

APPENDIX 2

Risk Factor Identification

APPENDIX 2

This Appendix corresponds with Step 2: Risk Factor Identification, and includes:

- The Level I Ergonomics Assessment Checklist Glossary; and
- A sample of a completed Level I Ergonomics Assessment Checklist

**LEVEL I ERGONOMICS
ASSESSMENT CHECKLIST GLOSSARY**

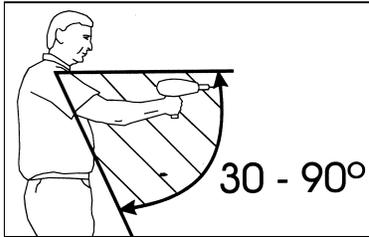
This Glossary provides additional information on each question in the Checklist. For each Job Factor question, the glossary provides:

- An explanation of the ergonomics risk factors upon which the Job Factor question is based;
- An explanation of how exposure to the Job Factor impacts the person;
- Assistance in determining if the Job Factor is present and if it is present at the level specified in the question; and,
- Examples and hints of what to look for in the workplace.

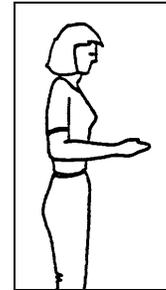
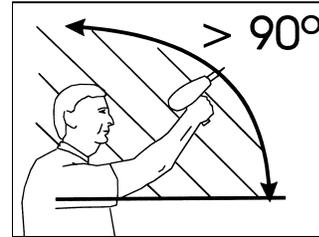
Note: As you gain experience using the Level I Ergonomics Assessment Checklist and with ergonomics in general, your reliance on this Glossary should decrease significantly.

Table 1
Checklist Question 1

Question: Repeated reaching or arms held continuously away from body while unsupported



Incorrect



Correct

Targeted Risk Factor Table

| Risk Factor | | Risk Factor | |
|-------------|----------------------------------|-------------|---|
| x | Stressful Positions or Movements | x | Static (fixed position) work |
| | Heavy or forceful work | x | High Frequency (repetitive) or high speed movements |

Background Discussion

Highly repetitive reaching over a period of time can result in excessive wear of the shoulder joint, rotator cuff tendons, and bursae. Holding the arms away from the body continuously (without support) causes static muscular effort. Static muscular effort produces discomfort in a matter of seconds because the energy stored in the muscle is rapidly depleted and the constricted muscles restrict the flow of replenishment energy and oxygen to the muscle.

What to Look For

This Job Factor is scored when one or both arms is held away from the body or reaches repeatedly away from the body. The shoulder posture is measured from the shoulder joint referencing the upper arm posture with respect to a vertical reference passing through the upper body.

- The *below shoulder level* Job Factor is scored when the upper arm is observed to be approximately 30-90° away from the torso while the task is being performed.
- The *above shoulder level* Job Factor is scored when the upper arm is observed to be greater than 90° away from the torso during while the task is being performed.

Table 1

Checklist Question 1 (Cont'd)

This assumes that the torso is upright and in a vertical orientation. If the arms are hanging down while bending this does not count as reaching unless the person reaches past the shoulders. If the person reaches past the shoulders while bending, this is scored as an *above shoulder level* reach.

As a general rule, reaching would be considered to be “repeated” if the person reaches, on average, every 30 seconds or more frequently. Holding the arms away from the body “continuously” would be considered to be occurring if the holding position is maintained for at least 10 seconds at a time.

Examples of tasks in which reaching would be scored include:

- working overhead;
- working in restricted spaces; or,
- accessing work objects which are far from the body.

References: 1, 2, 3, 4, 5, 6, 7, 8

Table 2
Checklist Question 2

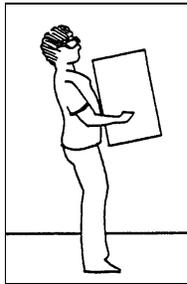
Question: Arm forces: Repeated arm forces exceeding 10 lb. (4.5 kg) (e.g. roughly equivalent to lifting a gallon of milk) or holding/carrying materials exceeding 25 lb. (11.4 kg) for more than three steps



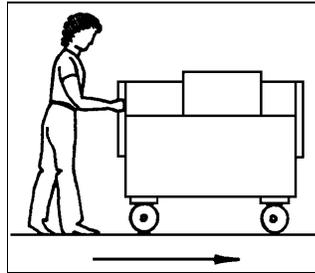
Incorrect



Correct



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|----------------------------------|-------------|---|
| | Stressful Positions or Movements | | Static (fixed position) work |
| x | Heavy or forceful work | | High frequency (repetitive) or high speed movements |

Background Discussion

Forceful use of the arm, repeatedly, over a period of time can result in wear of the shoulder joint, rotator cuff tendons, and bursae.

Holding and carrying heavy materials for long periods of time can also wear the shoulder joint and create fatigue from static muscular effort.

What to Look For

The *repeated arm forces* portion of the Job Factor is scored if the force required to perform the task exceeds 10 lb. (4.5 kg) and the arm forces must reoccur (on average) at least every 30 seconds. Lifting a gallon of water or milk is about 8 lb. (3.6 kg) So if the task seems to exceed the force required to lift a gallon of liquid the Job Factor is present.

Table 2
Checklist Question 2 (Cont'd)

Examples of tasks in which repeated arm forces would be scored include:

- Swinging a heavy hammer; or,
- Yanking on a stuck component to remove it from a machine.

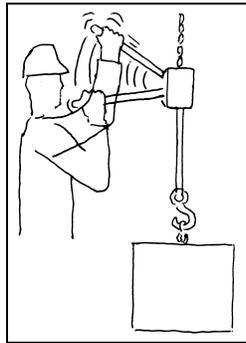
The *holding/carrying materials* portion of the Job Factor is scored if the person carries items which weigh more than 25 lb. (11.4 kg) for more than three steps at a time. This means that in order for the Job Factor to be scored, the item must be carried more than three steps (about 10 feet (3 meters) or more).

Examples of tasks in which holding/carrying materials would be scored include carrying tools or pieces of equipment that weigh more than 25 lb. (11.4 kg) for long distances.

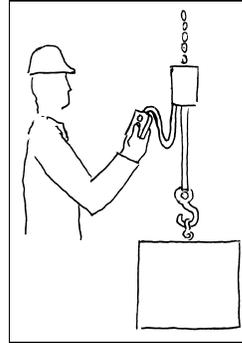
References: 9, 10, 11, 12, 13, 14

**Table 3
Checklist Question 3**

Question: High speed, sudden shoulder movements (e.g., opening a stuck door, pulling and yanking on a stuck component to remove it)



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|----------------------------------|-------------|---|
| x | Stressful Positions or Movements | | Static (fixed position) work |
| | Heavy or forceful work | x | High frequency (repetitive) or high speed movements |

Background Discussion

High speed sudden shoulder movements generate very high forces internally in the shoulder joint. These movements can result in wear and excessive damage to the shoulder joint, rotator cuff tendons, and bursae.

What to Look For

This Job Factor is scored when the arms are observed to be moving with high velocity during the task, such as sudden or jerky movements. High speed, sudden shoulder movements typically occur in tasks where high forces are also required.

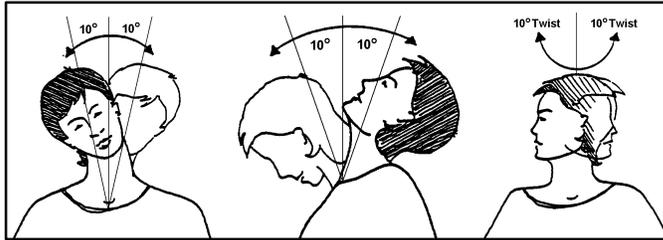
Examples of high speed or sudden shoulder movements may include:

- Any kind of heavy hammering activity (however, using a small hammer to tap might not constitute high speed, sudden shoulder movements);
- Yanking on a stuck component to move it;
- Opening a stuck door;
- Throwing objects.

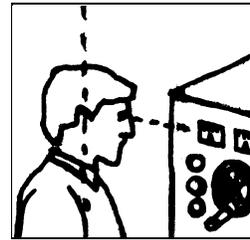
References: 15, 16

Table 4
Checklist Question 4

Question: Head/neck bent, tilted, or twisted ($>10^\circ$) (e.g., craning neck looking into tight spaces)



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|----------------------------------|-------------|---|
| x | Stressful Positions or Movements | x | Static (fixed position) work |
| | Heavy or forceful work | | High frequency (repetitive) or high speed movements |

Background Discussion

Generally, the concern with the head and neck is associated with prolonged use of awkward postures. Maintaining these postures causes static muscular effort since muscles are held in a state of contraction in order to support the head. Static muscular effort produces discomfort in a matter of seconds because the energy stored in the muscle is rapidly depleted and the constricted muscles restrict the flow of replenishment energy and oxygen to the muscle.

What to Look For

This Job Factor is scored when the head is observed to be bent or tilted greater than 10° in any direction (see picture labeled incorrect). The head angle is estimated by observing the orientation of the head with respect to the axis of the torso. Continuous or repetitive twisting of the neck greater than 10° to the left or right is scored as well. The correct posture (see picture labeled correct) occurs when the head angle is approximately 0° (or less than 10° bending).

As a rule of thumb, bending of the head/neck *continuously* would be considered to be occurring if the posture is maintained for at least 10 seconds at a time. Bending of the head/neck would be considered to be *repeated* if the person bends the head, on average, every 30 seconds or more frequently.

