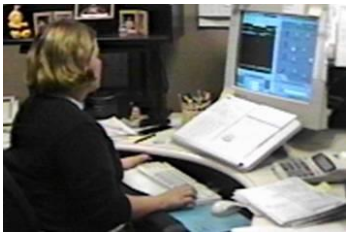
On a regular basis make sure that you can easily place and remove any of your office equipment and materials from their storage locations in file cabinets, drawers, shelves and cabinets.

Understand and make use of the reach zones.

STORAGE

Primary- desktop, shelf, file

- Commonly/frequently accessed from seating system
- Within easy reach
- Within accepted reach zone



Secondary - desktop, shelf, file

- Occasionally accessed
- Located in the "gray" or danger zone (able to reach to the location by over-extending)
- Require light weight and low frequency of access to limit stress
- Best bet: move into primary or tertiary

Tertiary – shelf, file

- Occasionally accessed
- Requires getting out of chair to reach

File cabinet types

If you try to put 50 files in a file cabinet that holds 30 you're going to have problems trying to get them in and out. This creates a great deal of unnecessary additional work as well as the potential for musculoskeletal disorders. (And not to mention the frustration that goes along with.)

Make good use of the different types available:

- Vertical
- Lateral
- Rolling

Storage		Issue	Comment	Recommendation
Desktop	OK No/Yes	No Yes	❑ Adequate desktop and file storage ❑ Limited desktop storage ❑ Limited file storage ❑ Other (comment)	❑ None ❑ Housecleaning to provide additional desktop storage ❑ Housecleaning to provide additional file storage ❑ Add additional file storage ❑ Other (comment)
File	OK No/Yes			

LIGHT

Lighting is a big issue. When you think about light in the office, think about two things: general light that allows you to se e in the office and task light that is specifically focused on the work itself.

General light in the office may be an issue: either too much or not enough.

Too much

For general light that may be too much, one option may be to turn out some of the overhead fluorescent lights. Before you do this on your own, contact your building facilities staff to make sure how to do it safely.

Also in some cases, turning out one fluorescent bulb in a set may cause the other bulbs to flicker

Too little

If you simply don't have enough general light for safety purposes, additional overhead lights may be added or another effective way is to add indirect lights, which bounce the light off of the ceiling and walls. Again contact your building facilities staff for the best solution.

Task lights are a great way to add additional light where you need it. They come in a variety of configurations and wattage. For example you may use a desktop lamp to provide additional light on your document holder. You may have a bulletin board where you post information; a task light can be attached to a wall panel or other surface and be pointed at the bulletin board to provide proper illumination.

Remember that how you position the task light is important, for example don't point it directly at your computer screen because you will create glare. Also make sure it is not in your direct line of vision and pointed at you because this also this will create a problem.

Lighting design

Lighting design within an office setting can get quite complicated and detailed. The recommendation is to work with lighting designers to tackle large jobs.

Illumination		Issue	Comment	Recommendation
Overhead	OK No/Yes	No Yes	❑ Ambient and task lighting appropriate ❑ Ambient light level too high ❑ Ambient light level too low ❑ Task lighting too high. ❑ Task lighting too low ❑ Other (comment)	❑ None ❑ Lower ambient light level ❑ Raise ambient light level ❑ Add desktop task light ❑ Decrease desktop task light ❑ Other (comment)
Task	OK No/Yes			

RECOMMENDED SPECIFICATIONS

Once the assessment has been performed, generate the Recommended Specifications. Refer to the notes and illustration below for details needed to take the measurements.

Recommended Specifications (inches)					
Seating System		**Worksurface Height**		**Computer**	
Seatpan height:		Writing/reading desk		Keyboard height:	
Seatpan depth:				Mouse height:	
Seatpan width:				Monitor height:	
Armrest height:				Monitor distance:	
Armrest width:					

Seatpan height is measured as the distance from the floor to the seatpan (at the side of the seatpan) Seatpan height is with the user in the chair.

Seatpan depth is measured as the distance from the back support to the front of the seatpan and allows for 1.5 to 2" of space between the back of the knee and front of the seatpan.

Seatpan width is measured as the distance side-to-side of the seatpan and allows for 1.5 to 2" of space between the thigh and side of the seatpan.

Armrest height is measured as the distance from the top of the armrest to the floor.

Armrest width is measured as the distance between the outside edges of the armrests.

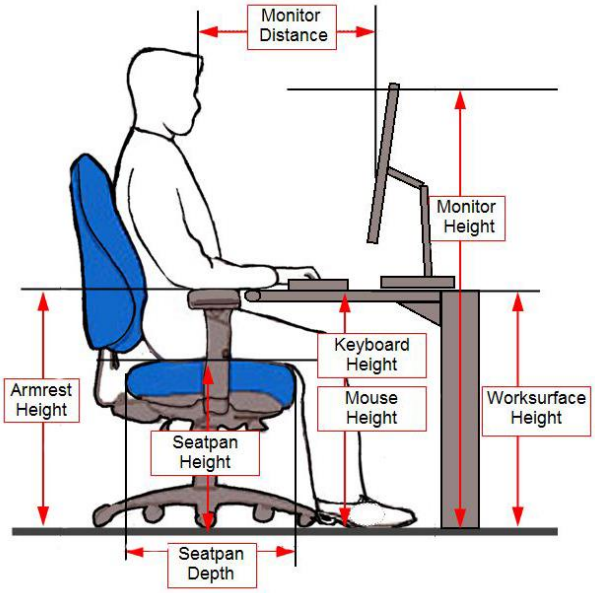
Worksurface height (writing/reading desk) is measured as the distance from the floor to the top surface of the worksurface.

Keyboard height is the distance from the floor to the top surface of the platform that the keyboard rests on. (It is not to the top of the keyboard.)

Mouse height is the distance from the floor to the top surface of the platform that the mouse rests on. (It is not to the top of the mouse.)

Monitor height is height from the floor to the top of the monitor screen (not the top of the monitor bezel.)

Monitor distance is from the eye position (bridge of the nose between the eyes) to the screen.



Follow-up
Date: (/ /)
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ERGOSYSTEMS OFFICE ERGONOMICS WORKSTATION EVALUATION

The purpose of the evaluation is to focus on ergonomics issues of the workstation, work practices, and work process to offer reasonable suggestions to help improve comfort, safety, and productivity in the workplace.

Background Information

Demographics		Work Activity	%	Reason for Assessment
Evaluated by		**Computer**		New employee New workstation Medical issue Equipment/furniture issue Other (*comment below*)
Eval Date		**Telephone**		
Last Name		**Handwriting**		
First Name		**10 key**		
Job Title		**Read-hard copy**		
Dept		**Meetings**		
Location		**Other**		
Stature *(shoeless)*		**Work Activity Comments**		**Other Information**
Heel height				
Handedness	Right/Left/Ambidextrous			
Job demands	Sedentary/Manual			
Work hours	Full/Part time			
User	Single/Multi			
Vision	No correction//Reading/Distance/Bi/trifocal/Computer/Contacts			

Issues/Comments/Recommendations

Chair		Issue	Comment	Recommendation
Chair ID		No Yes	❑ Chair fit/adjustment OK ❑ Chair not properly adjusted ❑ Back support not OK ❑ Armrests not OK ❑ Chair too small ❑ Chair too large ❑ Maintenance issue (comment) ❑ Other (comment)	❑ None ❑ Chair adjusted with instructions provided ❑ Replace chair - refer to Recommended Specifications ❑ Repair chair (comment) ❑ Other (comment)
Legs	4 / 5 / 6			
Casters	Carpet/Hard surface			
Seatpan	Ht/Tilt/Tension/Slide			
Back	Ht/Angle			
Armrest	Ht/Side/Rotate			
Fit	OK No/Yes			
Maint Issue	No/Yes			

