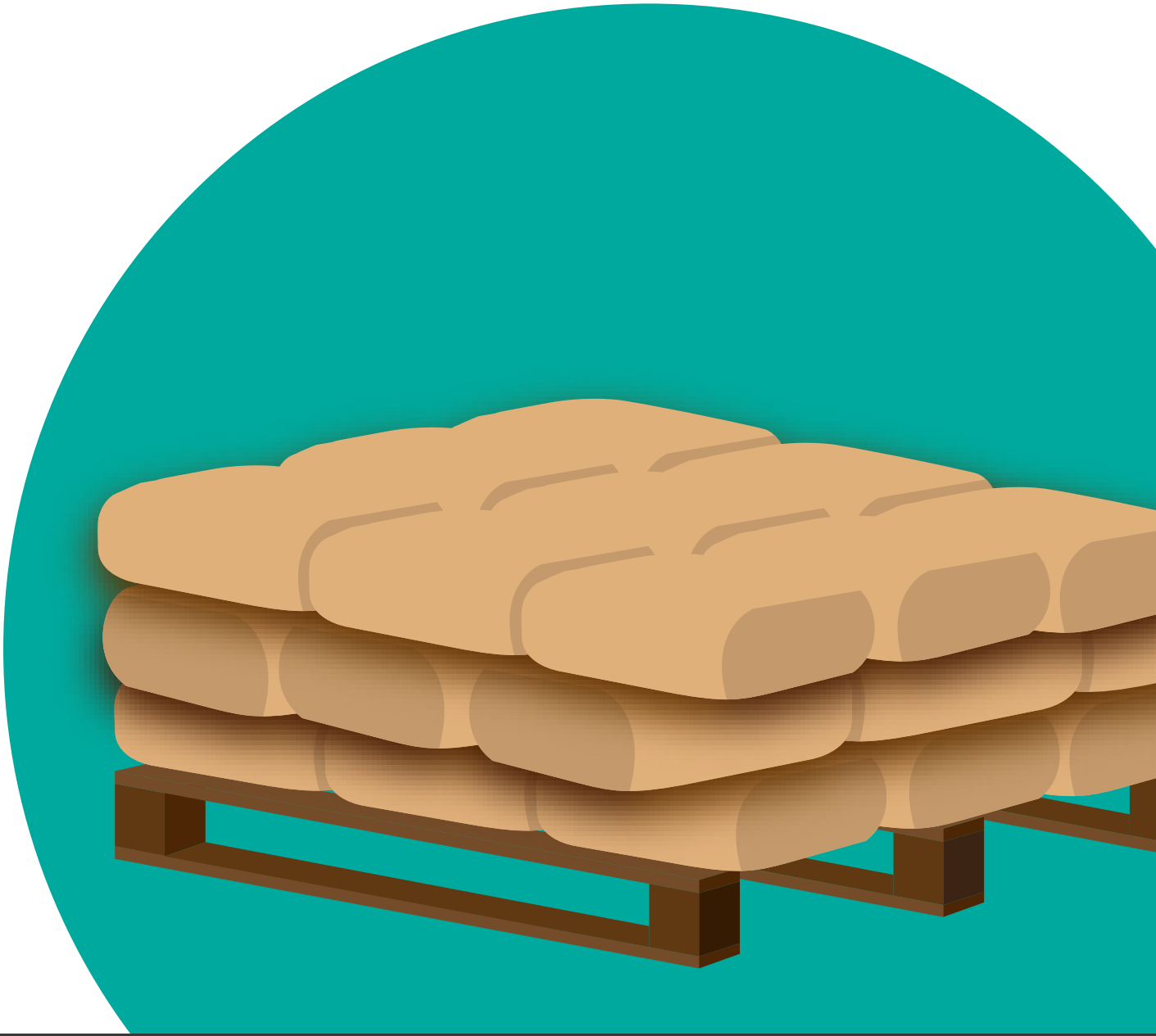
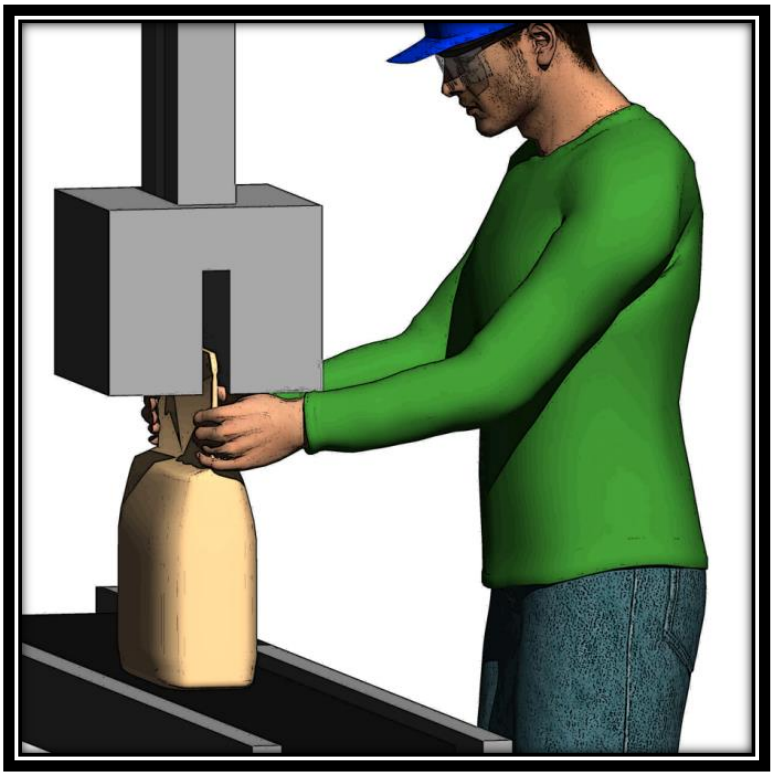
ErgoMine 2.0