Table 4
Checklist Question 4 (Cont'd)

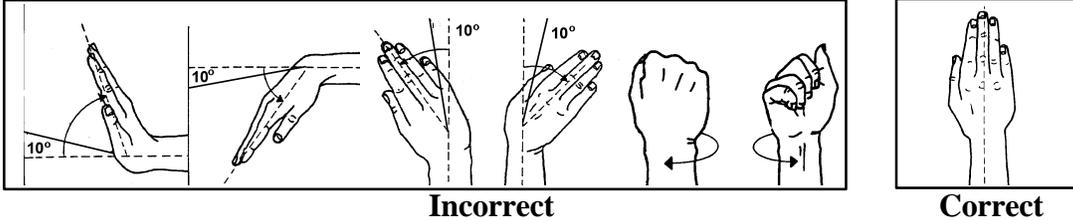
Examples of head/neck bent, tilted, or twisted would include:

- Performing overhead work;
- Performing detailed inspections in poor lighting conditions (e.g., leaning forward); and,
- Working in a restricted space and looking around an obstruction to see the work.

References: 1, 17, 18, 19, 20, 21, 22

Table 5
Checklist Question 5

Question: Bent wrists/repeated wrist movements (>10° in any direction) or repeated forearm rotation (e.g., turning a screw driver, Allen wrench)



Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|--|
| x | Stressful Positions or Movements | | Exposure to Hard Edges |
| | Excessive Forces or Forceful Exertions | | Exposure to Vibration |
| x | High frequency (repetitive) or high speed movements | | Temperature Extremes (especially cold) |
| x | Static (fixed position) work | | |

Background Discussion

Bending the wrist may significantly increase pressure inside the carpal tunnel. Increased pressure on tendons and nerves over time can lead to an accumulation of damage which can lead to tendonitis (i.e., inflammation of tendons) or carpal tunnel syndrome (i.e., compression of the median nerve). Awkward wrist postures also reduces grip strength.

Repeated rotation of the forearms over a period of time can contribute to epicondylitis which is an inflammation of tendons which attach at the elbow joint.

What to Look For

This Job Factor is scored when the wrist is bent greater than 10° in any direction. (see picture labeled incorrect).

The wrist angle can be estimated by comparing two reference lines to each other. The first reference line, representing the wrist posture, is created by the point at the center of the knuckles and the point at the center of the wrist. The second reference line, representing the forearm, is created by the point at the center of the wrist and the point at the center of the elbow. A straight wrist (see picture labeled correct) has an angle of approximately 0° (or bending less than 10°).

Table 5
Checklist Question 5 (Cont'd)

Caution: The neutral (resting) posture of the hand and wrist may appear to be tilted back approximately 10°.

Continuous or repetitive rotation of the forearms of greater than 10° inward or outward is scored as well.

As a general rule, bending of the wrist would be considered to be *repeated* if the person bends the wrist, on average, every 30 seconds or more frequently.

Examples of bent wrists/repeated wrist movements would be using a pistol-shaped power driver to drive screws on a horizontal surface.

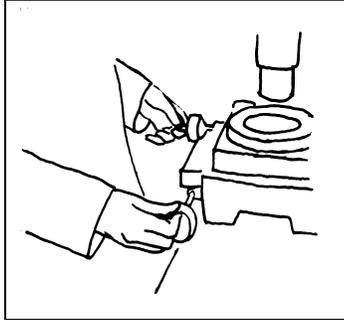
Examples of repeated forearm rotation would include:

- Repetitive use of a screw driver or other torquing tool;
- Turning of knobs or small valves;
- Twisting wires during wiring tasks.

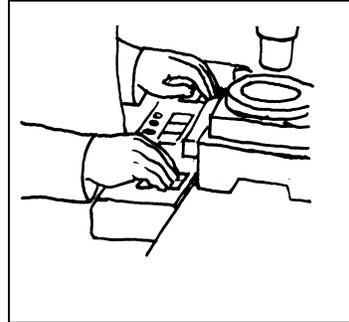
References: 4, 21, 23, 24, 25, 26, 27

Table 6
Checklist Question 6

Question: Repeated manipulations with fingers (e.g., repetitive computer keying tasks, removing small screws, electrical wiring tasks)



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|--|
| | Stressful Positions or Movements | | Exposure to Hard Edges |
| | Excessive Forces or Forceful Exertions | | Exposure to Vibration |
| x | High frequency (repetitive) or high speed movements | | Temperature Extremes (especially cold) |
| | Static (fixed position) work | | |

Background Discussion

Highly repetitive finger movements over a period of time can increase stress on the tendons which control finger movement.

What to Look For

This Job Factor is scored when there is significant finger movement observed in a task. Typically, there is a pattern of finger movements that are repeated frequently. As a general rule, if there is a finger movement which repeats at least once every four seconds, then this Job Factor is scored.

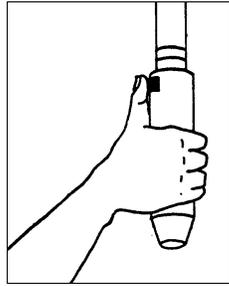
Examples of repeated finger movements would include:

- Repetitive keying tasks;
- Repetitive handling of small components;
- Removing small screws; and,
- Some electrical wiring tasks.

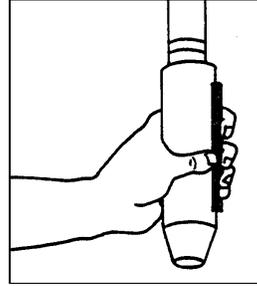
References: 25, 26

**Table 7
Checklist Question 7**

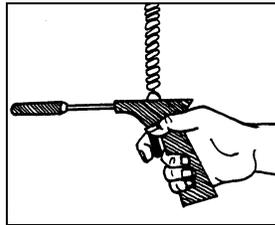
Question: Hyperextension of finger/thumb (e.g., using pliers with a wide handle span) or repeated single finger activation (e.g., single finger triggers on power tools)



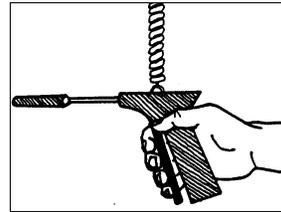
Incorrect



Correct



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|--|
| x | Stressful Positions or Movements | | Exposure to Hard Edges |
| | Excessive Forces or Forceful Exertions | | Exposure to Vibration |
| x | High frequency (repetitive) or high speed movements | | Temperature Extremes (especially cold) |
| | Static (fixed position) work | | |

Background Discussion

Hyperextension of finger/thumb and repeated single finger activation may increase the stress on the tendons and muscles controlling those fingers. In hyperextended positions, tendon/muscle groups are stretched to limits of their range. When this occurs, the structures are much more susceptible to damage.

What to Look For

This Job Factor is scored when one or more fingers (or the thumb) is held away from the rest of the hand. Finger/thumb hyperextension describes the activity of over extending (e.g., pointing) the finger or thumb. This Job Factor would be scored if the extension is

Table 7
Checklist Question 7 (Cont'd)

beyond a relaxed range of movement or is held in the position for a prolonged period of time.

This Job Factor may also be scored when the task requires repetitive movements of a single finger or the thumb. As a general rule, extension of the fingers *continuously* would be considered to be occurring if the posture is maintained for at least 10 seconds at a time. Finger extension, considered to be *repeated* if the person bends the wrist, on average, every 30 seconds or more frequently.

Examples of hyperextension of finger/thumb include:

- using pliers or cutting tools with a wide handle span that causes the person to spread the hand wide to operate the tool; and
- using a power tool with a trigger which is far away from the center of the grip.

Examples of repeated single finger activation include:

- using power tools with a trigger which can only be operated with a single finger trigger; and,
- pressing buttons or controls.

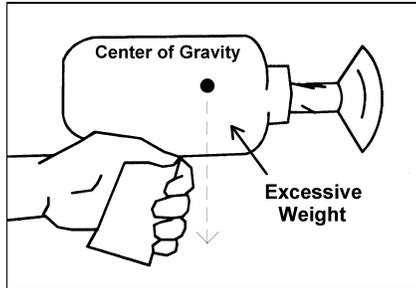
References: 22, 28

**Table 8
Checklist Question 8**

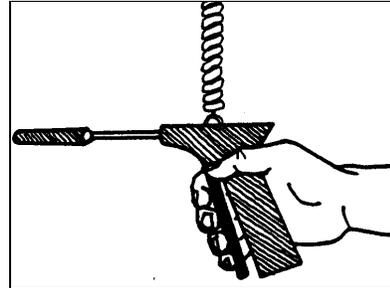
Question: Hand/grip forces:

fingertip_force: > 2 lb. (.9 kg) (e.g., 2 lb. is roughly equal to holding fingernail clippers closed)

full hand force: > 8 lb. (3.6 kg) (e.g., 8 lb. is roughly equal to holding a 8 lb. tool or holding a gallon of milk)



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|--|
| | Stressful Positions or Movements | | Exposure to Hard Edges |
| x | Excessive Forces or Forceful Exertions | | Exposure to Vibration |
| x | High frequency (repetitive) or high speed movements | | Temperature Extremes (especially cold) |
| x | Static (fixed position) work | | |

Background Discussion

Repeated forceful use of the hands or fingers over a period of time can result in significant stress to the tendons, ligaments, nerve, and other soft tissues. There is an increased likelihood for employees to report discomfort when a job requires forceful use of the hands or fingers. The presence of this *force* risk factor in a job may be one of the most significant contributors to reports of hand and wrist discomfort for employees in maintenance and inspection areas.

