

MP&W SAFETY & TRAINING

# Ergonomics

MSD Injury Prevention

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**Muscatine  
Power and Water**

# Ergonomics Definition

The International Ergonomics Association offers a very comprehensive definition: “The scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.”

# Laymen's Terms

- “Designing the job to fit the person.”
- Success lies in integrating ergonomics as a continuous improvement process where health and safety, engineering and product design all contribute to the activity and share in the benefit.

# APPROACHING THE ISSUE

- **The Reactive Phase**

- important procedural changes in injury investigation, documentation and the development of early reporting mechanisms and effective return-to-work processes.
- Implement stretching programs and lifting training.
- Companies may see an initial improvement in incident rate and subsequent compensation costs.
- Root Cause is not addressed.

# APPROACHING THE ISSUE

- **The Proactive Phase**

- Companies take a risk management approach to managing work-related musculoskeletal disorders (WMSDs).
- Improvements are designed and physical changes to equipment, workstation layout and tools are implemented to eliminate the root cause of the ergonomic risk.
- When an ergonomic process includes all of these characteristics, substantial and sustainable improvements in injury incidence and costs are experienced.

# APPROACHING THE ISSUE

- **The Advanced Phase**

- Change the perspective of engineers and designers.
- They must understand that their decisions impact the productivity, engagement and health of your employees as well as the quality of products and ultimately, the company's profitability.
- Apply an engineering discipline to the intersection of people, work and the work environment.

# Ergonomic Hazards

- Extreme Temperatures
- Lighting
- Contact Stress
- Vibration
- Repetition
- Force
- Awkward Posture
- Noise
- Brain
- Body

# Field Worker Issues

- Torque

- The last torque on a bolt will stretch the tendons
- Knowing how much to torque and using the right tools
- Proper fitted or adjusted tools

- Push/Pull

- Pushing is better than pulling
- Keep proper posture

# Field Worker Issues

## •Lifting/Over Reaching

- Proper posture
- Avoid over reaching
  - Place material where it can be reached
  - position body or bucket to keep work within your torso zone

## • Vehicles

- Proper posture
- Seat Adjustment
- Lumbar Support

## 2008 AE Ergonomic Evaluation Process - Tooling

New Tool or Tool Change proposed to Tool Committee and Committee requests an Ergonomic Evaluation.  
Sample Tool is ordered and sent to Muscatine Operating c/o Jon Nietzel