Worksurface		Issue	Comment	Recommendation
Config	Straight/Corner/ L-shape/U-shape	No Yes	❑ Worksurface is appropriate ❑ Worksurface is too low ❑ Worksurface is too high ❑ Worksurface does not have enough work area. ❑ Other (comment)	❑ None. ❑ Lower worksurface - see Recommended Specifications ❑ Raise worksurface - See Recommended Specifications. ❑ Reorganize to provide additional worksurface area. ❑ Other (comment)
Type	Fixed/Adjust			
Height	Sit/Stand: (“)			

Foot support/clearance		Issue	Comment	Recommendation
Feet	Dangling/Supported/ Clearance	No Yes	❑ Foot support is appropriate ❑ Feet dangling – not supported ❑ Inadequate foot/knee clearance ❑ Other (comment)	❑ None. ❑ Add footrest ❑ Lower worksurface - see Recommended Specifications ❑ Raise worksurface - See Recommended Specifications. ❑ Remove foot/knee obstruction (comment). ❑ Other (comment)
Footrest	No/Yes			

Keyboard Tray		Issue	Comment	Recommendation
Tray	No/Yes	No Yes	❑ Keyboard tray appropriate ❑ Keyboard tray limits reach access to worksurface ❑ Keyboard tray type does not allow neutral arm/hand position ❑ Keyboard tray location does not allow neutral hand/arm position ❑ Other (comment)	❑ None ❑ Adjusted keyboard tray position and provided user instruction ❑ Remove tray - place keyboard directly on worksurface ❑ Other (comment)
Ht adjust	No/Yes			
Ang adjust	No/Yes			
Size fits	Keyboard only Keyboard-mouse			

Keyboard		Issue	Comment	Recommendation
Type	Straight/Curved/ Articulated/Other	No Yes	❑ Keyboard type and location appropriate ❑ Keyboard type does not allow neutral arm/hand position ❑ Keyboard location does not allow neutral hand/arm position ❑ No wrist rest in use for support ❑ Other (comment)	❑ None ❑ Adjusted keyboard position and provided user instruction ❑ Replace keyboard - see comments ❑ Add gel keyboard wrist rest ❑ Other (comment)
Location	Work surface/Tray			
Shortcuts	Used: No/Yes			
Maint	No/Yes			

Mouse		Issue	Comment	Recommendation
Type	Shell/Rollerball/ Vertical/Joystick/ Touchpad/Other	No Yes	❑ Mouse type and location appropriate ❑ Mouse type does not allow neutral arm/hand position ❑ Mouse location does not allow neutral hand/arm position ❑ Mouse wrist rest in the way ❑ Other (comment)	❑ None ❑ Adjusted mouse position and provided user instruction ❑ Replace mouse - see comments ❑ Remove mouse wrist rest ❑ Other (comment)
Location	Work surface/Tray			
Scroll	No/Yes			
Maint	No/Yes			

Computer		Issue	Comment	Recommendation
Type	Desktop/Laptop	No Yes	❑ Computer type and location are appropriate ❑ Computer in the way ❑ Other (comment)	❑ None ❑ Reposition computer out of way ❑ Other (comment)
Location	Work surface/Floor			

Monitor		Issue	Comment	Recommendation
Type	CRT/LCD	No Yes	❑ Monitor type and location appropriate ❑ Monitor too low ❑ Monitor too high ❑ Monitor too close ❑ Monitor too far away ❑ Monitor resolution not appropriate. ❑ Other (comment)	❑ None ❑ Adjusted monitor position and provided user instruction ❑ Adjusted monitor resolution and provided user instruction ❑ Add monitor riser (comment) ❑ Other (comment)
Number	Single/Dual/More			
Adjustable Stand	No/Yes			
Resolution	OK No/Yes			
Position	OK No/Yes			

Document holder		Issue	Comment	Recommendation
Holder	No/Yes	No Yes	❑ No document holder in use - not needed ❑ No document holder in use - awkward head/neck position ❑ Other (comment)	❑ None ❑ Add landscape holder between keyboard and monitor ❑ Add landscape holder off to side of monitor ❑ Add portrait holder between keyboard and monitor ❑ Add portrait holder off to side of monitor ❑ Other (comment)
Type	Portrait/Landscape			
Location	Side/Front			

Telephone		Issue	Comment	Recommendation
Type	Handset/Headset/ Speaker	No Yes	❑ Telephone type and location appropriate ❑ Telephone located in awkward position ❑ Awkward head/neck position with handset use ❑ Other (comment)	❑ None ❑ Add headset to allow for hands-free operation ❑ Reposition telephone to left side worksurface ❑ Reposition telephone to right side worksurface ❑ Other (comment)
Location	Left/Right			

Storage		Issue	Comment	Recommendation
Desktop	OK No/Yes	No Yes	❑ Adequate desktop and file storage ❑ Limited desktop storage ❑ Limited file storage ❑ Other (comment)	❑ None ❑ Housecleaning to provide additional desktop storage ❑ Housecleaning to provide additional file storage ❑ Add additional file storage ❑ Other (comment)
File	OK No/Yes			

Illumination		Issue	Comment	Recommendation
Overhead	OK No/Yes	No Yes	❑ Ambient and task lighting appropriate ❑ Ambient light level too high ❑ Ambient light level too low ❑ Task lighting too high. ❑ Task lighting too low ❑ Other (comment)	❑ None ❑ Lower ambient light level ❑ Raise ambient light level ❑ Add desktop task light ❑ Decrease desktop task light ❑ Other (comment)
Task	OK No/Yes			

Other	Issue	Comment	Recommendation
	No Yes		
Other	**Issue**	**Comment**	**Recommendation**
	No Yes		

Recommended Specifications (inches)					
Seating System		**Worksurface Height**		**Computer**	
1. Seatpan height:		*6. Writing/reading desk*		*7. Keyboard height:*	
2. Seatpan depth:				*8. Mouse height:*	
3. Seatpan width:				*9. Monitor height:*	
4. Armrest height:				*10. Monitor distance:*	
5. Armrest width:					

1. **Seatpan height** is measured as the distance from the floor to the seatpan (at the side of the seatpan) with the user in the chair. Seatpan height is based on stature considering the height of the shoe heels.
2. **Seatpan depth** is measured as the distance from the back support to the front of the seatpan and allows for 1.5 to 2" of space between the back of the knee and front of the seatpan.
3. **Seatpan width** is measured as the distance side-to-side of the seatpan and allows for 1.5 to 2" of space between the thigh and side of the seatpan.
4. **Armrest height** is measured as the distance from the top of the armrest to the floor.
5. **Armrest width** is measured as the distance between the outside edges of the armrest.
6. **Worksurface height** (writing/reading desk) is measured as the distance from the floor to the top surface of the worksurface.
7. **Keyboard height** is the distance from the floor to the top surface of the platform that the keyboard rests on. (It is not to the top of the keyboard.)
8. **Mouse height** is the distance from the floor to the top surface of the platform that the mouse rests on. (It is not to the top of the mouse.)
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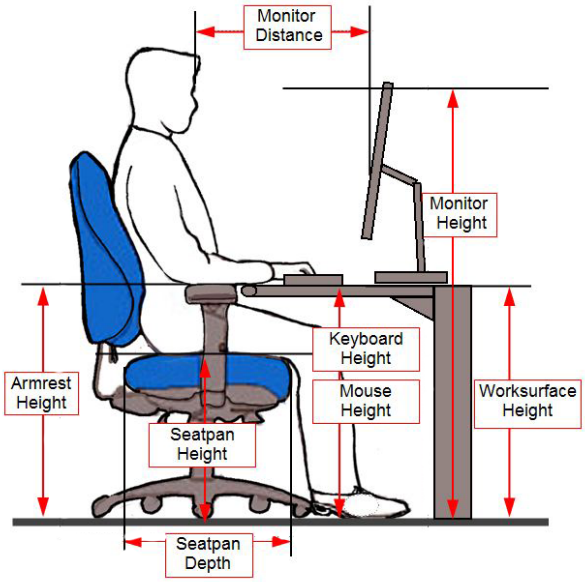

Follow-up
Date: (/ /)
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Date: (/ /)

Power Lifting

Principles and Practices

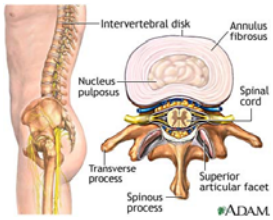
Mark Anderson, MA, PT, CPE
Ergonomist and Physical Therapist
ErgoSystems Consulting Group, Inc

Which one is a bigger problem?