A common example of high hand forces (see picture labeled incorrect) are tools which are heavy or unbalanced (i.e., the center of gravity of the tool is directly above the center of the grip).

What to Look For

This Job Factor is scored when forces are estimated to exceed the guidelines for two different types of grips.

Table 8

Checklist Question 8 (Cont'd)

This Job Factor is scored when the fingertip force exceeds 2 lb.(.9 kg). 2 lb. is roughly equal to holding fingernail clippers closed. A fingertip grip or *pinch grip* involves gripping primarily with the fingertips.

This Job Factor can also be scored when the full hand force exceeds 8 lb. (3.6 kg). 8 lb. is roughly equal to holding a 8 lb. (3.6 kg) tool or holding a gallon of milk. In order for a grip to qualify as a full hand grip or *power grip* there must be: (1) contact between the object and the palm of the hand and (2) a slight overlap of the thumb and fingers around the object. If both of the conditions are not met, the grip should be considered as a fingertip grip.

This Job Factor may also be scored when the task requires repetitive movements of a single finger or the thumb. As a general rule, extension of the fingers *continuously* would be considered to be occurring if the posture is maintained for at least 10 seconds at a time. Grip forces, considered to be *repeated* if the person bends the wrist, on average, every 30 seconds or more frequently.

Examples of forceful fingertip grips include:

- Using the fingers/finger tips like a biological clamp to stabilize a part; or,
- Applying substantial force to insert or remove snap fit components.

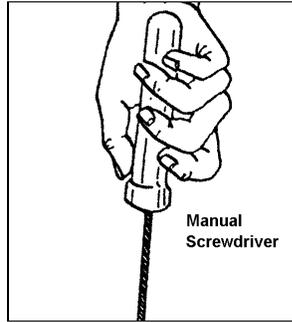
Examples of forceful full hand grips include:

- Holding a heavy power tool that weighs more than 8 lb.; or,
- Tightening a bolt or nut with a manual wrench.

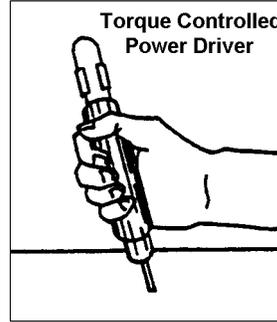
References: 9, 11, 29, 30

**Table 9
Checklist Question 9**

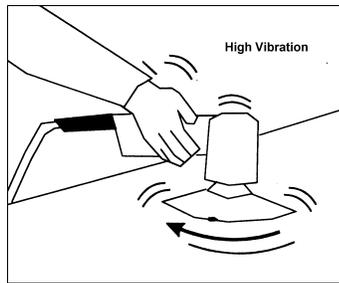
Question: High speed hand/wrist/arm movements (e.g., yank components with fingers, using the hand as a hammer) **or** Vibration, impact, or torque to the hand (e.g., using a nail gun or other power tools and equipment)



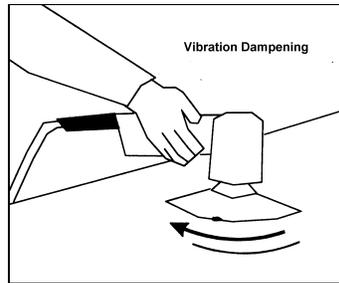
Incorrect



Correct



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|--|
| | Stressful Positions or Movements | | Exposure to Hard Edges |
| x | Excessive Forces or Forceful Exertions | x | Exposure to Vibration |
| x | High frequency (repetitive) or high speed movements | | Temperature Extremes (especially cold) |
| | Static (fixed position) work | | |

Background Discussion

High speed hand movements may produce excessive internal forces to the wrist. Excessive forces can damage tendons and nerves over a period of time.

Prolonged exposure to vibration, impact, and torque can reduce circulation and damage soft tissues. Vibrations, impact, and torque also tend to cause the worker to increase the grip to maintain control--creating an additional, compounding Job Factor, force.

Table 9
Checklist Question 9 (Cont'd)

What to Look For

This Job Factor is scored when high speed or sudden hand/wrist/arm movements are observed in the task. In some cases, high speed, hand/wrist/arm movements occur in tasks where high forces are also occurring (e.g., removing stuck components).

Examples of high speed hand/wrist/arm movements include:

- Yanking on a stuck component with fingers to remove it;
- Repetitive use of a hammer such as in nailing tasks; and,
- Using the hand as a hammer.

This question is also scored if any vibration, impact or torque is observed in the task. For the Level I Checklist there is no minimum intensity for this Job Factor. Regardless of the intensity of the exposure, if vibration, impact or torque is observed in the task, the question is scored.

Note: Measuring vibration exposure requires a detailed evaluation which is beyond the level and scope of this document. If you require evaluation of vibration exposure, contact AL/OEMO for consultative assistance.

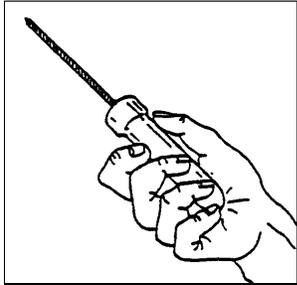
Examples of vibration, impact, or torque to the hand would include:

- Using various types of rotating or oscillating power tools such as power drills, air ratchets, grinders, sanders, or chain saws.
- Using various types of tools which deliver a blow or impact such as jack hammers, nail guns, staple guns, or rivet guns.

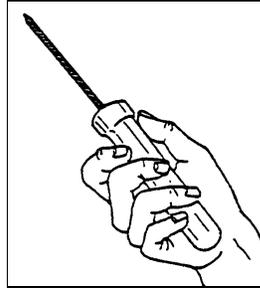
References: 4, 31

Table 10
Checklist Question 10

Question: Exposure to hard edges (e.g., tool handle or work area presses into fingers or palm of hands)



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|--|
| | Stressful Positions or Movements | x | Exposure to Hard Edges |
| | Excessive Forces or Forceful Exertions | | Exposure to Vibration |
| | High frequency (repetitive) or high speed movements | | Temperature Extremes (especially cold) |
| | Static (fixed position) work | | |

Background Discussion

Hard edges which press into the hand, wrist, or arm can place pressure on nerves or tendons which pass close to the surface of the skin. This can result in wear and damage to these structures over a period of time.

What to Look For

This Job Factor is scored when the hands, wrists or arms are exposed to a hard or sharp edges or corners. The term *exposed to a hard edge* means that the hard edge presses into the skin and tissues of the hand, wrist or arm for some portion of the task. Note: If a hard edge is present but does not press into the body, the Job Factor is **not** scored.

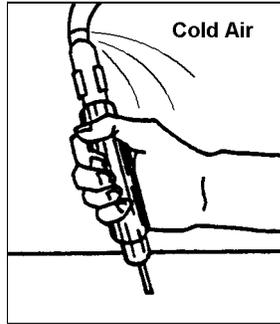
Exposure to hard edges may be caused by:

- Tool handles or components with square corners, protrusions, or hard edges;
- Work surfaces with a square edge (as opposed to a rounded, bull-nose edge); and
- Resting the arms/elbows on equipment to stabilize the hands during work.

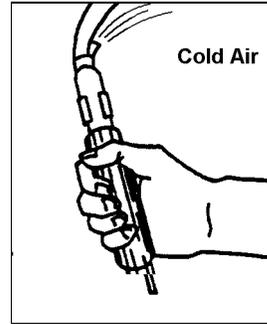
References: 4, 21, 31

**Table 11
Checklist Question 11**

Question: Hands and fingers exposed to cold temperatures (e.g., working outside in winter environment, cold exhaust air from tool blows on hand/wrist)



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|--|
| | Stressful Positions or Movements | | Exposure to Hard Edges |
| | Excessive Forces or Forceful Exertions | | Exposure to Vibration |
| | High frequency (repetitive) or high speed movements | x | Temperature Extremes (especially cold) |
| | Static (fixed position) work | | |

Background Discussion

Exposure to cold temperatures can reduce blood flow to the fingers and hands. This may cause the body's natural healing process to slow which allows micro-trauma created from exposure to other Job Factors to accumulate more quickly. Flexibility of the tendons and joints may also decrease with a corresponding increase in stress and muscle fatigue.

What to Look For

This Job Factor is scored when the person is in an environment where there is a tendency for the hands and fingers to become cold.

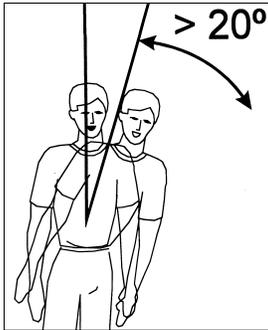
Examples of exposure to cold temperatures include:

- Doing hand-intensive work on the flight line or in cold or windy conditions for more than 15 minutes without a break;
- Exhaust air from an air-powered tool blows on hands and fingers; and,
- Gripping a tool handle which conducts heat away from the hand.

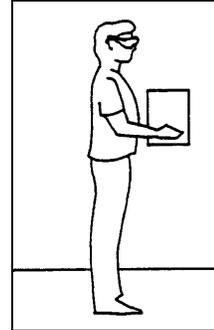
References: 4

Table 12
Checklist Question 12

Question: Repeated forward or side-ways bending movements (>20°) (e.g. lifting from floor level)



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|------------------------------|
| x | Awkward Positions or Movements | | Static (fixed position) work |
| | Excessive Forces or Forceful Exertions | | Exposure to Vibration |
| x | High frequency (repetitive) or high speed movements | | |

Background Discussion

Repeated forward or sideways bending causes the pressure on the muscles and intervertebral discs of the spine to be unevenly distributed. Forward or sideways bending can contribute to muscle fatigue as well increase the potential for back injuries (e.g., sprains/strains, disc herniation).