Bagging Audit



Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

Bagging Audit



This audit assesses the ergonomics of the processes for filling small bags (100 lb or less) and bulk bags (i.e., intermediate bulk container), closing them, and preparing them for shipment. The audits cover the individual filling stations as well as the environment in which the processes are housed.

Bagging Audit Instructions

The bagging audit package contains four documents that are necessary to conduct a bagging audit. A description and intended use of each document is provided below.

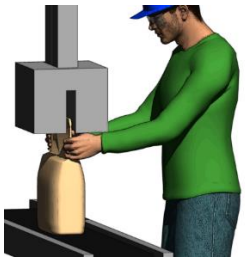
1. **Bagging Audit Information Page** – This page allows the bagging audit user to record pertinent information to be filed with the audit results and recommendations. A separate Bagging Audit Information Page should be used for each location and time when conducting an audit of multiple location or at multiple times.

2. **Bagging Audit Answer Sheet** – This document can be used to record responses to bagging audit questions, thereby allowing the user to reuse the Bagging Audit Questions Document multiple times without the need for additional copies of the questions.

3. **Bagging Audit Questions** – This document contains the full set of bagging audit questions and is arranged in a modular format. This should be used to conduct the ergonomics audit. Please note, completion of some modules will require tools. You will need a thermometer to complete module 4 and a tape measure to complete modules 7 through 12.

4. **Bagging Audit Recommendations** – This document contains all the recommendations for the bagging audit questions. It includes a checkbox beside each recommendation, allowing the user to check the recommendation that corresponds to each of the answers recorded on the answer sheet.

Bagging Audit Table of Contents



Bagging Audit Information Page

Name of Auditor: _____

Location of Audit: _____

Date of Audit: _____

Comments:

_____

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Bagging Audit Answer Sheet

Facility Level Modules

Module 1 – Bagging Operation Characteristics

1.1 _____

1.1.1 _____

1.1.2 _____

1.1.3 _____

1.1.4 _____

1.1.5 _____

1.1.6 _____

1.1.7 _____

1.2 _____

1.2.1 _____

1.2.2 _____

1.2.3 _____

1.2.4 _____

1.3 _____

1.4 _____

Module 2 – Personal Protective Equipment

1. _____

2. _____

Module 3 – Work Posture

3.0 _____

3.1 _____

3.2 _____

3.3 _____

3.4 _____

3.5 _____

Module 4 – Work Environment

4.1 _____

4.2 _____

4.3 _____

4.4 _____

4.4.1 Name of Area:_____

4.4.2 Air Temp: _____

4.4.3 Humidity: _____

4.4.4 Thermal Radiation:_____

4.4.5 Air Movement: _____

4.4.6 Workload:_____

4.4.7 Clothing: _____

4.4.8 Opinion:_____

Module 5 – Lighting

5.0 _____
5.1 _____
5.2 _____
5.3 _____
5.4 _____
5.5 _____
5.6 _____
5.7 _____
5.8 _____
5.9 _____
5.10 _____
5.11 _____
5.12 _____
5.13 _____
5.14 _____

Module 6 – Mobile Equipment

6.1 _____
6.2 _____
6.3 _____
6.4 _____
6.5 _____
6.6 _____
6.7 _____

Small Bag Modules

Module 7 – Filling

7.0 _____
7.1 Part 1_____Part 2_____
7.2 _____
7.3 _____
7.4 _____
7.5 _____
7.6 _____