- 100 people go see a doctor with a back problem
- How many due to?
  - Single episode
  - Cumulative
- Overall focus on both and really focus on the cumulative factors

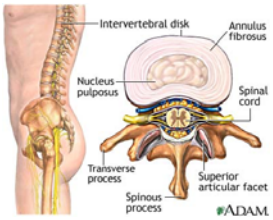
Spine Structures

- Vertebra
- Joints
- Spinal cord
- Nerves
- Ligaments
- Muscles
- Disc



Spinal Discs

- Disc wall
- Disc core

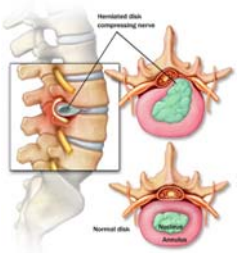


Spinal Discs

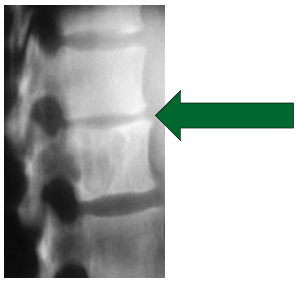
- Disc function
- Shock absorber
- Spacer

Types of spine problems

- Disc problems
- Joint pain
- Nerve compression
- Soft tissue pain



Spinal Discs



Spine Protection

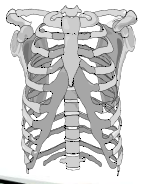
- Control compression and shear stress into structures of the spine!

Spine

- The Neutral Position
  - Each body segment lined up over the one below
  - Like a well constructed stone fence
  - Gravity helps hold it together not pull it apart
  - S-shaped curve

Structure and Function Principles

Mobility vs. stability



Operating Range

Feedback

Body Mechanics/Work Techniques

- What do we lift everyday?
- How important are work techniques?

Body Mechanics

- Body is a series of lever arms
- Goal is to improve mechanical advantage

Lifting Techniques Basics

- **Planning**
  - Think lift through
  - Know where load will end up
  - Decide if manual or power equipment
- **Get help if needed**
  - Good communication
  - Partner: Lift in unison

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Bent Back or Squat Lift?

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Does a Squat Lift work?

Why most people WILL NOT squat to lift!
Takes too much energy!

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Does a Bent Back Lift work?

Why most people WILL bend back to lift!
Perceived as taking less energy!
But . . .

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Power Lift Basics

- **Feet wide**
- **Maintain neutral spine**
- **Tighten stomach muscles**
- **Keep load close**
- **Build a bridge**
- **Good grip**
- **LOOK UP!**

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LOOK DOWN **LOOK UP**

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Lifting and Technique Basics

- **Good base of support**
  - Shoulder width
  - Stagger foot stance
  - Good footing
- **Build a Bridge**
  - Hand on support
- **Power Lift technique**
  - Feet wide
  - Maintain neutral spine
  - Keep load close
  - Good grip
  - **LOOK UP!**

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Lifting Techniques

Golfer's Lift

Pivot Lift

Overhead Lift

Straight Leg Lift

Power Lift

Partial Squat Lift

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Summary and Close

- **Body Mechanics and Work Techniques can be potent tools to control and prevent back problems**
- **Challenge is to integrate principles into course of day-to-day routine activities**
- **Practice for the next 30 days!**
- **Find out for yourself!**

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Thanks!

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Power Lifting

Principles and Practices

Mark Anderson, MA, PT, CPE
Ergonomist and Physical Therapist
ErgoSystems Consulting Group, Inc

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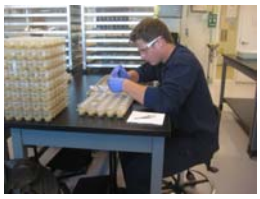
Personal Physical Performance

Fatigue Control
Stretching
Physical Fitness
Health and Wellness

Mark Anderson, MA, PT, CPE
Ergonomist and Physical Therapist
ErgoSystems Consulting Group, Inc

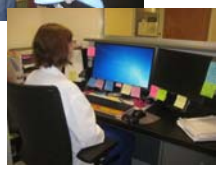
Fatigue Control and Recovery

- Can we **prevent** fatigue in the workplace?
- NO!
  - Fatigue is a natural part of the cycle of life!
- We need to learn strategies to **control fatigue** during the shift
- We need to learn strategies to **recover from fatigue** to get ready for the next shift or other activities



How to Recognize Fatigue

- **Physical fatigue**
  - Physically demanding
    - Highly repetitive
    - Result in muscle fatigue
    - Decreased hand-eye coordination
- **Mental fatigue**
  - Long periods of vigilance
    - Highly repetitive
    - Tight deadlines
    - Making mistakes



Control Fatigue at Work

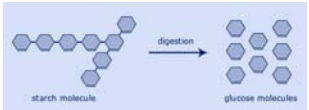
- **Job rotation!**
  - Provides both physical and mental task variety
  - Give the body and mind a change of pace
- **Take breaks!**
  - Use breaks as recovery time (both physical and mental)
  - Get away from the workstation – change of scenery

Control Fatigue at Work

- **Hydration!**
  - Maintains blood pressure and blood flow to vital organs of body
  - Proper fluid concentration levels
    - Sodium, potassium and calcium for healthy cellular activity
      - e.g. reduces muscle cramping
  - Hydration tips
    - Water
      - Try to avoid caffeinated / sugared drinks
    - How much?
      - 30 to 40% of body weight in ounces/day
        - Weigh 180#, drink 54 to 72 ounces/day
      - Listen to your body
      - Urine color - pale

Control Fatigue at Work

- **Nutrition!**
  - Fuel the body – we are what we eat!
    - Regular consistent consumption
    - Don't skip breakfast
  - Combination of complex and simple carbohydrates
    - Carbohydrates are sugars that break down into glucose (fuel for body)
    - Complex slow burning carbohydrates (whole grains, potatoes, squash, pumpkin and carrots)
    - Simple fast burning carbohydrates (fruits, vegetables and honey) provide immediate source of energy
    - Simple sugars found in candy bars, soft drinks and cookies provide quick boost, but then a **big letdown afterward**!



Control Fatigue at Work

- **Nutrition!**
  - Add in proteins
    - Meat, poultry, fish, eggs, beans, nuts, soy, and low-fat dairy products
  - Healthy fats
    - Unsaturated fats: found in foods like olive oil, avocados, nuts, and canola oil
- **Balanced nutrition is the goal!**

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Recover from Fatigue at Home

- **Rest**
  - 7 to 8 hours sleep
  - Adequate mattress
  - Darkened room
  - Sleep mask with ear plugs
- **Nutrition/Fluid**
  - Same as at work
- **Travel Safely**
  - Commuting to/from work
- **Personal/Family time**
- **Physical Fitness**
- **Health and Wellness**

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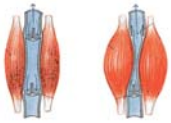
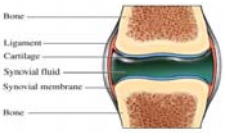
Stretching: What's it all about?

- **Oxygen**
  - Helps heart because muscles act like pumps
  - Increased blood flow
  - More oxygen and nutrition
- **Joint Lubrication**
  - Movement stimulates production of joint lubricating fluid
  - Improve joint health





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How Should You Stretch?