Ergonomic Evaluation is conducted on all New tooling within 30 days

Ergonomic Evaluation Passed

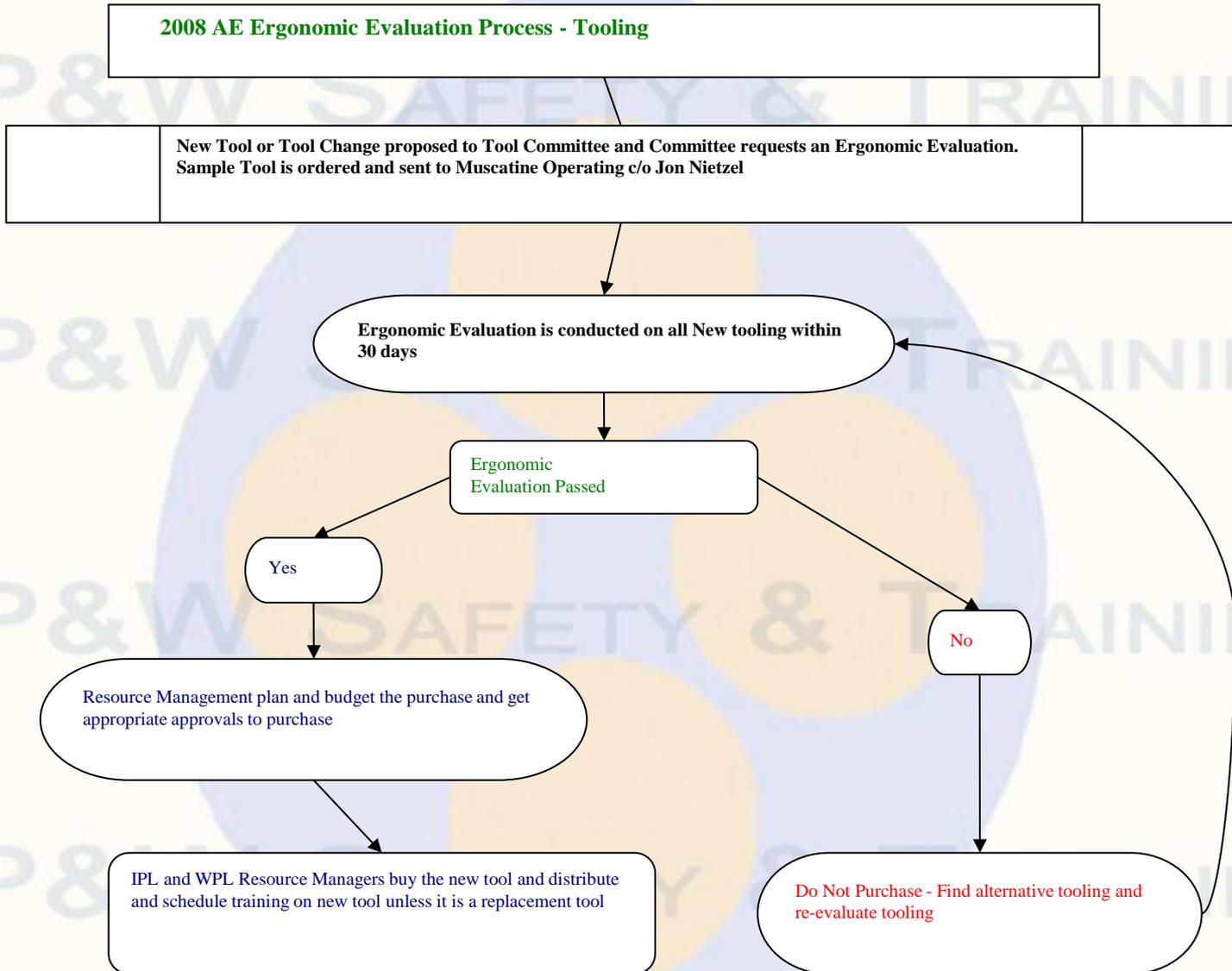
Yes

Resource Management plan and budget the purchase and get appropriate approvals to purchase

IPL and WPL Resource Managers buy the new tool and distribute and schedule training on new tool unless it is a replacement tool

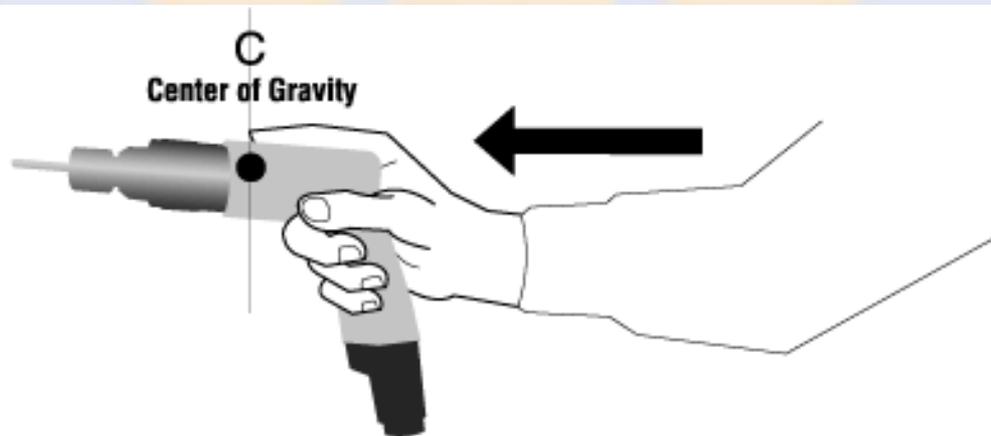
No

Do Not Purchase - Find alternative tooling and re-evaluate tooling



# What are the major ergonomic concerns of a hand tool design?

- A worker should be able to operate a tool with one hand. The weight of the tool, especially for repetitive use, should not exceed 1 kg (2.2 lb.). It is also important that the centre of gravity be aligned with the center of the gripping hand.