Module 8 – Weighing

8.0 _____
8.1 _____
8.2 _____

Module 9 – Sealing

9.0 _____
9.1 Part 1_____Part 2_____
9.2 _____
9.3 _____
9.4 _____
9.5 _____

Module 10 – Palletizing

10.0 _____

10.1 Part 1:_____

10.1 Part 2: Lowest height _____

10.1 Part 2: Highest height _____

10.2 _____

10.3 Height:_____

10.4 _____

10.5 _____

10.6 _____

10.7 _____

10.8 _____

10.9 _____

10.10 _____

10.11 _____

10.12 _____

Bulk Bag Modules

Module 11 – Hanging, Opening, and Filling

11.0 _____

11.1 _____

11.2 Lowest height:_____

11.2 Highest height:_____

11.3 Part 1: Height: _____

11.3 Part 2: Height: _____

11.4 Part 1:_____

11.4 Part 2:_____

11.5 _____

11.6 _____

11.7 _____

11.8 _____

Module 12 – Closing and Sealing

12.0 _____

12.1 Height:_____

12.2 _____

12.3 _____

12.4 _____

Small and Bulk Bags Module

Module 13 – Stretch and Shrink Wrapping

13.0 _____

13.1 _____

13.2 _____

13.3 _____

13.4 _____

13.5 _____

13.6 _____

Bagging Audit Questions

I. Facility Level Modules

This series of modules asks about the nature of the bagging operations, facilities, equipment, and PPE postures used during bagging.

1. Module 1: Bagging Operation Characteristics

This module asks about characteristics and processes of your bagging operations and determines which sections of this audit should be conducted.

1.1. Are small bags (typically 100 lb or less) used? Yes / No

- If yes, proceed to question 1.1.1
- If no, proceed to question 1.2

1.1.1. What is the filling process for small bags?

A. Automated process (empty and full bags are not manually handled)

B. Process requiring some manual handling such as adding empty bags or removing full bags from a filling spout

- If A, do not complete Module 7
- If B, complete Module 7

1.1.2. What is the process for checking the weight of small bags after filling?

A. Automated process (no manual handling during weighing)

B. Process requiring some manual handling such as lifting a filled bag and moving to a scale

- If A, do not complete Module 8
- If B, complete Module 8

1.1.3. What is the sealing process for small bags?

A. Automated process (no manual handling during sealing)

B. Process requiring some manual handling such as manually feeding the bag through the sealing machine or rolling/folding the top of the bag

- If A, do not complete Module 9
- If B, complete Module 9

1.1.4. What is the palletizing process for small bags?

A. Automated process (no manual handling during palletizing)

B. Process requiring some manual handling such as manually moving filled bags to pallet or using a vacuum hoist to lift and move the bags to the pallets

- If A, do not complete Module 10
- If B, complete Module 10

1.1.5. What is the stretch/shrink wrapping process for small bags?

A. Automated process (no manual handling of shrink/stretch wrap)

B. Process requiring some manual handling such as manually applying wrap

C. Small bags are not stretch/shrink wrapped

- If A or C, do not complete Module 13 (unless your answer to 1.2.4 is B)
- If B, complete Module 13

1.1.6. Do bag failures (broken bags) occur? **Yes / No**

- If yes, proceed to next question
- If no, proceed to question 1.2

1.1.7. During which processes do bag failures occur?
Choose all that apply:

A. Bag filling

B. Transporting on conveyor

C. Weighing

D. Sealing

E. Palletizing

F. Storing

1.2. Are bulk bags (e.g., super sacks) used? **Yes / No**. If yes, proceed to question 1.2.1

- If no, proceed to 1.3

1.2.1. Are liners ever used inside the bulk bags? Yes / No

- If yes, proceed to question 1.2.2
- If no, proceed to question 1.2.3

1.2.2. Is the liner attached (e.g., semi or fully glued or sewn to the bag)? **Yes / Sometimes / No**

1.2.3. What is the top design of the bulk bag (Figure 1)?
Choose all that apply:

A. Spout
B. Cone
C. Duffle or open

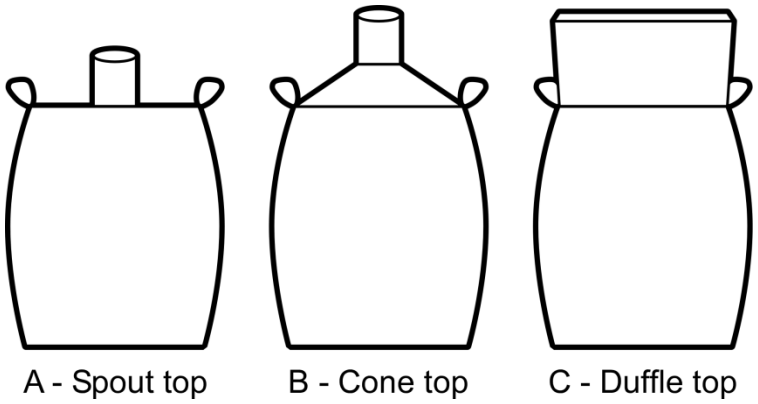

Figure 1. Types of bag tops.