- **Absolutely have to follow Doctor's orders for any restricted activities**
- **Technically correct**
- **Energy Input/output**
- **Neutral position**
- **Joint noises**
- **Don't hold breath**
- **Regular and consistent**
- **Intensity/controlled stretching**

ErgoSystems

Stretching Guidelines

- **Absolutely have to follow Doctor's orders for any restricted activities**
- **Technically correct**
- **Energy Input/output**
- **Neutral position**
- **Joint noises**
- **Don't hold breath**
- **Regular and consistent**
- **Intensity/controlled stretching**

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Bottom Line . . . Why Stretch?

- **Alertness levels**
- **Help prevent injuries**
- **Control stress**
- **Reduce muscle tension**
- **Increase flexibility**
- **Develop body awareness**
- **IT FEELS GOOD!**

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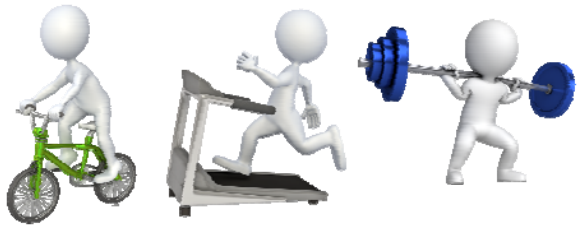
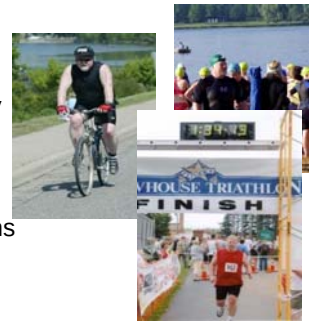
Physical Fitness



Physical Fitness

- **Basic Guidelines**
  - Medical check
  - Start slow and easy
  - Reasonable expectations
  - Buddy system
  - Commit for 6 months

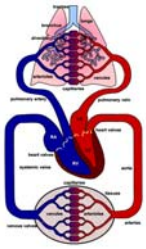


Examples

		
Strength	**Flexibility**	**Heart/lung fitness**

Fitness/Aerobic Capacity

- **Measure of body's ability to bring air into lungs**
  - Transfer to red blood cells
  - Supply body with oxygen through the circulatory system
- **Guidelines:**
  - 20 to 30 minutes at moderate intensity
  - 3 to 4 times per week

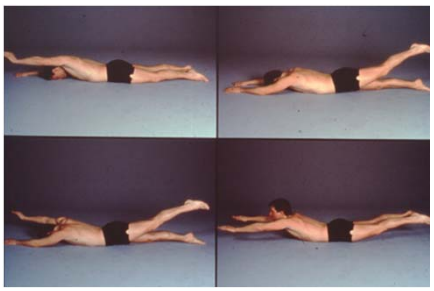


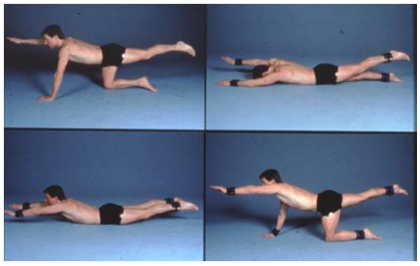
Examples

- **Treadmill**
- **Bicycle**
- **Swimming**
- **Park at some distance at mall and walk**
- **Take stairs**
- **Take dog for a walk**
- **You get the point!**

Strength/Endurance

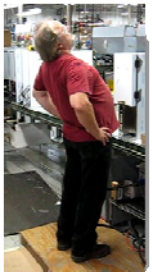
- **How much do you need?**
- **Does your work provide what you need?**
- **Is your strength balanced?**
- **Basic program**
  - 3 to 4 times per week
  - 5 to 10 repetitions
  - 2 to 3 sets of each exercise





Flexibility

- How much do you need?
- Does your work provide what you need?
- Is your flexibility balanced?
- Basic program
  - 3 to 4 times per week
  - hold for count of 10 to 15
  - 2 to 3 repetitions



Health and Wellness

- **General health and wellness has an impact!**
  - Diet and nutrition
  - Body weight control
  - Stress management
  - Smoking cessation
  - Blood pressure control
  - Adequate rest/sleep
  - Fluid intake - don't get dehydrated

Thanks!

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Personal Physical Performance

Fatigue Control
Stretching
Physical Fitness
Health and Wellness

Mark Anderson, MA, PT, CPE
Ergonomist and Physical Therapist
ErgoSystems Consulting Group, Inc

Why Should YOU Stretch?

Taffy

Go to your refrigerator; take out a piece of cold taffy. Give it a stretch and guess what . . . it doesn't, stretch that is. In fact what it does do is break! Next warm-up the taffy and then give it a stretch — now it actually stretches.

Taffy is a lot like the connective tissue that forms the matrix of our muscles, ligaments, tendons, nerves, blood vessels and so on. When warm these tissues are much more likely to stretch and not be injured compared to when they are cold and stiff.

Increased Blood Flow

Stretching not only warms up the body, it also increases blood flow to the working tissues of the body to provide more oxygen and nutrition,

Control Joint Stiffness

Stretching helps to control joint stiffness; less stiff, more flexible and more comfortable!

Bottom Line . . . Why Stretch?

- Improves alertness levels
- Helps to prevent injuries
- Controls stress
- Reduces muscle tension
- Increases flexibility
- Develops body awareness
- IT FEELS GOOD!

When Should YOU Stretch?

Stretch before work, during breaks and after physical activity. This will help you get ready, keep you ready and help you to cool down once the activity is done.

Group Stretch Sessions

Stretching as a group twice a shift is a great way to stretch. When the group as a whole stretches each individual member of the group feels more comfortable doing the stretches.

Individual Stretch Sessions

Periodically (every 30 to 60 minutes) also do one or two of the stretches at a time. Tie the particular stretch to a particular job task or part of the body — if you have been using hands to grip parts and tools do one of the hand stretches.

How Should YOU Stretch?

Stretching Rules

Follow Medical Restrictions Absolutely have to follow doctor's orders for any restricted activities.

Technically Correct Stretches must be performed correctly. Sloppy technique will not provide desired benefits and increases the risk of technique related problems.

Energy Input/Output Stretching benefits are directly tied to effort exerted. If very little energy goes in very little energy comes out with little or no benefit.

Stretching Guidelines

Warm-up prior to stretching Do a short period (count of 30) of general warm-up prior to the group stretches — fast walking or stepping in place for count of 30.

Joint noises Some joint noises - snaps, crackles and pops - are normal, but if you hear or feel more than this stop the movement and investigate.

Neutral position Stretch from the Neutral Body Position.

Regular and consistent performance Stretching is really 'breathing' for the muscles and other tissues of the body. Just like you need to take oxygen into your lungs on a consistent basis you need to stretch regularly.

Breathing Do not hold your breath when stretching. Inhale with the stretch and exhale with relaxation of the stretch.

Controlled stretching Always stretch in a slow controlled graceful way: no fast, jerky movements. You should not experience any 'pain'.

Intensity Start slow and increase intensity on a gradual level. Don't compete with anyone. Listen to what your body is telling you about how hard to push.

Assess response Always assess response on an on-going basis. Here are some comments to consider.

Typical normal comments:

- "I feel warmth in the area stretched." (This may linger for a few minutes – means blood flow has been enhanced to the area!)
- "I feel a tingling in the area stretched." (It goes away shortly after the stretch is released- nerves have been stretched.)

Comments to watch out for and may call for modification of the stretch:

- "I am still really sore after I stretch." (Need to back off on intensity.)
- "I feel pain down into my arm or leg." (Quite rare, indicates the need for further investigation.)

Unacceptable sensations

- Discomfort does not go away with warm up activity
- Radiating pain into the arm or leg
- Dizziness
- Sick to stomach feeling

Modify Stretch

- Decease range of movement
- Decrease forcefulness
- Refrain from stretch

Continue to Monitor

- If under control
- Gradually add back into routine
- If issue not resolved
- Refer to appropriate party

Always error on the side of being conservative!