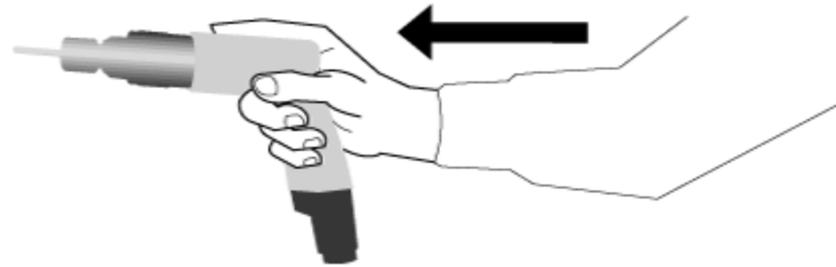


# What are the major ergonomic concerns of a hand tool design?

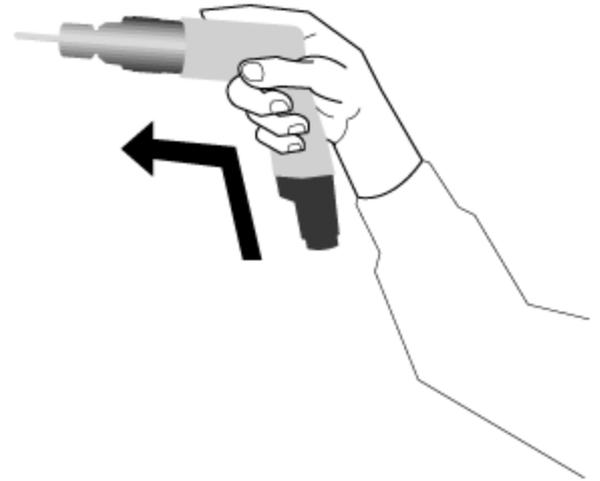
- Tools should feel "easy" to hold in an upright position or in the position it will be used (ie. pointing down).
- Drills that are "front-heavy" will require effort (especially in the wrist and forearm) to hold in a usable position and should be avoided.
- Tools heavier than 1 kg or poorly balanced tools should be supported by counter-balancers.

# What are the major ergonomic concerns of a hand tool design?

- Handles and grips of hand tools should be designed for a power grip.

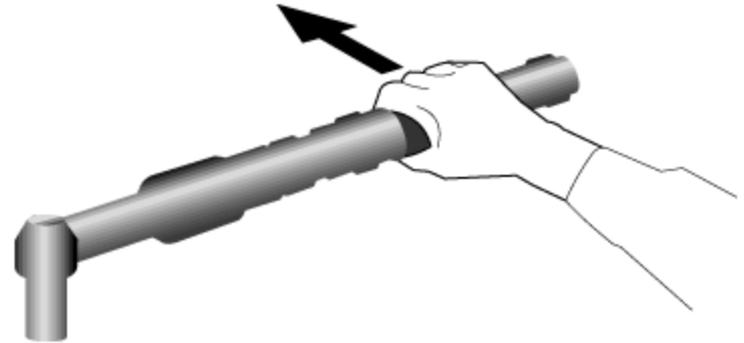


- Tools with "bent" or angled handles or tools with pistol-grips are beneficial where the force is exerted in a straight line in the same direction as the straightened forearm and wrist, especially when the force must be applied horizontally



# What are the major ergonomic concerns of a hand tool design?

- Tools with straight handles are for tasks where the force is exerted perpendicular to the straightened forearm and wrist, for instance, when the force must be applied vertically.



# What are the major ergonomic concerns of a hand tool design?

- Shaped tools such as bent-handle tools are effective where most of the tasks are done in the same plane and height as the arm and hand.



# What are the major ergonomic concerns of a hand tool design?

- Select tools that allow you to keep the wrist straight or in a neutral position.
- The crucial ergonomic principle in tool use and design -- **bend the tool, not the wrists**

# Tool Handle Diameter

- Handles should be cylindrical or oval in cross section, with a diameter of between 30 mm and 45 mm.
- For precision work the recommended diameter for handles is between 5 mm and 12 mm.
- For a greater torque large screwdrivers should have a handle diameter up to 50-60 mm.

# Tool Handle Length

- A handle that is too short can cause compression in the middle of the palm.
- It should extend across the entire palm.
- Tool handles longer than 100 mm will reduce the negative effects of any compression exerted.
- Rounded handles minimize palm compression.
- Keep in mind that the use of gloves requires longer tool handles.

# Materials & Textures of Handles

Hand tools should be made of non-slip, non-conductive and compressible materials. For example, textured rubber handles provide a good grip, reduce the effort needed to use the tool effectively, and prevent the tool from slipping out of the hand.

Electrical and heat insulation properties of the handles are important for power hand tools. Handles made of plastics or compound rubber are recommended.