What to Look For

This Job Factor is scored when the person is bent forward or to the side more than 20° vertical.

As a general rule, bending of the back would be considered to be *repeated* if the person bends the back, on average, every 30 seconds or more frequently.

Examples of repeated forward or side-ways bending movements would include:

- handling of items below knee level; and,
- reaching for tools or components which are too far away from the work.

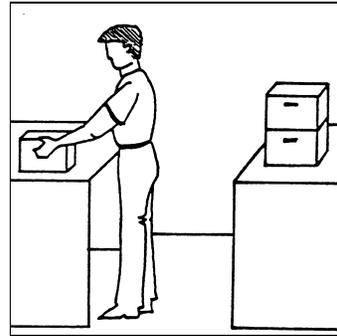
References: 3, 21, 32, 33

Table 13
Checklist Question 13

Question: Twisting of the lower back (e.g. rushing while lifting, pulling, open a stuck door)



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|------------------------------|
| x | Awkward Positions or Movements | | Static (fixed position) work |
| | Excessive Forces or Forceful Exertions | | Exposure to Vibration |
| x | High frequency (repetitive) or high speed movements | | |

Background Discussion

Twisting may be one of the most damaging movements for the spinal discs because of the shear force created during twisting. Repeated twisting over a period of time can accelerate wear of the cartilage and plates and fibrous tissue of the disc itself.

What to Look For

This Job Factor is scored when twisting of the lower back is observed while the task is being performed.

Due to the difficulty in estimating twisting angle, there is no minimum twist angle required to score this Job Factor. If any twisting of the lower back is observed to reoccur in the task, the Job Factor should be scored.

Examples of twisting of the lower back would include:

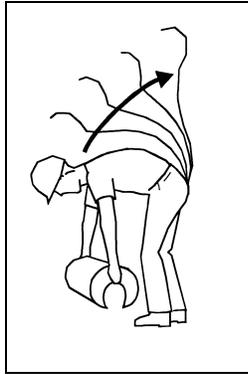
- turning while moving an object in a restricted space; or,
- turning to transfer an object while seated in a chair that does not swivel.

References: 15

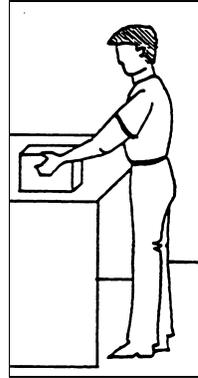
Table 14

Checklist Question 14

Question: High speed, sudden movements with the back



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|------------------------------|
| | Awkward Positions or Movements | | Static (fixed position) work |
| | Excessive Forces or Forceful Exertions | | Exposure to Vibration |
| x | High frequency (repetitive) or high speed movements | | |

Background Discussion

High speed movements of the back can generate high forces internally throughout the spine, muscles, and other supporting tissues. Research indicates that high speed movements (acceleration) may increase the risk of back injury.

What to Look For

This Job Factor is scored when jerky or sudden movements of the back are observed while the task is being performed. It is common to see these movements in tasks which also require large forces.

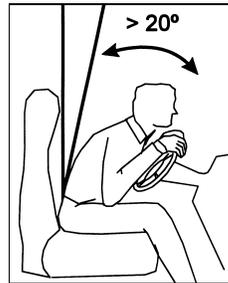
Examples of high speed or sudden movements include:

- Lifting a very heavy object that is difficult to grasp (e.g., man hole cover);
- Opening a stuck door;
- Pushing a large piece of rolling equipment up a ramp, or over a crack in the floor; and
- Rushing while handling an object.

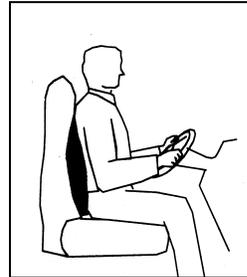
References: 15

Table 15
Checklist Question 15

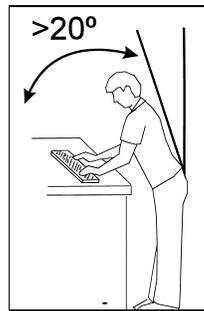
Question: Static, awkward back postures (for >10 sec at a time).
While standing, continuous leaning forward or to the side (>20°).
While seated, continuous leaning forward (>20°) or poor lower back posture (e.g., poor lower back support, no support for feet).



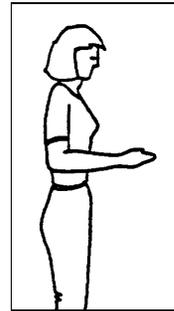
Incorrect



Correct



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|------------------------------|
| x | Awkward Positions or Movements | x | Static (fixed position) work |
| | Excessive Forces or Forceful Exertions | | Exposure to Vibration |
| | High frequency (repetitive) or high speed movements | | |

Background Discussion

Leaning forward continuously (without support for the body) causes static muscular effort. Static muscular effort produces discomfort in a matter of seconds because the energy stored in the muscle is rapidly depleted and the constricted muscles restrict the flow of energy and oxygen to the muscle.

Table 15
Checklist Question 15 (Cont'd)

What to Look For

This Job Factor is scored when the person is observed leaning forward or to the side for a prolonged period of time (at least 10 seconds at a time). Leaning forward becomes a risk factor when the individual maintains this posture for a period of time. It is not as significant a risk factor when the individual is simply making a change in his/her posture.

The Job Factor is scored only if the angle of bending of the upper body with respect to vertical exceeds 20°.

This Job Factor is also scored when a person in a seated position has poor lower back posture. Poor lower back posture is exhibited by a lack of an inward curve in the lower back. That is, the lower back area looks slightly rounded. Poor lower back posture while seated may be caused by lack of adequate lower back support.

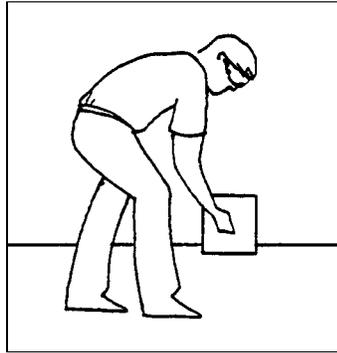
Examples of static, awkward back postures would include:

- Leaning forward to perform a task which is too low or too far away;
- Leaning forward or sideways, while holding or guiding a heavy panel into position (e.g., installing wing slats);
- Sitting in a chair without a backrest; and,
- Sitting in a chair with a seat pan which is too deep (can't sit against the backrest).

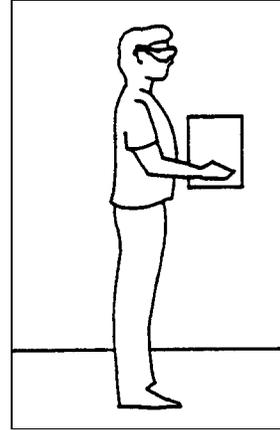
References: 21, 32, 33

Table 16
Checklist Question 16

Question: Lifting forces



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|------------------------------|
| | Awkward Positions or Movements | | Static (fixed position) work |
| x | Excessive Forces or Forceful Exertions | | Exposure to Vibration |
| | High frequency (repetitive) or high speed movements | | |

Background Discussion

Research has shown that as the forces in the lower back increase, frequency of complaints of lower back pain may increase. Forces can be high due to an awkward body posture (and the resulting additional forces in the back) as well as the weight of the object handled.

What to Look For

This Job Factor may be scored for four different situations:

- When the person handles a 50-70 lb. (22.7-31.8 kg.) object while the torso is upright **and** the elbows are close to the body. The torso can be considered “upright” as long as the person is not bent forward more than 20 degrees from vertical. The elbows can be considered “close” to the body as long as the angle between the torso and upper arm is no greater than 15 degrees. Notice that in order to meet this criteria, both the back and the arms must be in a good posture. In this example, the body is in a good position but the weight is significant.

Table 16
Checklist Question 16 (Cont'd)

- When the person handles a 10-40 lb. (4.5-18.1 kg.) object while the person is bent forward **or** is reaching. (e.g., upper body is bent greater than 20° from vertical or the upper arms are more than 15° from the torso). Notice that this portion of the Job Factor is scored if the person is either bending or reaching (or both bending and reaching) while lifting. In this example, the body is in a stressful position but the weight is minimal.
- When the person handles an object which weighs more than 70 lb. (31.8 kg.) while the upper body is upright **and** the elbows are close to the body (e.g., torso is bent forward no more than 20 degrees and the angle between the upper arm and the torso is no more than 15 degrees). Notice that in order to meet this criteria, both the back and the arms must be in a good posture. In this example, the body is in a good position but the weight is excessive.
- When the person handles an object which weighs greater than 40 lb. (18.1 kg.) while bent forward **or** reaching (e.g., the torso is bent more than 20° from vertical or the upper arms are more than 15° from the body). Notice that this portion of the Job Factor is scored if the person is either bending or reaching (or both bending and reaching) while handling an object. In this example, the body is in a stressful position and the weight is significant.