Flex Break Stretches (Start with Step-in-Place, end with the 'Scoop')

Step-In-Place

High step in place for 30 seconds
Swing arms as you step

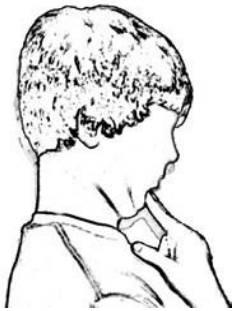
Cup Eyes

Remove any eyeglasses
Gently place palms on eyes
Hold for count of 5
Remove hands
Repeat 2 times

Chicken Neck

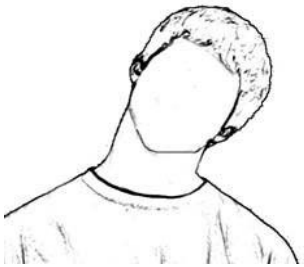
Glide head forward - protrude chin
Tuck chin, pull head straight back
Relax to neutral position
Repeat 2 times

Chin Tuck



Place fingers on chin
Tuck chin
Pull head straight back
Hold for count of 5
Relax
Repeat 2 times

Neck Side Stretch

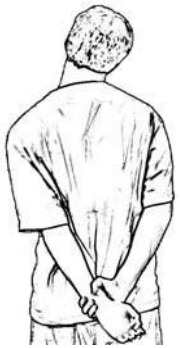


Look straight ahead, arms at sides
Tip head to side to lay ear on shoulder
Hold for count of 5
Return to neutral
Repeat on other side
Repeat sequence 2 times

Neck Side Stretch –Reach

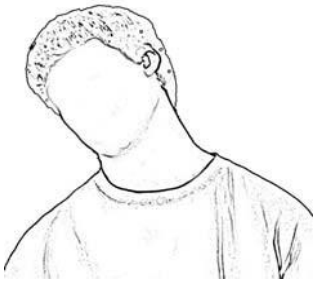
Look straight ahead, hand on head, other arm out to the side
Tip head to side to lay ear on shoulder
Hold for count of 5
Return to neutral
Repeat on other side
Repeat sequence 2 times

Neck Side Stretch – Arm behind back



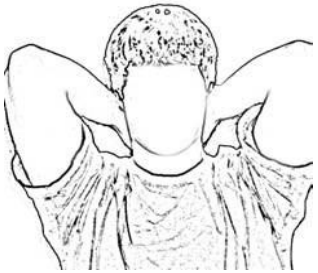
Place arm behind back, pull down on hand with other arm
Tip head to side
Hold for count of 5
Return to neutral
Repeat on other side
Repeat sequence 2 times

Neck Rotation - Side-Front-Side



Rotate head/neck to one side, hold for count of 5
Rotate head to middle, look down
Rotate head to other side, look down, hold for count of 5
Repeat sequence 2 times

Elbow Pull/Roll



Place hands on back of neck
Circle elbows at shoulders, 2 times one way and 2 times the other way
Repeat sequence 2 times

Flex Break Stretches (Start with Step-in-Place, end with the 'Scoop')

Shoulder Pull

Interlock fingers behind back
Squeeze shoulder blades together
Hold for count of 5
Relax arms/shoulder
Repeat 2 times

Arm Cross Pull

Place arm on opposite shoulder
Pull elbow toward body with other arm
Hold for count of 5
Repeat on other side
Repeat sequence 2 times

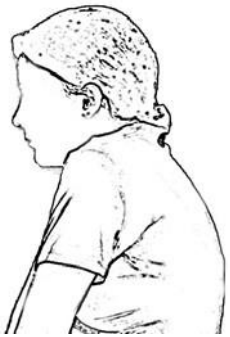
Pat Back

Raise one arm with elbow pointed ceiling
Use other hand to pull elbow backward
Hold for count of 5
Switch arms
Repeat 2 times

Shoulder Shrug

Shrug shoulders up to the ears
Hold for count of 5
Relax
Repeat 2 times

Shoulder Roll

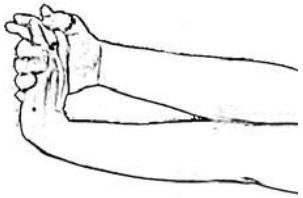


Roll shoulders 5 times in one direction, make small circles
Relax shoulders
Repeat sequence in other direction

Large Arm Circles

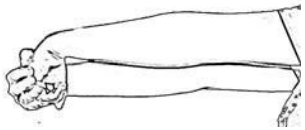
Place arms in front
Cross wrists
Make big arm circles as you can - breath in on the way up and out on the way down
Go 3 times in one direction
Relax arms to sides
Repeat 3 times in other direction

Wrist Extend



Extend arm out to front
With elbow straight, bend wrist up to stretch
Hold for count of 5
Relax
Repeat on other side
Repeat sequence 2 times

Wrist Flex



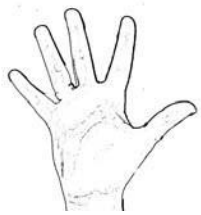
Extend arm out to front
With elbow straight, bend wrist down to stretch, make a fist
Hold for count of 5
Relax
Repeat on other side.
Repeat sequence 2 times

Hands Together

Start with hands overhead with palms together
Lower hand to chest level, keeping palms together
Hold for count of 5
Relax arms
Repeat sequence 2 times

Flex Break Stretches (Start with Step-in-Place, end with the 'Scoop')

Open/Close Hands



Start with arms/hands in front
Open hands to spread fingers as wide as possible
Hold for count of 5
Close hands to make fists
Hold for count of 5
Relax hands
Repeat 2 times

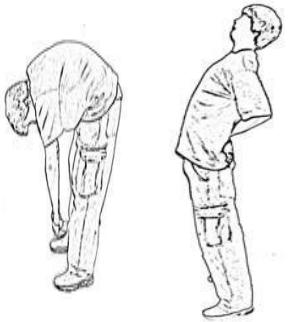
Back Bend

Start in neutral position
Place hands on belt line on back
Bend backward. Let head naturally follow shoulders. Hold for a count of 5
Return to neutral position
Repeat 2 times

Rotation Hug

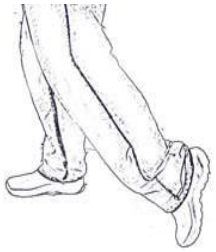
Start in neutral position with arms at sides
Swing one arm to front and one arm to back as you rotate your trunk
Hold for count of 5
Return to neutral
Repeat to other side
Repeat 2 times

Slump/Return to Neutral



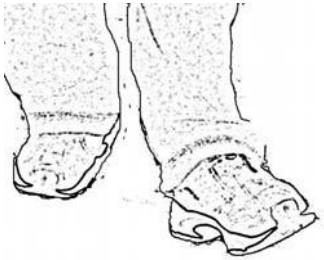
Start in neutral position with arms at sides
Allow your back to bend to reach to the floor
Hold for count of 5
BEND YOUR KNEES, LOOK UP and return to neutral
Repeat 2 times

Shin Stretch



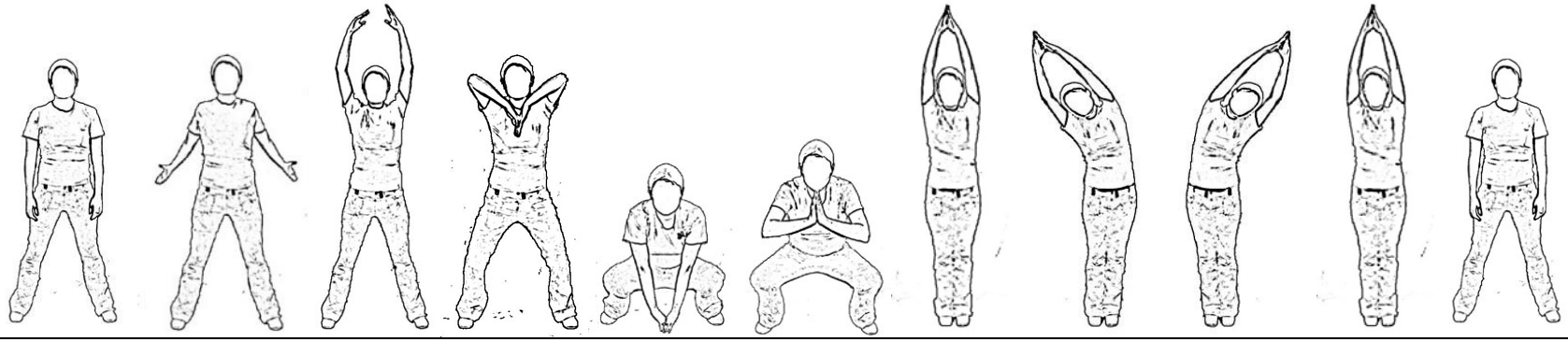
Place one foot behind other, point back foot toward floor, stretch front of lower leg.
Hold for count of 5
Repeat 2 times
Switch legs and repeat sequence