1.2.4. Is the bulk bag stretch/shrink wrapping process:

A. Automated process (no manual handling of shrink/stretch wrap)
B. Process requiring some manual handling such as manually applying wrap
C. Bulk bags are not stretch/shrink wrapped

- If A or C and you answered A or C to 1.1.5, do not complete Module 13
- If B, complete Module 13

1.3. At any given time, how many workers are typically involved in bagging tasks? **One / two or more**

- If one, proceed to Module 2
- If two or more, proceed to next question

1.4. Do workers rotate between tasks (e.g., driving fork lift, palletizing, bagging)? **Yes / No**

2. Module 2: Personal Protective Equipment

This module asks about personal protective equipment worn while bagging.

2.1. Are respirators (dust masks) required for bagging activities? **Yes / No**

2.2. Are gloves ever worn during bagging activities? **Yes / No**

3. Module 3: Work Posture

This module asks about postures observed while workers are bagging. This module should be completed for each bagging workstation.

3.0. Please record the name of the bagging station you are evaluating: _____

3.1. What posture is used for the task?

- **A. Standing**
- **B. Sitting**
- **C. Mix of standing and sitting with the ability to move freely and frequently**

- If A, answer 3.2 and proceed to Module 4
- If B, proceed to question 3.3
- If C, proceed to question 3.2

3.2. What type of floor surface is the worker on?

- **A. Hard surface (e.g. concrete)**
- **B. Cushioned surface (e.g. anti-fatigue mat)**
- **C. Mix of hard and cushioned surfaces**

3.3. Is the seat fixed or sliding/swivel?

- **A. Fixed**
- **B. Sliding/Swivel**

3.4. Is the worker able to rest their feet comfortably with a near 90˚ angle at the hip and knee (e.g., Figure 2) and not like Figure 3? **Yes / No**

Figure 2. Worker is sitting with hip and knee at same level, hip and knee at approximately 90 degrees, and get supported.

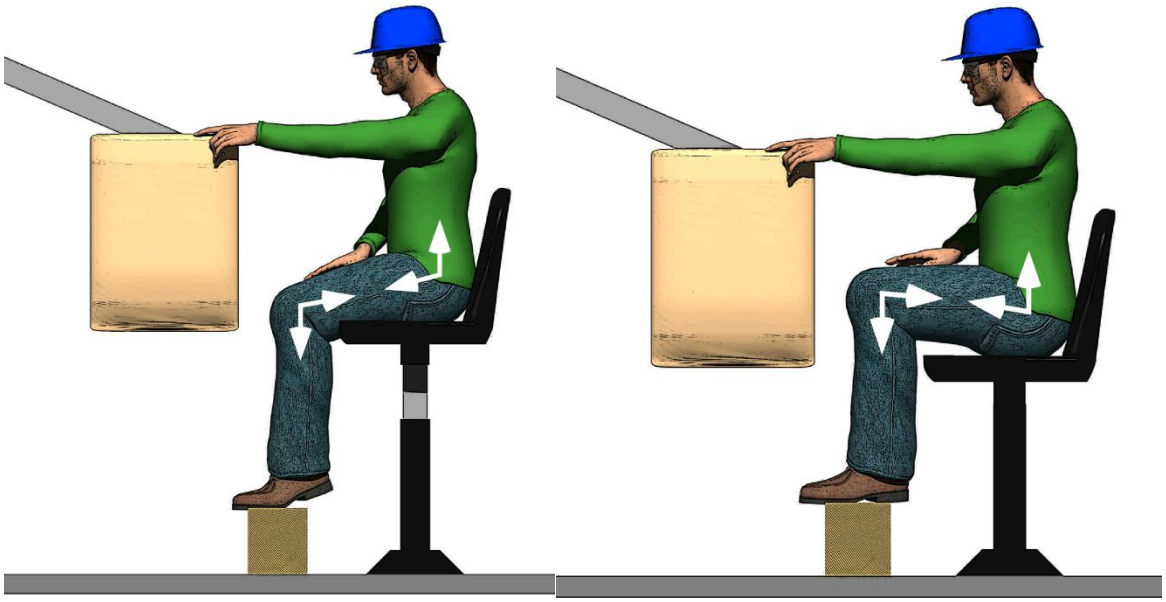

Figure 3. Worker is sitting too far from the foot support, resulting in the knee being below the hip and a greater than 90-degree angle at the hip and knee (left); worker is sitting too close to the foot support, resulting in the knee being above the hip and a less than 90-degree angle at the hip and knee (right).