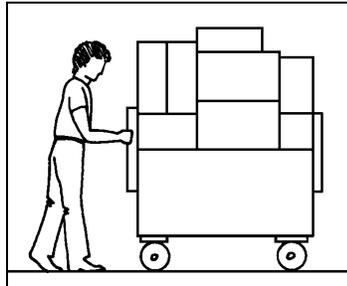
Examples of situations where high lifting forces may be created include:

- Lifting/handling heavy equipment or supplies;
 - Lifting objects from floor level;
 - Lifting a cowl door (e.g., aircraft engine) to stabilize it during installation; and,
- Lifting a 2-gallon pail of solvent from a shipping pallet and placing it on a high storage shelf.

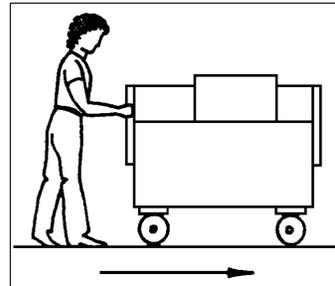
References: 21, 34

Table 17
Checklist Question 17

Question: Pushing or pulling where the initial force > 50 lb. (22.7 kg.) (e.g. pushing/pulling a full two-drawer file cabinet across a carpeted floor)



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|------------------------------|
| | Awkward Positions or Movements | | Static (fixed position) work |
| x | Excessive Forces or Forceful Exertions | | Exposure to Vibration |
| | High frequency (repetitive) or high speed movements | | |

Background Discussion

There are several factors that impact the stresses created by pushing and pulling tasks. These factors include: the height of the hands (e.g., shoulder level, waist level, knee level), the distance the object is moved, and the frequency of the activity (e.g., one push/pull every minute or one push every 30 minutes, etc.).

The push/pull force reference of 50 pounds (22.7 kg.) is provided to reflect the capabilities of the female population for initial (e.g., get the item moving) push/pull forces. While the actual capabilities of the entire work force vary due to strength, this reference is presented as a starting point and is within the scope of the Level I Analysis. If this Job Factor is found in the job, the user is encouraged to contact AL/OEMO and request a Level II Analysis. The Level II Analysis considers factors like, body/hand position, frequency, distance traveled, as well as weight.

What to Look For

This Job Factor is scored when the person pushes or pulls an object with an initial force of greater than 50 pounds (22.7 kg.). A weight of 50 pounds (22.7 kg.) is roughly equivalent to the force required to push a full two-drawer file cabinet across a carpeted floor. This Job Factor can also be scored if the person shows substantial exertion push or pull the object.

Table 17
Checklist Question 17 (Cont'd)

Examples of pushing or pulling include:

- Pushing or pulling heavy rolling equipment (especially with worn wheels);
- Transporting pallets of material with a hand pallet jack; or,
- Sliding a large work piece on a work surface or the floor.

References: 12

Table 18
Checklist Question 18

Question: Whole body vibration felt through floor surface (e.g. operating heavy machinery)



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---|-------------|------------------------------|
| | Awkward Positions or Movements | | Static (Fixed Position) Work |
| | Excessive Forces or Forceful Exertions | x | Exposure to Vibration |
| | High Frequency (Repetitive) or High Speed Movements | | |

Background Discussion

Whole body vibration should be considered as a general stressor or secondary risk factor to the body, and the lower back in particular. This is because, while workers exposed to whole body vibration (e.g., long distance truck drivers, heavy equipment operators) have reported muscular and back disorders at a rate greater than that for the general population, a precise cause-effect relationship has not been shown. What seems to be consistent in the research is that potential effect on the employee is most likely in the whole-body resonance frequency range--the range in which there is maximum mechanical vibration energy transfer between the vibration source and the body with an actual amplification of the vibration by the body. For sitting tasks, the frequency range is 3-5 Hz. For standing tasks, the range is 4-7 Hz. Since the measurement of vibration is well beyond the scope of the Level I Assessment, any questions about vibration exposure should be directed to AL/OEMO.

What to Look For

This Job Factor is scored, when the person is exposed (any level) to whole body vibration. Whole body vibration is typically transmitted through a floor surface or seat. There is no minimum intensity for this Job Factor.

Table 18
Checklist Question 18 (Cont'd)

Examples of situations where whole body vibration may be present include:

- Operation of heavy equipment such as back hoes, bulldozers, or cranes, or fork trucks;
and
- Working on or around large pieces of machinery.

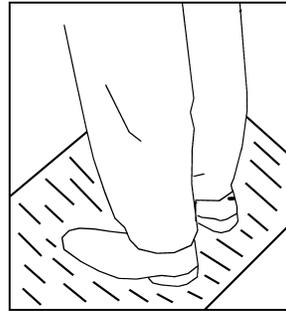
References: 35, 45

Table 19
Checklist Question 19

Question: Fixed position, standing static effort in legs (e.g. standing on hard floor surfaces)



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|----------------------------------|-------------|------------------------------|
| | Stressful Positions of Movements | x | Static (Fixed Position) Work |
| | Excessive Forces | | Exposure to Hard Edges |

Background Discussion

Standing in one position for prolonged periods can contribute to pooling of the blood in the veins especially in the lower leg. Such conditions can contribute to varicose veins, swelling of the tissues in the lower legs and feet, and blisters in the swollen areas. Prolonged standing can also increase muscle fatigue in the lower back.

What to Look For

This question is scored when the person is observed standing in a fixed position for prolonged periods of time (e.g., 30 minutes at a time or longer) on a hard floor surface (such as concrete or tile). The question is not scored if the person is standing on a compressible surface such as an anti-fatigue mat, or if the person walks throughout the task.

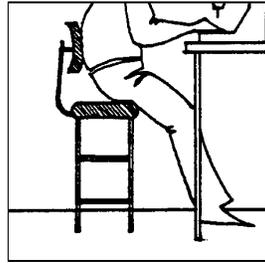
Examples of standing in a fixed position would include:

- Working at a lathe or machine for long periods of time;
- Working under an exhaust hood in a laboratory; or,
- Standing on a work platform while servicing an aircraft.

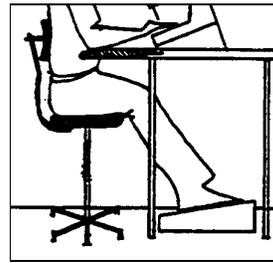
References: 3, 21

Table 20
Checklist Question 20

Question: Exposure to hard edges on legs, knees, and feet (e.g., kneeling on a hard surface, standing on rungs of a ladder, leaning against a hard edge, or exposure to hard front edge of seat).



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|----------------------------------|-------------|------------------------------|
| | Stressful Positions of Movements | | Static (Fixed Position) Work |
| | Excessive Forces | x | Exposure to Hard Edges |

Background Discussion

Hard edges which press into the legs or buttocks can place pressure on muscles, vessels, nerves, and other soft tissue which pass close to the surface of the skin. Pressure on these tissues can restrict circulation and impact sensation.

What to Look For

This Job Factor is scored when the legs, knees or feet are exposed to a hard or sharp edge which presses into the skin while tasks are being performed. Note: Sharp edges may exist in the work area. If they don't contact the body, this Job Factor is not scored.

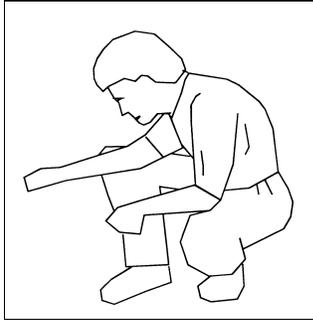
Examples of exposure to hard edges on legs, knees, and feet would include:

- Leaning against a hard edge to stabilize the body working on overhead on a large piece of machinery;
- Kneeling on a hard surface such as metal or concrete;
- Standing for prolonged periods on round or narrow rung of an extension ladder; or,
- While sitting, the hard front edge of the seat presses into the back of the legs.

References: 21

**Table 21
Checklist Question 21**

Question: Awkward leg postures (e.g. kneeling, squatting, crawling, or knee hyperextension)



Incorrect



Correct

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|----------------------------------|-------------|------------------------------|
| x | Stressful Positions of Movements | | Static (Fixed Position) Work |
| | Excessive Forces | | Exposure to Hard Edges |

Background Discussion

Kneeling or squatting questions have been included in the OSHA checklist. Kneeling or squatting for extended periods of time can create stress and strain on the ligaments of the knee. Kneeling can also create direct pressure on the bursa sac in the knee joints and causes inflammation or bursitis of the knee.

What to Look For

This question is scored when the legs are in an awkward posture for a prolonged period of time (greater than 10 seconds at a time). These awkward postures include squatting, kneeling, crawling on hands and knees, or knee hyperextension. Knee hyperextension is an over extension of the lower leg (leg looks like it is bent backwards at the knee) which increases the pressure in the knee joint.

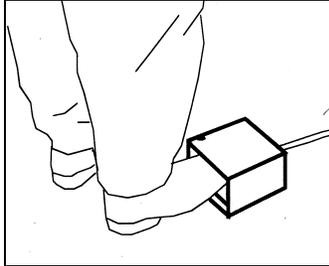
Examples of awkward leg postures include:

- Kneeling or squatting to work on a control panel which is low to the floor;
- Leaning forward over a thigh high guard to access a part (knee hyperextension); or,
- Working in a restricted space which requires crawling or squatting.