Sharp edges and contours can be covered with cushioned tape to minimize lacerations.

# When should power tools be used?

- When manual hand tools are used for tasks that require the frequent and repetitive use of force to perform a task or job, the risk of contracting an WMSD increases.
- Replace with power tools
- Always conduct a risk assessment before making any change. Make sure that all aspects of the new tool has been considered (weight, size, etc.) to be sure that one type of hazard has not been exchanged for another.

# Power tool triggers

- Frequent movements of the index finger while operating the trigger of power tools poses a considerable risk for both "trigger finger" and "trigger thumb" (tendonitis in the index finger and/or thumb).
- A longer trigger which allows the use of two or three fingers to activate them reduces discomfort and minimizes the risk for injury.
- The recommended minimum length of the trigger is 50 mm.

# Vibration

- The only effective way to reduce vibration in power tools is at the design stage.
- This fact makes tool selection most critical.
- The common practices of covering handles of vibrating tools with a layer of viscoelastic material or of using anti-vibration gloves made of similar material are of dubious value.
- These "anti-vibration" materials will dampen vibration above certain frequencies that are characteristic for the kind of material, but most of the vibration energy in a handle of a power tool is below those frequencies.

# When selecting and using a hand tool it is important to:

- "bend" the tool, not the wrist; use tools with angled or "bent" handles, when appropriate
- avoid high contact forces and static loading
- reduce excessive gripping force or pressure
- avoid extreme and awkward joint positions
- avoid twisting hand and wrist motion by using power tools rather than hand tools.
- avoid repetitive finger movements, or at least reduce their number
- avoid or limit vibration
- minimize the amount of force needed to activate trigger devices on power tools.

# KEYS TO BACK INJURY PREVENTION

## 1. KEEP SHOULDERS AND HIPS IN THE SAME PLANE.

**CORRECT**



**INCORRECT**



## 2. KEEP THE PELVIS IN A "GUNS UP" NEUTRAL POSITION

**INCORRECT**



**CORRECT**



**CORRECT**



**3. "DON'T SPILL THE WATER." KEEP YOUR TRUNK IN UPRIGHT POSITION.**

**CORRECT**



**INCORRECT**



**4. WHEN LIFTING, KEEP YOUR FEET SPREAD AND "DON'T SPILL THE WATER"**

**CORRECT**



**INCORRECT**



5. WHEN LIFTING, KEEP YOUR HEELS DOWN. YOUR FEET NEED TO BE SEPARATED AND ON STABLE GROUND.

**CORRECT**



**INCORRECT**



6. KEEP THE LOAD CLOSE TO YOUR BODY.

**CORRECT**



**INCORRECT**



**7. KEEP YOUR SPINE CURVES NEUTRAL WHEN REACHING.  
DON'T BEND BACKWARDS! !**

**CORRECT**



**INCORRECT**



**8. WHEN SITTING, KEEP YOUR HIPS HIGHER THAN  
YOUR KNEES.**

**CORRECT**



**INCORRECT**

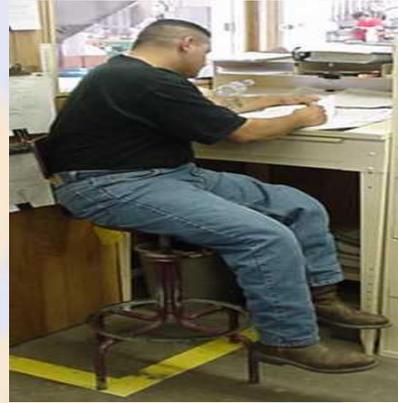


**9. WHEN SITTING, SUPPORT YOUR WEIGHT THROUGH YOUR FEET. DON'T LET YOUR FEET DANGLE.**

**CORRECT**



**INCORRECT**



**10. SUPPORT THE LOWER BACK WHILE SITTING.**

**CORRECT**



**INCORRECT**



COACH: \_\_\_\_\_ UNIT: \_\_\_\_\_  
 DATE: \_\_\_\_\_ CRAFT: \_\_\_\_\_

**ERGONOMICS COACHING DATA SHEET**

CONDITION/ACT	NUMBER PROPER	NUMBER IMPROPER
HAND PLACEMENT		
CONTACT STRESS		
REACHING TO LIFT		
LIFTING HEELS DOWN		
LIFTING AND BENDING		
AWKWARD POSITION		
SHOVELING		
WHEELBARROW		
PUSHING AND PULLING		
KEEPING LOAD CLOSE		
SPECIAL LIFTING EQUIP.		
CHAIR HEIGHT		
LUMBAR SUPPORT		
ARM/WRIST SUPPORT		
LINE OF VISION		
NECK POSTURE		