3.5. By asking the worker, what is the condition of the seat?

- **A. Good (no rips in seat cover, padding intact, provides proper support, and sliding/swivel function still working properly)**
- **B. Fair/poor (seat cover ripped, padding lost or no longer comfortable, pieces broken off, sliding/swivel function is not working properly)**

4. Module 4: Work Environment

This module asks about environmental conditions, particularly factors affecting thermal comfort. This module requires a thermometer.

4.1. During hot weather, is work performed outdoors? **Yes / No**

4.2. During cold weather, is work performed outdoors? **Yes / No**

- If yes, proceed to next question
- If no, proceed to question 4.4

4.3. Are workers provided portable heating sources, if needed? **Yes / No / Not needed**

4.4. Using Table 1, ask employees who routinely work in the area being audited to score their current thermal environment. Complete this for each working area.

4.4.1. Input a name for the work area you are currently evaluating: _____

4.4.2. Air Temperature Score: _____

4.4.3. Humidity Score: _____

4.4.4. Thermal Radiation Score: _____

4.4.5. Air Movements Score:_____

4.4.6. Physical Workload Score: _____

4.4.7. Clothing Score:_____

4.4.8. Opinion of Workers Score:_____

Table 1. Thermal working conditions scores[1].

Score	Condition
	Air Temperature
-3	Generally freezing
-2	Generally between 32˚F and 50˚F
-1	Generally between 50˚F and 64˚F
0	Generally between 64˚F and 75˚F
1	Generally between 75˚F and 90˚F
2	Generally between 90˚F and 104˚F
3	Generally greater than 104˚F
	Humidity
-1	Dry throat/eyes after 2–3 hours
0	Normal
1	Moist skin
2	Skin completely wet

[1] ISO [2004]. ISO 15265 Risk assessment strategy for the prevention of stress or discomfort in thermal working conditions. Geneva, Switzerland: International Organization for Standardization, pp. 4–5.

Score	Condition
	Thermal Radiation
-1	Cold on the face after 2–3 minutes
0	No radiation discernible
1	Warm on face after 2–3 minutes
2	Unbearable on the face after more than 2 minutes
3	Immediate burning sensation
	Air Movements
-2	Cold strong air movements
-1	Cold light air movements
0	No air movements
1	Warm light air movements
2	Warm strong air movements
	Physical Work Load
0	Office work: easy, low muscular constraints, occasional movements at normal speed
1	Moderate work with arms or legs: use of heavy machines, steadily walking
2	Intense work with arms and trunk: handling heavy objects, shoveling, woodcutting, walking rapidly, or while carrying a heavy load
3	Very intense work at high speed: stairs, ladders
	Clothing
0	Light, flexible, not interfering with the work
1	Long, heavier, interfering slightly with the work
2	Clumsy, heavy, special for radiation, humidity or cold temperatures
3	Special overalls with gloves, hoods, shoes
	Opinions of the Workers
-3	Shivering, strong discomfort for the whole body
-2	Strong local discomfort; overall sensation of coolness
-1	Slight local cool discomfort
0	No discomfort
1	Slight sweating and discomfort; thirst
2	Heavy sweating, strong thirst, work pace modified
3	Excessive sweating, very tiring work, special clothing

5. Module 5: Lighting

This module asks about lighting characteristics of the work area. This module should be completed for each work area.

5.0. Input a name for the work area you are currently evaluating: _____

5.1. Are all of the light sources working? **Yes / No**

5.2. Are LED lights used for overhead lighting everywhere? **Yes / No**

- If yes, proceed to question 5.4
- If no, proceed to next question

5.3. Are fluorescent bulbs used? **Yes / No**

5.4. Does flicker exist? **Yes / No**

5.5. Are all light fixtures clean (e.g., free from dirt/paint)? **Yes / No**

5.6. Are light sources provided with shades or glare shields? **Yes / No**

5.7. Is additional lighting (in the form of spot lights or area lighting) provided in areas with high spillage and near bagging equipment? **Yes / No**

5.8. Is additional lighting (in the form of spot lights or area lighting) provided in passageways and entrances/exits? **Yes / No**

5.9. According to workers, how should current lighting be changed?

A. Increase amount of light (brighter)
B. Decrease amount of light (less bright)
C. Current levels of light do not need to be changed

5.10. According to workers, do current sources of light create shadows or glare that interfere with task performance or safety? **Yes / No**

5.11. According to workers, do workers look from bright to dark places routinely? **Yes / No**

5.12. Which types, if any, of portable lighting are used?
Choose all that apply:

A. Flashlight or other hand-held light
B. Head lamp
C. Standing/floor lamp
D. No portable lighting used

- If A, proceed to next question
- If B or C, proceed to question 5.14
- If D, proceed to Module 6

5.13. According to workers, do hand-held lighting sources need to be held when walking up/down stairs, walking on inclined walkways, climbing or descending ladders or while holding other objects? **Yes / No**

5.14. Do workers experience any difficulties handling portable light sources due to the size or weight of the lighting equipment? **Yes / No**

6. Module 6: Mobile Equipment

This module asks about mobile equipment (such as fork lifts) that may be present in bagging areas.