Ankle Circles



Use support for balance
Circle ankle 5 times each way.
Repeat with other ankle

The 'Scoop'



Start in Neutral Position, reach arms to side with thumbs up, raise arms overhead, bring backs of hands together, dive down into squat, put palms together, stretch into overhead reach, bring feet together, clap 3 times, stretch to one side, stretch to the other side, back to middle, lower arms, feet shoulder width apart, return to Neutral Position (Don't hold your breath!)

FLEX BREAK STRETCHES

As a group, pick about eight of the stretches to do as set. Rotate through all the stretches.
Also perform individual stretches periodically throughout the day.

Rules of the Road

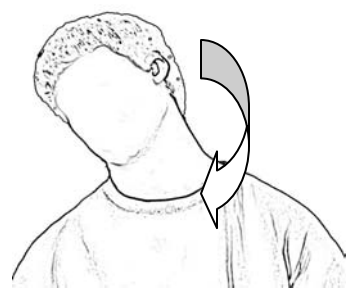
Follow Medical Restrictions Absolutely have to follow doctor's orders for any restricted activities.

Technically Correct Stretches must be performed correctly. Sloppy technique will not provide desired benefits.

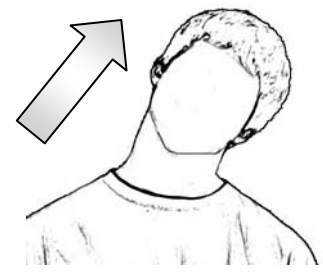
Energy Input/Output If very little energy goes into stretch very little energy comes out with little or no benefit.

High Reach

Neck Rotation



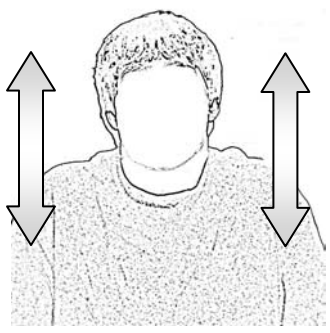
Neck Side Stretch



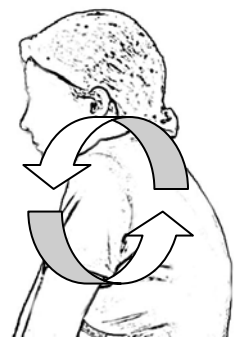
Neck Side Stretch

Neck Side Stretch

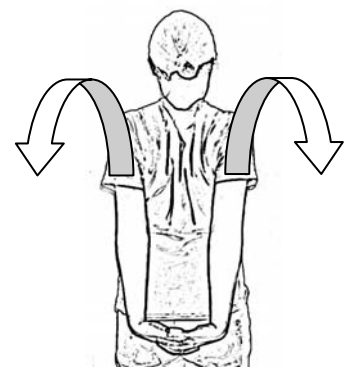
Shoulder Shrug



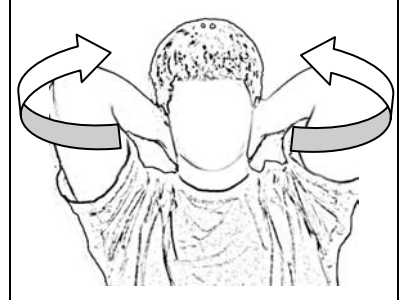
Shoulder Roll



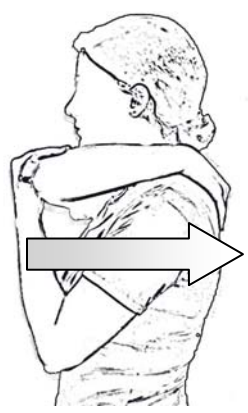
Shoulder Pull



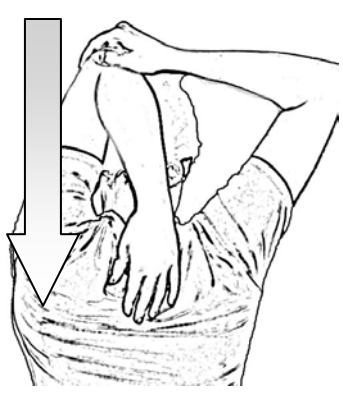
Elbow Pull/Roll



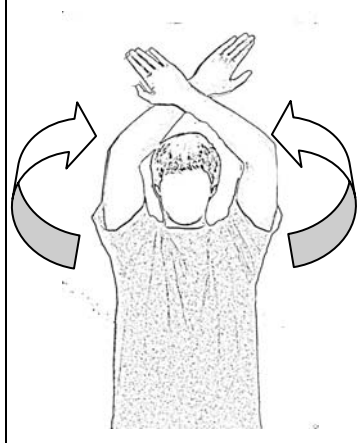
Arm Cross Pull



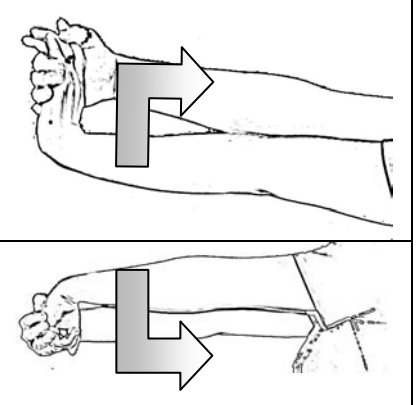
Pat Back



Large Arm Circles

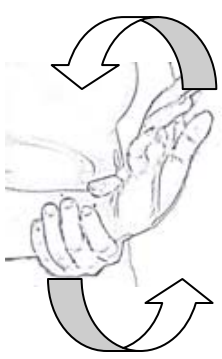


Wrist Flex/Extend



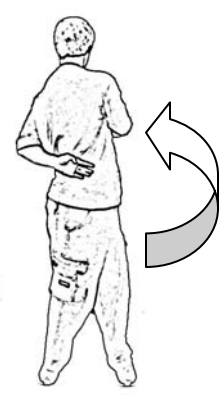
Hands Together

Wrist Circles



Slump/Backbend

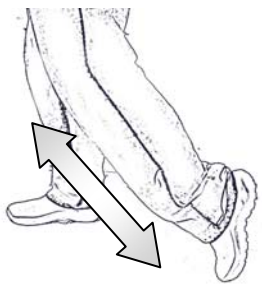
Rotation Hug



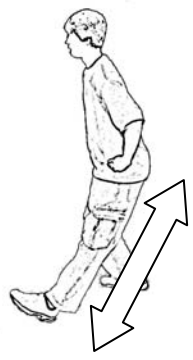
Side Bend

Hip Swivel

Shin Stretch



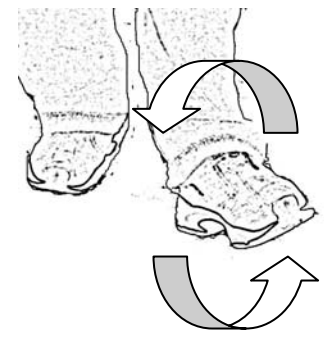
Hamstring



Calf

Heel/Toe Rock

Ankle Circles



The 'Scoop'

Situational Awareness

For a Healthy and Safe Place to Work!