COMMENTS: NOTE CRAFT OBSERVED IF NOT YOUR CRAFT.  
 ADDITIONAL COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

# Train for more mobility, more frequently!!

- *As age increases, we lose mobility.*

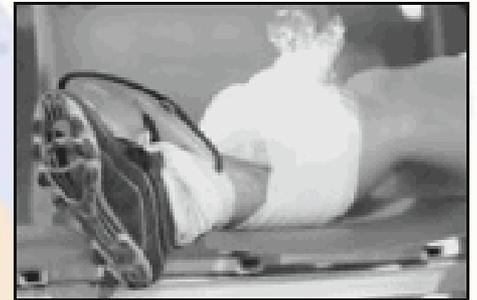
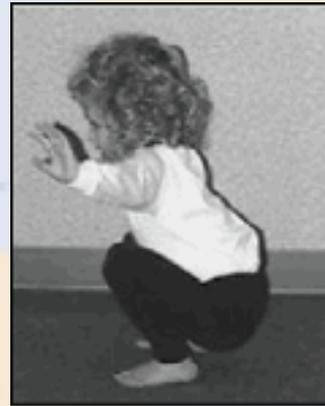
20's 2 times per week

30's 3 times per week

40's 4 times per week

50's 5 times per week

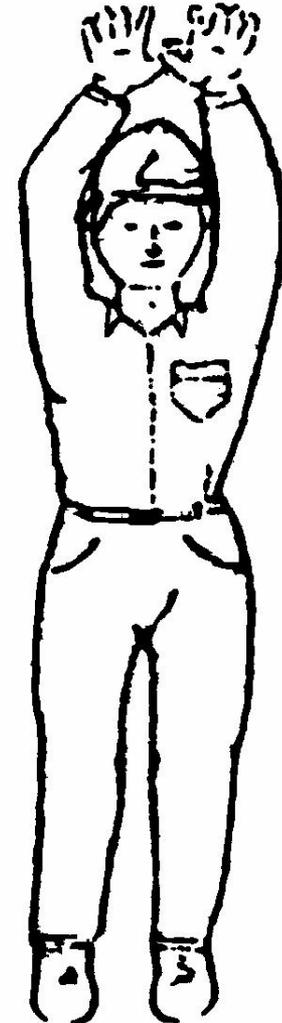
60's 6 times per week



# Body Stretch

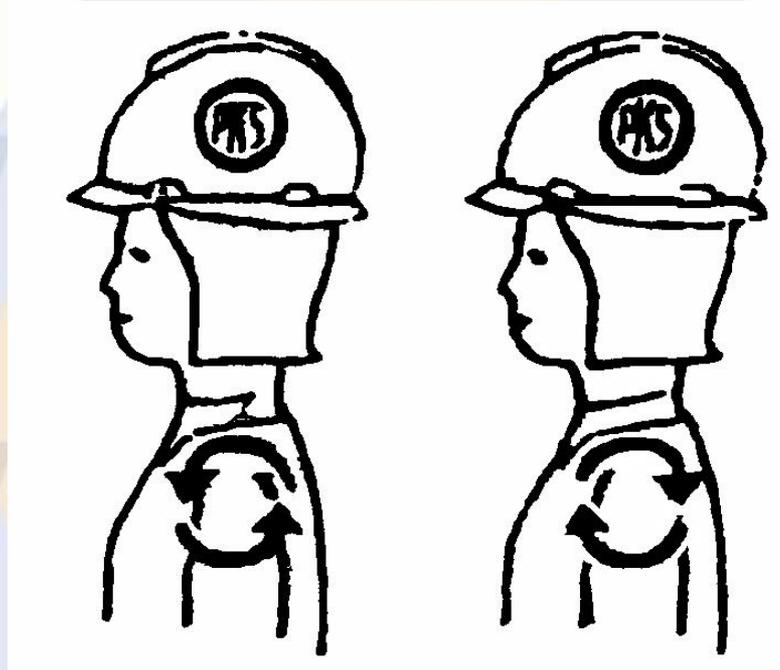
## Stretches overall upper body

- Maintain a neutral body posture.
- Raise arms overhead, directly above shoulders.
- Interlock thumbs and spread fingers.
- Extend body upward on toes.
- Hold for 5-8 seconds.
- Repeat 3-5 times