6.1. Is mobile equipment (e.g., bobcat, forklift, backhoe) used indoors in areas with foot traffic? **Yes / No**

6.2. Are propane cylinders properly secured and stored and rechargeable mobile equipment charged in well-ventilated areas? **Yes / No**

6.3. Are pre-shift inspection reports always reviewed by someone other than the driver before the mobile equipment is put into operation each shift?

- **A. Yes**
- **B. No**
- **C. Only if there is a problem**

6.4. Does the operator have the option to not drive a piece of mobile equipment due to a safety concern which did not cause the vehicle to be out of service? **Yes / No**

6.5. Does anyone other than a mechanic have the authority to put mobile equipment back into service? **Yes / No**

6.6. Are operators required to set the parking brake whenever parking the mobile equipment? **Yes / No**

6.7. Do operators always physically immobilize (e.g., use wheel chocks) mobile equipment when parking? **Yes / No**

II. Small Bag Modules

This series of modules asks about the characteristics of small bag filling stations.

7. Module 7: Filling

This module should be completed for each small bag filling station. This module requires a tape measure. This module should be completed for each small bag filling station.

7.0. Input a name for the small bag filling station you are currently evaluating: _____

7.1. Part 1: Where are empty bags located relative to the worker when worker is facing filling spout?

- **A. Behind**
- **B. To the side**
- **C. In front**

Part 2: What is the height of the stack of empty bags at the filling station (measured from the surface the worker is on to the middle of the stack when it is full)?

If worker is seated, choose one of the following:

- **D. below elbow level**
- **E. between elbow and chest level**
- **F. above chest level**

If worker is standing, choose one of the following:

- **D. below 30 in**
- **E. between 30 and 50 in**
- **F. above 50 in**

7.2. Are there obstructions that influence posture for any worker (e.g., guardrail that causes worker to bend to reach filling spout like in Figure 4)? **Yes / No**

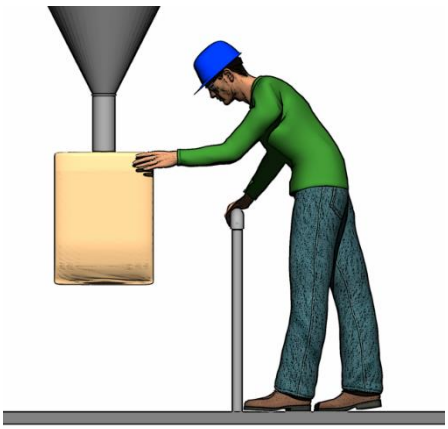

Figure 4. The guardrail is an obstruction. The worker must lean forward to place the bag on the spout. If the standing surface were closer to the spouts, the worker may not need to bend over as far and the guardrail could be modified to prevent the worker from falling onto the conveyor.

7.3. How are bags supported during filling?

- **A. By the filling machine**
- **B. Manually held by the worker**

7.4. How is the filling machine activated?

- **A. Hand button or switch**
- **B. Footswitch or pedal**
- **C. Automatically**

7.5. How often are pinch or wide finger grips observed during bag filling (e.g., Figure 5)?

- **A. Rarely**
- **B. Sometimes or frequently**

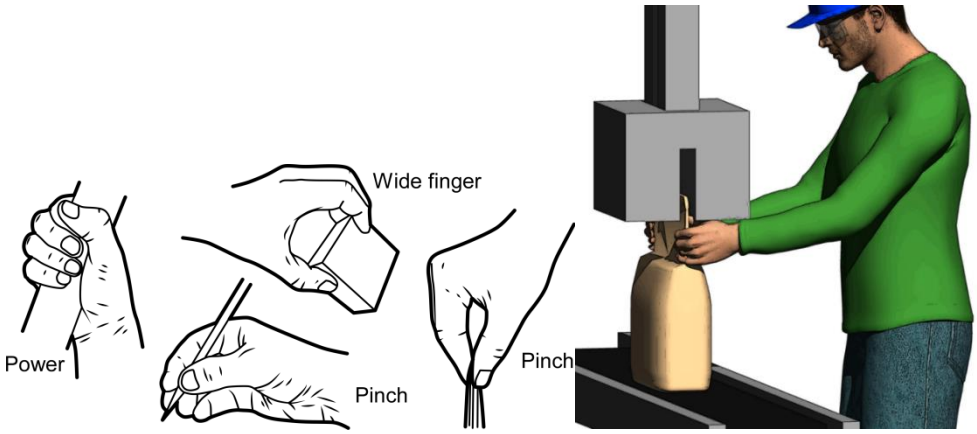

Figure 5. Types of hand grips (left) and example of pinch grip during bag sealing (right)