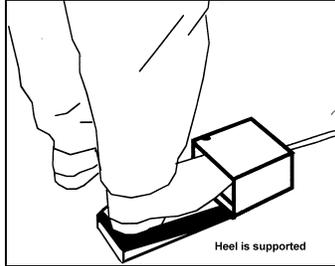
References: 21, 36

Table 22
Checklist Question 22

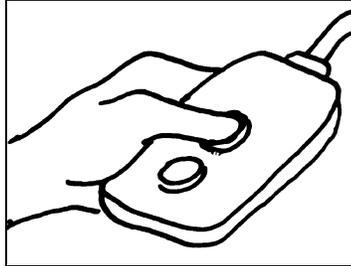
Question: Standing foot pedal (e.g., using foot pedal while standing)



Incorrect



Correct



Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|----------------------------------|-------------|------------------------------|
| x | Stressful Positions of Movements | x | Static (Fixed Position) Work |
| | Excessive Forces | | Exposure to Hard Edges |

Background Discussion

Use of foot pedals while standing can create problems for the back as well as the legs by causing the back to be in an unbalanced posture for prolonged periods of time. Use of foot pedals are of concern when the foot must be on the pedal continuously, when the legs cannot be alternated on the foot pedal, or when the person cannot rest the heel while actuating the pedal.

What to Look For

This Job Factor is scored when the person is required to use foot pedal while standing and when the position of the foot pedal leg looks different from the position of the support leg.

Examples include:

- Using a foot pedal while operating blasting equipment; or
- Using a foot pedal for welding operations.

References: 21

Table 23
Checklist Question 23

Question: Difficult to see/light levels too low /too high (e.g., see detail).

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---------------------------------|-------------|------------------------------|
| x | Excessive Glare/Excessive Light | | Static (fixed position) work |
| x | Inadequate Light | | |

Background Discussion

Light levels which are too low or too high can increase the potential for eyestrain and errors. Light levels which are too low tend to produce low contrast, requiring the eyes to work harder to see. Light levels which are too high tend to increase glare. The inappropriate light level may decrease employee performance in visual inspection tasks as well as during computer use.

What to Look For

This Job Factor is scored when the lighting conditions are poor (too high or too low) for performing the required tasks.

The desired light levels vary depending upon the type of task performed.

| Task | Recommended Light Levels in foot-candles (lux) |
|--|--|
| Working spaces where visual tasks are not generally performed (e.g., hallways) | 10-20 (100-200 lux) |
| Rough bench work and machine work (e.g., cutting pieces, building crates, bulk packaging) | 20-50 (200-500 lux) |
| Reading computer screen | 20-50 (200-500 lux) |
| General inspection, fine assembly (e.g., using a lathe, sanding, polishing) | 50-100 (500-1,000 lux) |
| Extra fine bench and machine work, extra fine assembly, detailed inspection (e.g., electronic maintenance, inspecting for surface defects) | 500-1,000 (5,000-10,000 lux) |

Table 23
Checklist Question 23 (Cont'd)

Examples of difficult visual conditions include:

- Visual inspection of gauges which are in a dark area or are covered with a grease film;
- Viewing a computer monitor screen in bright conditions (near a window); or,
- Reading schematics/engineering drawings in areas where light levels are less than 50 fc.

References: 20

Table 24
Checklist Question 24

Question: Intensive visual tasks, staring at work objects for long periods (e.g., inspection, troubleshooting).

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---------------------------------|-------------|------------------------------|
| | Excessive Glare/Excessive Light | x | Static (fixed position) work |
| | Inadequate Light | | |

Background Discussion

Intensive visual demands which occur over a prolonged period of time can contribute to eyestrain because of static muscular effort imposed on the eye muscles.

What to Look For

This Job Factor is scored when the person performs intensive visual tasks which involve continuous inspection, monitoring or staring at work objects or a screen. The key characteristic is **continuous** and **intensive** staring and the deliberate focusing of attention. Most of the tasks that you will encounter in the maintenance and inspection environment will not involve intensive visual tasks.

Examples of intensive visual tasks include:

- Visual inspection activities;
- Continuous systems monitoring activities (e.g., control room, control panel monitoring);
- Diagnosing and trouble shooting electrical or mechanical problems; and,
- Machining or lathing of parts.

References: 37

Table 25
Checklist Question 25

Question: Restricted space

Targeted Risk Factors

| Risk Factor | | Risk Factor | |
|-------------|---------------------------------|-------------|----------------------|
| | Excessive Noise | | Extreme Temperatures |
| x | Awkward body postures/movements | | Poor Air Quality |

Background Discussion

Restricted space is not the same as “confined space.” Space is often restricted when there is limited access to where the work must be performed such as reaching through a small access panel to repair a fuel line. If adequate space is not available, the individual may have difficulty performing the task efficiently. Productivity may also be compromised.

What to Look For

This Job Factor is scored when the person works in a workspace which is physically inadequate in size for the tasks performed, such as access panels, or full cell work. If there are obstacles that interfere with movement and performance of tasks this question should also be scored.

Examples of restricted space include:

- Working in man-holes;
- Working in the interior of aircraft or other pieces of equipment; and,
- Maneuvering in areas where there are many obstructions.

References: 38

Table 26
Checklist Question 26

Question: Extreme Temperatures - chronically low or high temperatures or extreme fluctuation.

Targeted Risk Factors

| Risk Factors | | Risk Factors | |
|--------------|----------------------|--------------|----------------------|
| | Excessive Noise | x | Extreme Temperatures |
| | Static Work Postures | | Poor Air Quality |

Background and Discussion

Most individuals feel comfortable in a work environment when the air temperature is between 68° - 76° F or 20 - 26° C. The normal body temperature is 98.6° F (37° C). In the summer, skin temperature is around 95° F (37° C) and in the winter is approximately 91.4° F (33° C). Many M/I tasks occur in hangars where temperature cannot be controlled to maximize worker comfort. In addition, some M/I tasks occurred outdoors under extreme climatic conditions (e.g., flight line in winter). Extreme conditions can be controlled using portable heaters or ventilation units. Uncontrolled temperature extremes should be scored.

What to Look For

Extreme temperatures, chronically low or high temperatures, or extreme fluctuation in temperature in the work environment. Individuals may complain of being too cold or too hot affecting their ability to concentrate or increasing their feeling of fatigue especially when the individual feels too warm. Ask the employee to help you rate this risk factor based on their perception. If the employee comments that the temperature is always a problem or that the temperature reaches extreme levels, mark the *strongly agree response*. If the employee simply states that temperature is *sometimes* a problem, mark the *agree response*.

References: 39, 41

Table 27
Checklist Question 27

Question: Noise or distractions

Targeted Risk Factors

| Risk Factors | | Risk Factors | |
|--------------|----------------------|--------------|----------------------|
| x | Excessive Noise | | Extreme Temperatures |
| | Static Work Postures | | Poor Air Quality |

Background Discussion

In the work environment, there are many sources of noise including:

- machinery, equipment, generators or AGE;
- power tools;
- aircraft, engines (operative and testing);
- pressurized systems (airlines, compressors); or
- HVAC systems.

Not only can noise from these sources be annoying and create distractions for the worker, prolonged exposure to excessive noise may cause permanent hearing loss.

What to Look For

You may answer the question in two ways. First, ask the employee about his/her perception of noise. Check off the appropriate response. Second, review AFOSH STD 48-19, (Chapter 2) and previous industrial hygiene noise surveys performed for the shop. If noise levels can be controlled with hearing protection, check the *neutral* response. If noise levels are controlled with hearing protection **but** employees still complain about noise, check the *agree* response.

References: 40, 42, 43

Table 28
Checklist Question 28

Question: Air quality concerns

Targeted Risk Factors

| Risk Factors | | Risk Factors | |
|--------------|----------------------|--------------|----------------------|
| | Excessive Noise | | Extreme Temperatures |
| | Static Work Postures | x | Poor Air Quality |

Background Discussion

The air quality issue is complex. Work environments can contain a number of air, contaminants and odors. Odors do not necessarily represent a hazardous condition. Lack of odors, on the other hand, does not necessarily represent a safe condition (e.g., carbon monoxide).

What to Look For

It is not the purpose of the Level I Checklist to determine/identify exposures to potentially unsafe air contaminants. These assessments and measurements are performed as part of industrial hygiene surveys. Rather, the purpose of the Level I checklist *air quality concerns* question is to identify if employees perceive that there is a problem. Concern may increase physiological stress and the potential impact of exposure to other risk factors. Ask the employee to help you rate air quality concerns. If a concern is indicated, you may need to review results of past industrial hygiene surveys or evaluate the need for BEF to perform additional surveys.

References: 39, 44

**SAMPLE LEVEL I ERGONOMICS
ASSESSMENT CHECKLIST**

| | | | |
|--|---|--|------------------------------|
| Level I Ergonomics Assessment Checklist for Maintenance and Inspection Work Areas | Survey Date (YYMMDD) 96-10-09 | Workplace Identifier: | |
| <i>(use this space for mechanical imprint)</i> | | Base Dover AFB | Organization 96ABW |
| | | Workplace Survival Equipment | |
| | | Bldg. No/Location 306 | Room/Area A |
| | | AFSC/Job Series | |
| | | Job Name: | |
| BEF Technician: _____ Sign | | | |

Part I - Work Content (Description of Tasks Performed)

For this section, work with the employee to determine those reoccurring jobs/tasks that are most difficult on the body. Ask the employee the following questions:

- “In terms of stress to the body, what are the most difficult, fatiguing jobs/tasks that you do?”
- “Which of those jobs/tasks do you perform on a regular basis (or occur most frequently)?”