# Shoulder Rolls

Stretches upper back, neck and shoulder regions

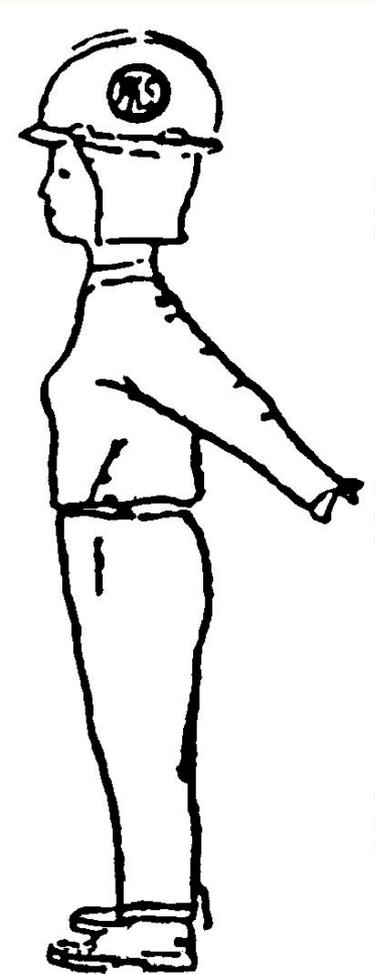


- Standing tall, rotate shoulders forward 5-7 times.
- Reverse the direction and rotate backwards 5-7 times.

# Chest Stretch

Stretches arms, chest, hands and shoulders

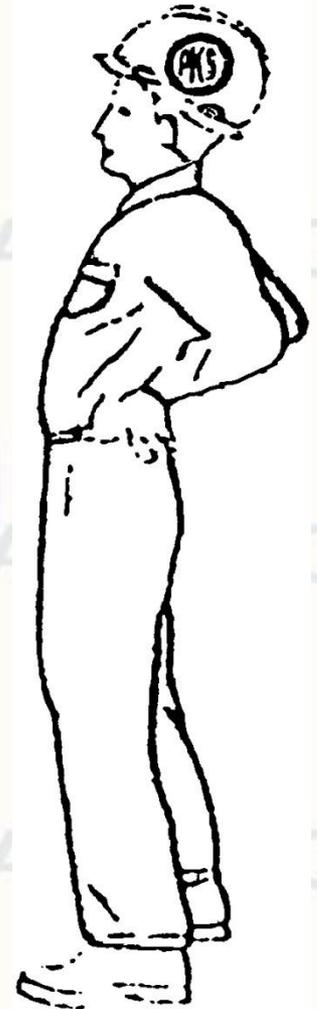
- Interlace your fingers behind your back, palms facing away from you back.
- Slowly move your elbows in towards your spine while straightening your arms until a stretch is felt.
- Lift your breastbone slightly upward as you stretch.
- Hold for 5-8 seconds
- Repeat 3-5 times.



# Lower Back Reliever

## Stretches chest and back

- Place hand just above the back of your hips, elbows back.
- Gently press forward.
- Slightly lift your breast bone upward as you hold the stretch.
- Hold for 5-8 seconds. Breathe easily.
- Repeat 3-5 times. (If this causes pain at the forearm, modify the stretch by making a fist on the back of your hips to alleviate pressure at the wrists.)



# Quadriceps Stretch

## Stretches front of thigh, hip flexors and ankles

- Balance the weight of left leg or use something for support.
- Grab the right ankle with the left hand. Maintain a straight line with the knee to the floor.
- Press hips forward to feel the stretch, avoid pulling the knee up and back.
- Hold for 5-8 seconds.  
Repeat with other leg.