Mark Anderson, MA, PT, CPE
Ergonomist and Physical Therapist
ErgoSystems Consulting Group, Inc

ErgoSystems

Has this ever happened to you?

ErgoSystems 2

Situational Awareness

- Situational Awareness:
  - A way of assessing risk
  - Situational awareness is being aware of what is happening around you in terms of where you are and whether anything around you is a risk to your health and safety.

ErgoSystems 3

Who best to use Situational Awareness?

- People who are the Experts in the job!

ErgoSystems 4

What are the FACTORS?

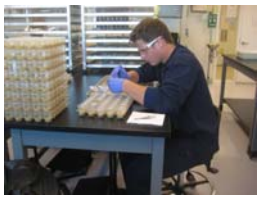
- Things we do or don't do that result in a healthy and safe place to work?

GROUP ACTIVITY

ErgoSystems 5

Fatigue Control and Recovery

- Can we **prevent** fatigue in the workplace?
- NO!
  - Fatigue is a natural part of the cycle of life!
- We need to learn strategies to **control fatigue** during the shift
- We need to learn strategies to **recover from fatigue** to get ready for the next shift or other activities



ErgoSystems 6

Ergonomics

- Does design of tools, equipment and workstations have impact on injuries?
- Professional carpenter spend how much on tools and why?
  - Safer
  - Quicker
  - More productive

EgroSystems 7

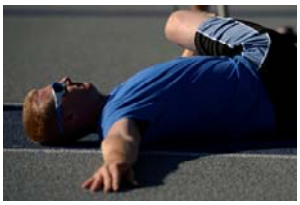
Body Mechanics/Work Techniques

- Do body mechanics and work techniques have an impact on injuries?
- Ask professional weightlifters – what is more important: STRENGTH or TECHNIQUE?
- **TECHNIQUE!**

EgroSystems 8

Stretching/Warm-up

- Does stretching/warm-up prior to, during and after physical activity have an impact on injuries?
- Do athletes warm up/cool down and why?
- Yes!
  - Otherwise increase risk of injury
  - Able to compete at a higher level



EgroSystems 9

Physical Fitness

- Does level of physical fitness (strength, flexibility, aerobic capacity) have impact on injuries?
- Your work physically demanding?!?!
- But does work provide all physical fitness you need?

EgroSystems 10

Health and Wellness

- Does general health and wellness have impact?
  - Diet and nutrition
  - Body weight control
  - Stress management
  - Smoking cessation
  - Blood pressure control
  - Adequate rest/sleep
  - Fluid intake - don't get dehydrated

EgroSystems 11

Health and Safety Factors

- Fatigue control and recovery
- Stretching/Warm-up
- Ergonomics
- Body Mechanics/ Techniques
- Physical Fitness
- Health and Wellness

EgroSystems 12

Fatigue Control and Recovery

- Can we **prevent** fatigue in the workplace?
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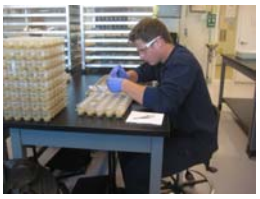


ErgoSystems 13

How to Recognize Fatigue

- **Physical fatigue**
  - Physically demanding
    - Highly repetitive
    - Result in muscle fatigue
    - Decreased hand-eye coordination
- **Mental fatigue**
  - Long periods of vigilance
    - Highly repetitive
    - Tight deadlines
    - Making mistakes

ErgoSystems 14

Control Fatigue at Work

- **Job rotation!**
  - Provides both physical and mental task variety
  - Give the body and mind a change of pace
- **Take breaks!**
  - Use breaks as recovery time (both physical and mental)
  - Get away from the workstation – change of scenery

ErgoSystems 15

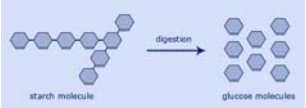
Control Fatigue at Work

- **Hydration!**
  - Maintains blood pressure and blood flow to vital organs of body
  - Proper fluid concentration levels
    - Sodium, potassium and calcium for healthy cellular activity
      - e.g. reduces muscle cramping
  - Hydration tips
    - Water
      - Try to avoid caffeinated / sugared drinks
    - How much?
      - 30 to 40% of body weight in ounces/day
        - Weigh 180#, drink 54 to 72 ounces/day
      - Listen to your body
      - Urine color - pale

ErgoSystems 16

Control Fatigue at Work

- **Nutrition!**
  - Fuel the body – we are what we eat!
    - Regular consistent consumption
    - Don't skip breakfast
  - Combination of complex and simple carbohydrates
    - Carbohydrates are sugars that break down into glucose (fuel for body)
    - Complex slow burning carbohydrates (whole grains, potatoes, squash, pumpkin and carrots)
    - Simple fast burning carbohydrates (fruits, vegetables and honey) provide immediate source of energy
    - Simple sugars found in candy bars, soft drinks and cookies provide quick boost, but then a **big letdown afterward**!



ErgoSystems 17

Control Fatigue at Work

- **Nutrition!**
  - Add in proteins
    - Meat, poultry, fish, eggs, beans, nuts, soy, and low-fat dairy products
  - Healthy fats
    - Unsaturated fats: found in foods like olive oil, avocados, nuts, and canola oil
- **Balanced nutrition is the goal!**

ErgoSystems 18

Recover from Fatigue at Home

- **Rest**
  - 7 to 8 hours sleep
  - Adequate mattress
  - Darkened room
  - Sleep mask with ear plugs
- **Nutrition/Fluid**
  - Same as at work
- **Travel Safely**
  - Commuting to/from work
- **Personal/Family time**
- **Physical Fitness**
- **Health and Wellness**

ErgoSystems 19

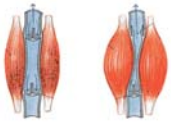
Health and Safety Factors

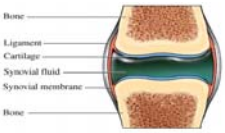
- Fatigue control and recovery
- **Stretching/ Warm-up**
- Ergonomics
- Body Mechanics/ Techniques
- Physical Fitness
- Health and Wellness

ErgoSystems 20

Stretching: What's it all about?

- **Oxygen**
  - Helps heart because muscles act like pumps
  - Increased blood flow
  - More oxygen and nutrition
  - Joint Lubrication
    - Movement stimulates production of joint lubricating fluid
    - Improve joint health





ErgoSystems 21

Stretching Guidelines

- Absolutely have to follow Doctor's orders for any restricted activities
- Technically correct
- Energy Input/output
- Neutral position
- Joint noises
- Don't hold breath
- Regular and consistent
- Intensity/controlled stretching

ErgoSystems 22

Bottom Line . . . Why Stretch?

- Alertness levels
- Help prevent injuries
- Control stress
- Reduce muscle tension
- Increase flexibility
- Develop body awareness
- IT FEELS GOOD!

ErgoSystems 23

Health and Safety Factors

- Fatigue control and recovery
- Stretching/Warm-up
- **Ergonomics**
- Body Mechanics/ Techniques
- Physical Fitness
- Health and Wellness

ErgoSystems 24

What is Ergonomics?

- Ergonomics is working smarter not harder!

Ergonomics Principles

- Promote effective work processes
- Position and support body in neutral
- Work in power zone
- Provide correct tools, equipment and facilities

Promote effective WORK PROCESSES

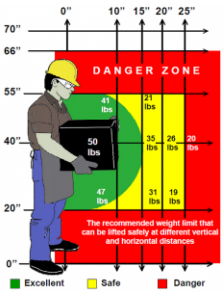
- Take step back and really examine why something is done as it is
- If answer is. . . 'Because it has always been done that way!'
- Take fresh look
- Is there better way to get it done?