7.6. How often is wrist bending or deviating observed during bag filling (e.g., Figure 6)?

- **A. Rarely**
- **B. Sometimes or frequently**

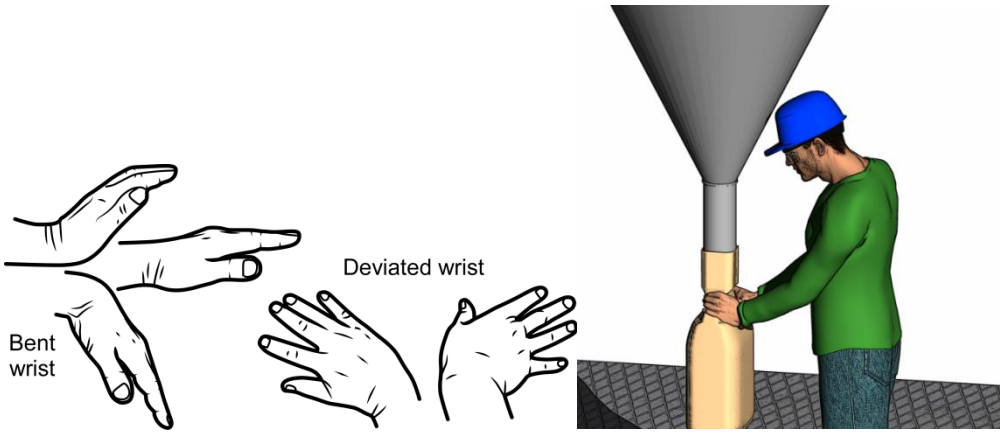

Figure 6. Types of wrist postures (left). Example of wrist bending and deviating during bag filling (right).

8. Module 8: Weighing

This module should be completed for each small bag weighing station. This module requires a tape measure. This module should be completed for each small bag weighing station.

8.0. Input a name for the small bag weighing station you are currently evaluating: _____

8.1. What is the highest height of the hands when placing bag on or taking bag off scale (measured from the surface the worker is standing on to the highest height of the middle knuckle, Figure 7)?
Fill in the blank: **Height: _____ in**

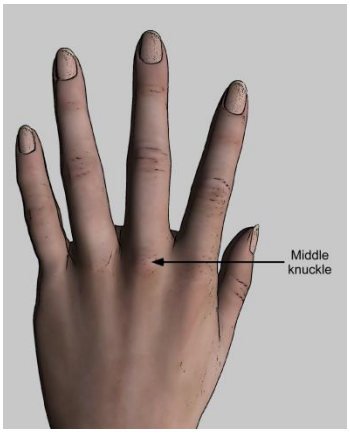

Figure 7. The middle knuckle is the knuckle between the middle finger and the back of the hand

8.2. If the weight of the bag is not within tolerance, what action is typically performed?

- **A. Product added to or taken out of bag**
- **B. Bag and product discarded or recycled**
- **C. No change to filled bag**

9. Module 9: Sealing

This module asks about characteristics of the sealing process such as methods and worker posture. This module should be completed for each small bag sealing station. This module requires a tape measure. This module should be completed for each small bag sealing station.

9.0. Input a name for the small bag sealing station you are currently evaluating: _____

9.1. How is the bag sealed?

- **A. Manual process such as rolling or folding the top of the bag**
- **B. Semi-automatic process such as manually feeding the bag through the sealing machine or using a sealing machine that requires manual control**

9.2. Part 1: Is sealing performed standing or sitting?

- **A. Standing**
- **B. Sitting**

Part 2: What is the highest height of the hands when sealing is performed (measured to the highest position of the middle knuckle, Figure 8). If the worker is standing, measure from the surface the worker is standing on (e.g., Figure 9); if the worker is sitting, measure from the seat of the chair. Fill in the blank: **Height: ___ in**

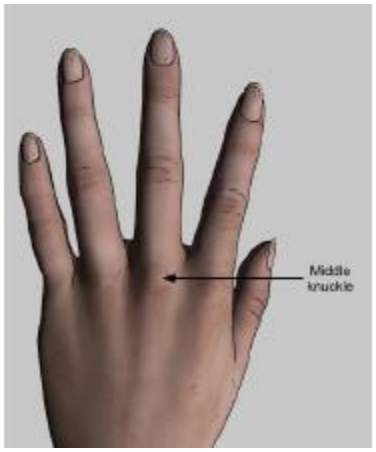

Figure 8. The middle knuckle is the knuckle between the middle finger and the back of the hand.