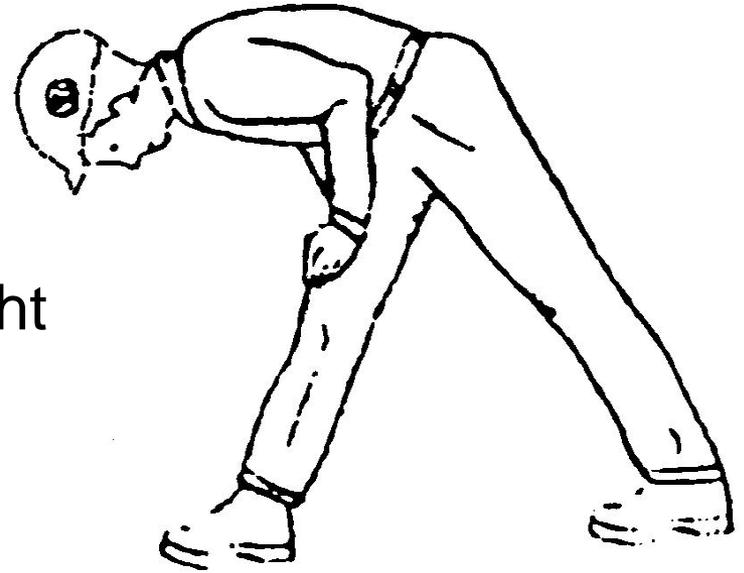
(If you are unable to reach your ankle, modify the stretch by placing your foot on a bench or ledge that is about 1-2 feet off the ground. Slowly press your hips forward to feel the stretch in front of the thigh.)



# Hamstring Stretch

## Stretches back of calf and thigh

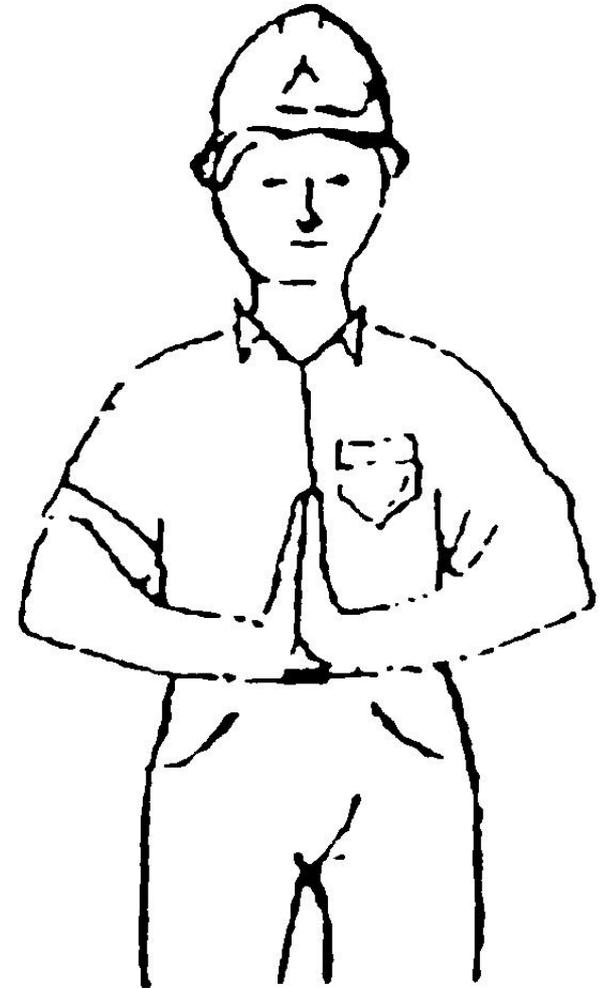
- Assume stride position with right leg forward, legs straight, feet flat on floor and toes pointed forward.
- Place both hands on right thigh for support. Slowly bend forward over right knee, keeping head and back straight.
- Hold 5-8 seconds. Push upward with hands and arms for recovery. Repeat with other leg.