Position and support BODY IN NEUTRAL

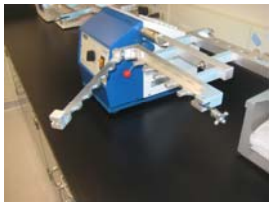
- Spine neutral position
  - S-shape
- Spring like

Work in POWER ZONE

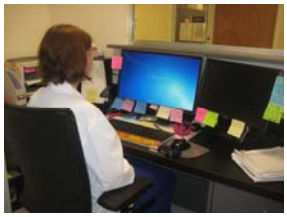
- Stature and arm's length determine Power Zone
- Determine individual reach and set up workstation to promote work in that zone



Provide Correct TOOLS, EQUIPMENT and MATERIALS



Office Ergonomics Set-up



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Art of Sitting

- **Body not designed to sit**
  - Particularly for long periods
  - Studies determined even when seated in well-supported postures . . .
  - How soon do we want to move?
  - About every 20 to 30 minutes!

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Chair

- **Adjustments**
  - Seat height, tilt and depth
  - Back support height and angle
  - Armrests height and side-to-side
  - Five legs
  - Wheels for floor surface
  - Mesh or fabric

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Functional seated positions

- **Provide for several different acceptable postures**
- **Rotate throughout day on regular basis:**
  - Upright "keyboard" position
  - Semi-reclined/rocking "conversation" position
  - Standing

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Foot Support

- **In an ideal world the best foot support when seated in a chair is the floor . . .**
- **However if needed use proper sized foot rest**

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Computer equipment

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Keyboard Technique

Free float piano playing style

Use of worksurface for forearm support

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Mouse Technique

- **Neutral positions**
  - Same plane as keyboard
- **Mousing style or technique**
  - Free float piano playing style
  - Use of worksurface for forearm support

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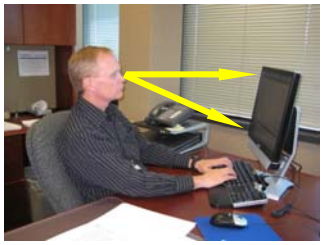
Monitor Height

- Top of screen no higher than eye level
- Look out and use downward eye movement to look at lower part of screen



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Monitor Distance

- **Eyes**
  - Accommodation
    Convergence
- **Guideline**
  - Get screen as far away from user as possible
    - At least arm's length
    - Still be able to read it clearly with good posture

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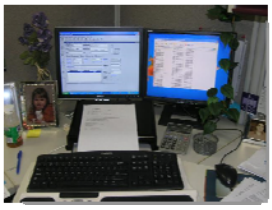
Dual Monitors

Primary/Primary



Primary/Secondary

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Eye Examinations

- **Regular eye examinations**
- **Eyewear prescriptions changes**
- **Eye health in general**
- **Based on job task**

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Presbyopia

- Age-related process
- Slow loss of flexibility within lens inside eye
- Solutions
  - Bifocals
  - Computer glasses
  - Lower monitor

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Document holder

- Horizontal vs. inclined

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Office equipment

- Make use of principles to position office equipment
  - Calculator
  - Printer
  - Fax
  - Writing utensils
  - Scissors
  - Paper clips
  - Stapler
  - Stuff

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Lighting – General and Task

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Health and Safety Factors

- Fatigue control and recovery
- Stretching/Warm-up
- Ergonomics
- **Body Mechanics/ Techniques**
- Physical Fitness
- Health and Wellness

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Body Mechanics/Work Techniques

- What do we lift everyday?
- How important are work techniques?

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Lifting Techniques Basics

- **Planning**
  - Think lift through
  - Know where load will end up
  - Decide if manual or power equipment
- **Get help if needed**
  - Good communication
  - Partner: Lift in unison

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Power Lift Basics

- **Feet wide**
- **Maintain neutral spine**
- **Tighten stomach muscles**
- **Keep load close**
- **Build a bridge**
- **Good grip**
- **LOOK UP!**

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LOOK DOWN **LOOK UP**

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Lifting Techniques

Golfer's Lift

Pivot Lift

Overhead Lift

Straight Leg Lift

Power Lift

Partial Squat Lift

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Health and Safety Factors

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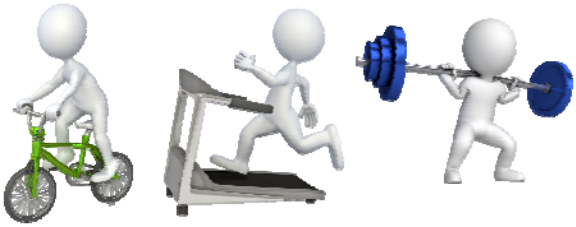
Physical Fitness



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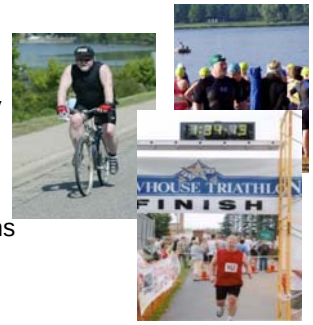
Physical Fitness

- **Basic Guidelines**
  - Medical check
  - Start slow and easy
  - Reasonable expectations
  - Buddy system
  - Commit for 6 months



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Examples

Strength	Flexibility	Heart/lung fitness

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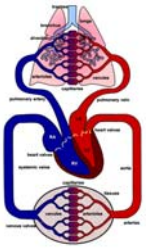
Fitness/Aerobic Capacity

- **Measure of body's ability to bring air into lungs**
  - Transfer to red blood cells
  - Supply body with oxygen through the circulatory system
- **Guidelines:**
  - 20 to 30 minutes at moderate intensity
  - 3 to 4 times per week



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Examples

- **Treadmill**
- **Bicycle**
- **Swimming**
- **Park at some distance at mall and walk**
- **Take stairs**
- **Take dog for a walk**
- **You get the point!**

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Strength/Endurance

- **How much do you need?**
- **Does your work provide what you need?**
- **Is your strength balanced?**
- **Basic program**
  - 3 to 4 times per week
  - 5 to 10 repetitions
  - 2 to 3 sets of each exercise

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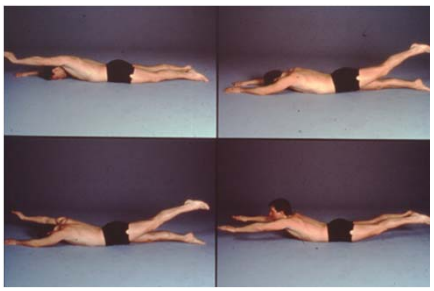
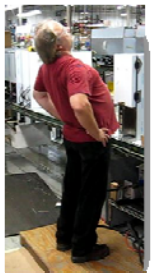


Flexibility

- How much do you need?
- Does your work provide what you need?
- Is your flexibility balanced?
- Basic program
  - 3 to 4 times per week
  - hold for count of 10 to 15
  - 2 to 3 repetitions



Health and Safety Factors

- Fatigue control and recovery
- Stretching/Warm-up
- Ergonomics
- Body Mechanics/ Techniques
- Physical Fitness
- **Health and Wellness**

Health and Wellness

- **Does general health and wellness have impact?**
  - Diet and nutrition
  - Body weight control
  - Stress management
  - Smoking cessation
  - Blood pressure control
  - Adequate rest/sleep
  - Fluid intake - don't get dehydrated

Health and Safety Factors

- Fatigue control and recovery
- Stretching/Warm-up
- Ergonomics
- Body Mechanics/ Techniques
- Physical Fitness
- Health and Wellness

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Summary and Close

- Situational Awareness for a healthy and safe workplace!
- Integrate strategies into day-to-day routine!

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Thanks!

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VALENT BIOSCIENCES CORPORATION

Situational Awareness

For a Healthy and Safe Place to Work!

Mark Anderson, MA, PT, CPE
Ergonomist and Physical Therapist
ErgoSystems Consulting Group, Inc

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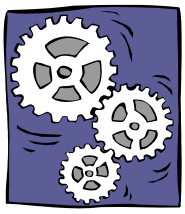

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Productivity and Safety through Ergonomics

☑ CONSULTATION
☑ TRAINING
☑ INSTRUCTIONAL DESIGN

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