Using the Maintenance and Inspection Task Key List as a reference, write in the task names in the work content matrix below. If the employee mentions tasks which are not included on the Task Key List, write-in the additional tasks in the Task Key List. **Note: If the person mentions several jobs which each have multiple tasks, complete a separate checklist for each job.**

For each task performed, determine the approximate task frequency using the following proportions of job time:

> 50 % (High): The total percentage of work time spent performing the task is greater than 50%.

10-50 % (Moderate): The total percentage of work time spent performing the task is between 10 and 50%.

< 10 % (Low): The total percentage of work time spent performing the task is less than 10%.

For each task, check the most appropriate circle in the Work Content Matrix below to indicate approximate task frequency. If lifting/high force exertions occur in the task, indicate by checking the appropriate circle.

WORK CONTENT MATRIX

| Task | Lifting / Exertion Occur in Task | Task Frequency (Check one) | | |
|----------------------------|--|----------------------------------|----------------------------------|----------------------------------|
| | | (Low) 0-9% | (Moderate) 10-50%. | (High) 51-100% |
| 1. Folding/Fitting | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> |
| 2. Tying/Twisting/Wrapping | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. Packing | <input checked="" type="radio"/> | <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> |
| 4. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6. | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

= Critical tasks are indicated by the shaded boxes in the Work Content Matrix. Critical tasks are tasks which occur greater than 10% of the job time or which involve lifting or high forces.

ONLY COMPLETE THE CHECKLIST FOR CRITICAL TASKS.

LOW FREQUENCY TASKS WITH LIFTING OR EXERTION ARE SCORED AS MODERATE FREQUENCY

Performance Measures

How is your performance measured? Performance is based on project completion. There is no formal process for evaluation.

Part I - Work Content (Description of Tasks Performed) (Cont.)

Maintenance and Inspection Task Key List

- | | |
|---|--|
| 66. abrading | 101. paving |
| 68. bolting/screwing | 102. pumping (by hand) |
| 70. chipping | 103. riveting/bucking |
| 71. cleaning by hand | 104. sanding |
| 72. cleaning with high pressure equipment | 105. sawing |
| 73. coating/immersing | 107. sewing |
| 76. crimping | 108. soldering/brazing |
| 77. cutting/shearing | 110. stripping/depainting by hand |
| 79. drilling | 111. stripping/depainting mechanically |
| 80. driving (vehicles) | 113. turning valves |
| 81. excavating | 114. tying/twisting/wrapping |
| 83. flame cutting | 116. welding |
| 84. folding/fitting | 118. wiring |
| 85. gluing/laminating (dopping) | 119. wrenching/ratcheting |
| 86. grinding/buffing/polishing | 121. assembly/disassembly internal component |
| 87. hammering | 122. assembly & repair (bench work) |
| 88. lifting | 123. computer work |
| 90. lubricating | 124. hose handling |
| 91. machining | 125. forming |
| 92. masoning | 126. masking |
| 93. melting | 127. media blasting (blast cabinet) |
| 94. molding | 128. media blasting (high pressure gun) |
| 95. monitoring (visual displays) | 129. ordnance disposal |
| 97. nailing | 130. prying |
| 98. opening/closing heavy doors | 131. visual inspection |
| 99. packing/packageing | (Write in others) |
| 100. painting/spray painting | 131. _____ |
| | 132. _____ |

Part II - Checklist, Shoulder / Neck

Job Factors

For each Job Factor, select the appropriate Job Factor frequency score using the following guidelines:

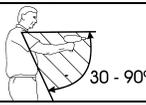
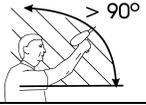
Frequently (F): Job Factor occurs for greater than 50% of the task

Sometimes (S): Job Factor occurs for 10-50% of the task

Occasionally (O): Job Factor occurs for less than 10% of the task

Never (N): Job Factor does not occur or does not apply

Critical Tasks

| Job Factor | Task Name: <i>Folding/Fittin g</i> | Task Name: <i>Packing</i> | Task Name: | Comments | | | | |
|--|---|------------------------------|--------------------|--------------------|--------------------|--------------------|--|--|
| | Task Frequency | | Task Frequency | | Task Frequency | | | |
| | Moderate 10-50% | High 51-100% | Moderate 10-50% | High 51-100% | Moderate 10-50% | High 51-100% | | |
| 1. Reaching <i>repeated reaching or arms held continuously away from body while unsupported</i> | | | | | | | | |
|  <i>Below shoulder level (arm 30-90° away from body)</i> | F S O N 1 1 0 0 | F S O N 3 2 1 0 | F S O N 1 1 0 0 | F S O N 3 2 1 0 | F S O N 1 1 0 0 | F S O N 3 2 1 0 | | |
|  <i>Above shoulder level (arm > 90° away from body)</i> | F S O N 3 2 1 0 | F S O N 4 3 1 0 | F S O N 3 2 1 0 | F S O N 4 3 1 0 | F S O N 3 2 1 0 | F S O N 4 3 1 0 | | |
| 2. Arm forces: Repeated arm forces exceeding 10 lb. (4.5 kg.) (e.g. roughly equivalent to lifting a gallon of milk) or Holding/carrying materials exceeding 25 lb. (11.3kg.) for more than three steps | F S O N 2 1 0 0 | F S O N 5 2 1 0 | F S O N 2 1 0 0 | F S O N 5 2 1 0 | F S O N 2 1 0 0 | F S O N 5 2 1 0 | | |
| 3. High speed, sudden shoulder movements (e.g., opening a stuck door, pulling and yanking on a stuck component to remove it) | F S O N 2 1 0 0 | F S O N 5 2 1 0 | F S O N 2 1 0 0 | F S O N 5 2 1 0 | F S O N 2 1 0 0 | F S O N 5 2 1 0 | | <i>Forcing the last of the raft into the container</i> |
| 4. Head/neck bent, tilted, or twisted (>10°) (e.g., craning neck looking into tight spaces) | F S O N 3 2 1 0 | F S O N 6 3 1 0 | F S O N 3 2 1 0 | F S O N 6 3 1 0 | F S O N 3 2 1 0 | F S O N 6 3 1 0 | | <i>Looking down into fixture during packing</i> |
| Task Scores = (column total) | | 6 | 7 | | | | | |

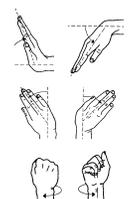
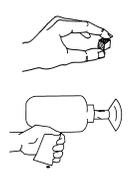
Part II - Checklist, Hands/Wrists/Arms

Job Factors

For each Job Factor, select the appropriate Job Factor frequency score using the following guidelines:

Frequently (F): Job Factor occurs for greater than 50% of the task **Sometimes (S):** Job Factor occurs for 10-50% of the task **Occasionally (O):** Job Factor occurs for less than 10% of the task **Never (N):** Job Factor does not occur or does not apply

Critical Tasks

| Job Factor | Task Name: <i>Folding/Fitting</i> | Task Name: <i>Packing</i> | Task Name: | Comments | | | |
|---|--------------------------------------|------------------------------|--------------------|--------------------|--------------------|--------------------|-------------------------------------|
| | Task Frequency | | Task Frequency | | | | |
| | Moderate 10-50% | High 51-100% | Moderate 10-50% | High 51-100% | Moderate 10-50% | High 51-100% | |
|  <p>5. Bent wrists/repeated wrist movements (>10° in any direction) or repeated forearm rotation (e.g., turning a screw driver, Allen wrench)</p> | F S O N 2 1 0 0 | F S O N 5 2 1 0 | F S O N 2 1 0 0 | F S O N 5 2 1 0 | F S O N 2 1 0 0 | F S O N 5 2 1 0 | |
|  <p>6. Repeated manipulations with fingers (e.g., repetitive computer keying tasks, removing small screws, electrical wiring tasks)</p> | F S O N 1 0 0 0 | F S O N 2 1 0 0 | F S O N 1 0 0 0 | F S O N 2 1 0 0 | F S O N 1 0 0 0 | F S O N 2 1 0 0 | |
|  <p>7. Hyperextension of finger/thumb (e.g., using pliers with a wide handle span) or repeated single finger activation (e.g., single finger triggers on power tools)</p> | F S O N 1 0 0 0 | F S O N 3 1 0 0 | F S O N 1 0 0 0 | F S O N 3 1 0 0 | F S O N 1 0 0 0 | F S O N 3 1 0 0 | |
|  <p>8. Hand/grip forces <i>finger tip force:</i> > 2 lb. (.9 kg.) (e.g., 2 lb. is roughly equal to holding fingernail clippers closed) <i>full hand force:</i> > 8 lb. (3.6 kg.) (e.g., 8 lb. is roughly equal to holding a 8 lb. tool or holding a gallon of milk)</p> | F S O N 3 1 0 0 | F S O N 4 2 1 0 | F S O N 3 1 0 0 | F S O N 4 2 1 0 | F S O N 3 1 0 0 | F S O N 4 2 1 0 | Some forcing of raft into container |
|  <p>9. High speed hand/wrist/arm movements (e.g., yank components with fingers, using the hand as a hammer) or Vibration, impact, or torque to the hand (e.g., using a nail gun or other power tools and equipment)</p> | F S O N 3 1 0 0 | F S O N 5 2 1 0 | F S O N 3 1 0 0 | F S O N 5 2 1 0 | F S O N 3 1 0 0 | F S O N 5 2 1 0 | |
|  <p>10. Exposure to hard edges (e.g., tool handle or work area presses into fingers or palm of hands)</p> | F S O N 2 1 0 0 | F S O N 5 2 1 0 | F S O N 2 1 0 0 | F S O N 5 2 1 0 | F S O N 2 1 0 0 | F S O N 5 2 1 0 | |
|  <p>11. Hands and fingers exposed to cold temperatures (e.g., working outside in winter environment, cold exhaust air from tool blows on hand/wrist)</p> | F S O N 1 0 0 0 | F S O N 2 1 0 0 | F S O N 1 0 0 0 | F S O N 2 1 0 0 | F S O N 1 0 0 0 | F S O N 2 1 0 0 | |
| Task Scores = (column total) | | 5 | 5 | | | | |