# Greeting Stretch

Stretches wrists, forearms and hands

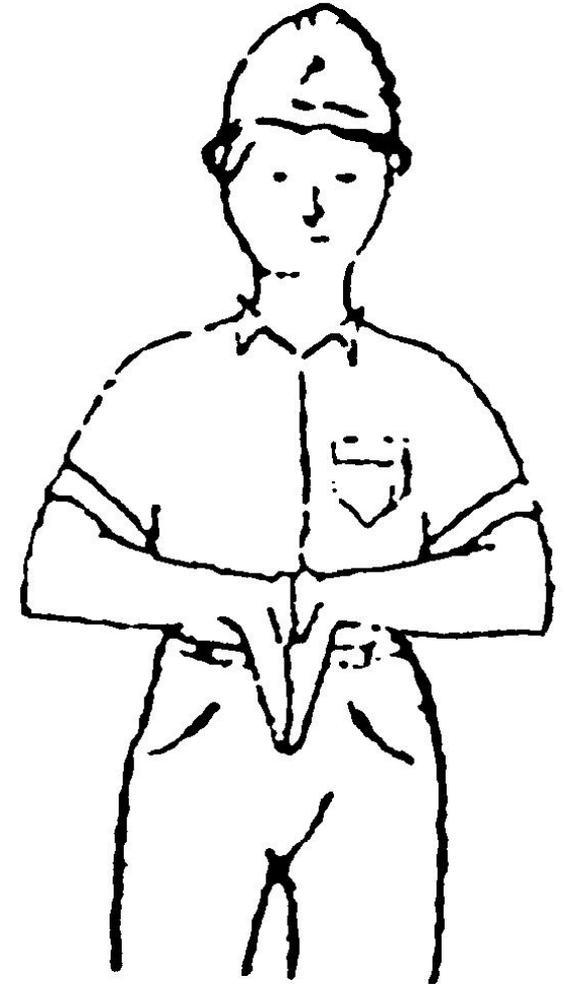
- Place hand palm-to-palm in front of you.
- Move hands downward, keep your palms together until you feel a mild stretch.
- Keep elbows up and even
- Hold 5-8 seconds



# Inverted Greeting Stretch

## Stretches wrists, forearms and hands

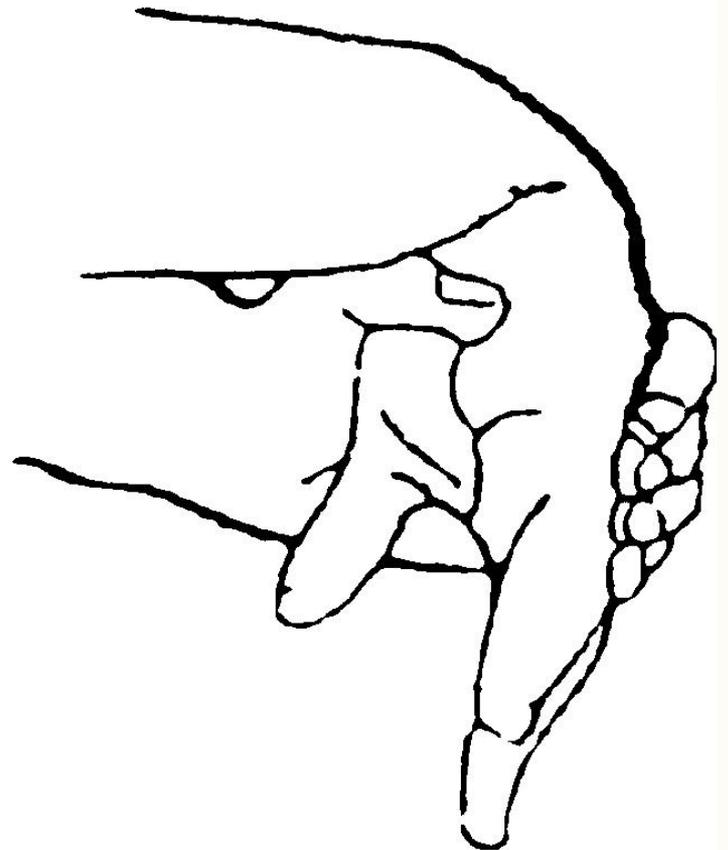
- From the previous stretch, rotate your palms around until they face or less downward.
- Go until you feel a mild stretch.
- Hold 5-8 seconds



# Forearm Stretch

Stretches the wrist extensors.

- Straighten right arm. Place the palm of the left hand on top of right hand.
- Slowly move right palm in the direction of the floor until a stretch is felt.
- Hold 5-8 seconds.  
Repeat with the other arm.



# Body Motion Injury Reduction

- Share the repetitious stuff with some one else
- Get closer to the work
- Get help lifting heavy objects
- Prepare the body for physically demanding tasks
- Compensate: take frequent mini breaks and stretch during highly repetitive tasks
- Self Trigger and check your posture frequently

# Ergonomics and SafeStart

- See a Co-Worker attempt to lift too much – Stop Them!
- See a Co-worker bend at the waist to lift – Stop Them!
- See a Co-worker reach too far – Stop Them!
- See a co-worker frustrated, complacent, tired or in a hurry – Stop Them Remind Them!

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**QUESTIONS????**

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