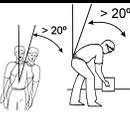
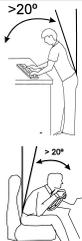
Part II - Checklist, Back/Torso

Job Factors

For each Job Factor, select the appropriate Job Factor frequency score using the following guidelines:

Frequently (F): Job Factor occurs for greater than 50% of the task **Sometimes (S):** Job Factor occurs for 10-50% of the task **Occasionally (O):** Job Factor occurs for less than 10% of the task **Never (N):** Job Factor does not occur or does not apply

Critical Tasks

| Job Factor | Task Name: <i>Folding/Fitting</i> | Task Name: <i>Packing</i> | Task Name: | Comments | | | |
|---|--------------------------------------|------------------------------|--------------------|--------------------|--------------------|--------------------|---|
| | Task Frequency | | Task Frequency | | Task Frequency | | |
| | Moderate 10-50% | High 51-100% | Moderate 10-50% | High 51-100% | Moderate 10-50% | High 51-100% | |
|  12. Repeated forward or side-ways bending movements (>20°) (e.g. lifting from floor level) | F S O N 2 1 0 0 | F S O N 3 2 1 0 | F S O N 2 1 0 0 | F S O N 3 2 1 0 | F S O N 2 1 0 0 | F S O N 3 2 1 0 | |
|  13. Twisting of the lower back (e.g. rushing while lifting, pulling, open a stuck door) | F S O N 3 1 0 0 | F S O N 4 2 1 0 | F S O N 3 1 0 0 | F S O N 4 2 1 0 | F S O N 3 1 0 0 | F S O N 4 2 1 0 | |
|  14. High speed, sudden movements with the back | F S O N 3 1 0 0 | F S O N 4 2 1 0 | F S O N 3 1 0 0 | F S O N 4 2 1 0 | F S O N 3 1 0 0 | F S O N 4 2 1 0 | |
|  15. Static, awkward back postures (for >10 sec at a time) While standing, continuous leaning forward or to the side (>20°) or While seated, continuous leaning forward (>20°) or poor lower back posture (e.g., poor lower back support, no support for feet) | F S O N 2 1 0 0 | F S O N 6 2 1 0 | F S O N 2 1 0 0 | F S O N 6 2 1 0 | F S O N 2 1 0 0 | F S O N 6 2 1 0 | Constantly leaning forward when packing into fixture |
|  16. Lifting forces | | | | | | | |
|  • 50-70 lb. (22.7-31.8 kg.) while upright w/ load close to body <u>or</u> | F S O N 3 2 2 0 | F S O N 4 3 2 0 | F S O N 3 2 2 0 | F S O N 4 3 2 0 | F S O N 3 2 2 0 | F S O N 4 3 2 0 | |
|  • 10-40 lb. (4.5-18.1 kg.) while bending or reaching | | | | | | | |
|  • > 70 lb.(31.8 kg.) while upright w/ load close to body <u>or</u> | F S O N 6 5 4 0 | F S O N 7 6 4 0 | F S O N 6 5 4 0 | F S O N 7 6 4 0 | F S O N 6 5 4 0 | F S O N 7 6 4 0 | Heave lift of packaged raft into and out of the fixture |
|  • > 40 lb. (18.1 kg.) while bending or reaching | | | | | | | |
|  17. Pushing or pulling (initial force > 50 lb. (22.7 kg.)) (e.g. pushing/pulling a full two-drawer file cabinet across a carpeted floor) | F S O N 3 2 1 0 | F S O N 4 3 2 0 | F S O N 3 2 1 0 | F S O N 4 3 2 0 | F S O N 3 2 1 0 | F S O N 4 3 2 0 | |
|  18. Whole body vibration felt through floor surface (e.g. operating heavy machinery) | F S O N 2 1 0 0 | F S O N 4 2 1 0 | F S O N 2 1 0 0 | F S O N 4 2 1 0 | F S O N 2 1 0 0 | F S O N 4 2 1 0 | |
| Task Scores = (column total) | | 11 | 14 | | | | |

Part II - Checklist, Legs/Feet

Job Factors

For each Job Factor, select the appropriate Job Factor frequency score using the following guidelines:

Frequently (F): Job Factor occurs for greater than 50% of the task **Sometimes (S):** Job Factor occurs for 10-50% of the task **Occasionally (O):** Job Factor occurs for less than 10% of the task **Never (N):** Job Factor does not occur or does not apply

Critical Tasks

| Job Factor | Task Name: <i>Folding/Fitting</i> | Task Name: <i>Packing</i> | Task Name: | Comments | | | |
|---|--------------------------------------|------------------------------|--------------------|--------------------|--------------------|--------------------|---|
| | Task Frequency | | Task Frequency | | Task Frequency | | |
| | Moderate 10-50% | High 51-100% | Moderate 10-50% | High 51-100% | Moderate 10-50% | High 51-100% | |
|  19. Fixed position, standing static effort in legs (e.g. standing on hard floor surfaces) | F S O N 2 1 0 0 | F S O N 3 2 1 0 | F S O N 2 1 0 0 | F S O N 3 2 1 0 | F S O N 2 1 0 0 | F S O N 3 2 1 0 | |
|  20. Exposure to hard edges on legs, knees, and feet (e.g., kneeling on a hard surface standing on rungs of a ladder, leaning against a hard edge, exposure to hard front edge of seat) | F S O N 2 1 0 0 | F S O N 5 2 1 0 | F S O N 2 0 0 0 | F S O N 5 2 1 0 | F S O N 2 1 0 0 | F S O N 5 2 1 0 | <i>Kneeling on floor during initial folding</i> |
|  21. Awkward leg postures (e.g. kneeling, squatting, crawling, or knee hyperextension) | F S O N 2 1 0 0 | F S O N 5 2 1 0 | F S O N 2 1 0 0 | F S O N 5 2 1 0 | F S O N 2 1 0 0 | F S O N 5 2 1 0 | |
|  22. Standing foot pedal (e.g., using foot pedal while standing) | F S O N 1 0 0 0 | F S O N 3 2 1 0 | F S O N 1 0 0 0 | F S O N 3 2 1 0 | F S O N 1 0 0 0 | F S O N 3 2 1 0 | |
| Task Scores = (column total) | | 6 | 3 | | | | |

Part II - Checklist, Head/Eyes

Job Factors

For each Job Factor, select the appropriate Job Factor frequency score using the following guidelines:

Frequently (F): Job Factor occurs for greater than 50% of the task

Sometimes (S): Job Factor occurs for 10-50% of the task

Occasionally (O): Job Factor occurs for less than 10% of the task

Never (N): Job Factor does not occur or does not apply

Critical Tasks

| Job Factor | Task Name: <i>Folding/Fitting</i> | Task Name: <i>Packing</i> | Task Name: | Comments | | | |
|--|--------------------------------------|------------------------------|--------------------|--------------------|--------------------|--------------------|--|
| | Task Frequency | | Task Frequency | | | | |
| | Moderate 10-50% | High 51-100% | Moderate 10-50% | | | High 51-100% | |
|  <p>23. Difficult to see/light levels too low /too high. (e.g., see detail)</p> | F S O N 2 1 0 0 | F S O N 3 2 1 0 | F S O N 2 1 0 0 | F S O N 3 2 1 0 | F S O N 2 1 0 0 | F S O N 3 2 1 0 | |
|  <p>24. Intensive visual tasks, staring at work objects for long periods (e.g., inspection, troubleshooting)</p> | F S O N 2 1 0 0 | F S O N 3 2 1 0 | F S O N 2 1 0 0 | F S O N 3 2 1 0 | F S O N 2 1 0 0 | F S O N 3 2 1 0 | |
| Task Scores = (column total) | | 0 | 0 | | | | |

Part III - Environmental

Environmental Factors

| | Strongly Disagree 1 | Disagree 2 | Neutral 3 | Agree 4 | Strongly Agree 5 |
|------------------------------------|------------------------|---------------|--------------|------------|---------------------|
| 25. Restricted space | 0 | 0 | 0 | 1 | 4 |
| 26. Extreme temperatures heat/cold | 0 | 0 | 0 | 1 | 4 |
| 27. Noise or distractions | 0 | 0 | 0 | 1 | 4 |
| 28. Air quality concerns | 0 | 0 | 0 | 1 | 4 |

Environmental Score = 0

| | | | |
|----------------------|-----|-----|------|
| Environmental Rating | Low | Med | High |
| Environmental Score | 0-3 | 4-7 | 8+ |

Part IV - Employee Suggestion

| Ask the employee for any suggestions for corrective actions that they may have. |
|---|
| |
| |
| <i>Put locks on wheels so fixture/cart doesn't move when we're placing raft</i> |
| |
| |
| |
| |
| |
| |