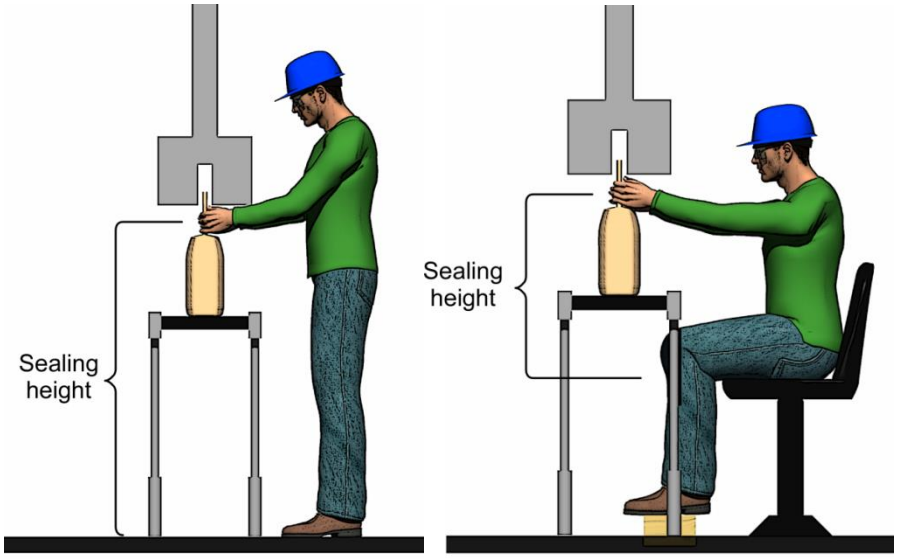

Figure 9. When the worker is standing, the height of the hands is measured from the surface the worker is standing on to the highest position of the middle knuckle when performing the sealing task (left). If the worker is sitting, the height is measured from the seat of the chair the is sitting on to the highest position of the middle knuckle (right).

9.3. Does the worker support the weight of the bag during the sealing process? **Yes / No**

9.4. How often is a pinch or wide finger grip observed during bag sealing (e.g., Figure 10)?

- **A. Rarely**
- **B. Sometimes or Frequently**

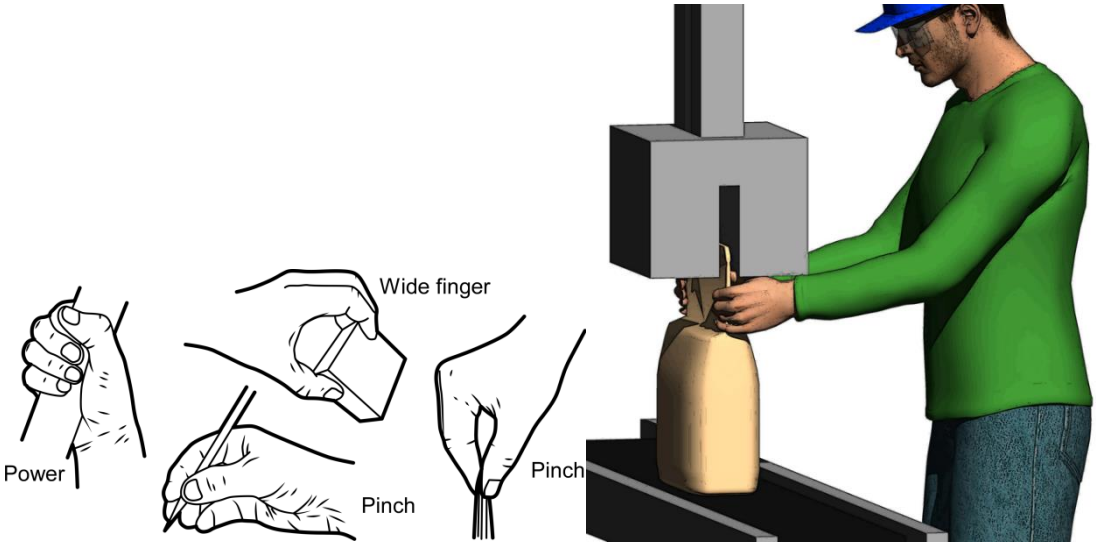

Figure 10. Types of hand grips (left) and example of pinch grip during sealing (right).

9.5. How often is wrist bending or deviating observed during bag sealing (e.g., Figure 11)?

A. Rarely

B. Sometimes or Frequently

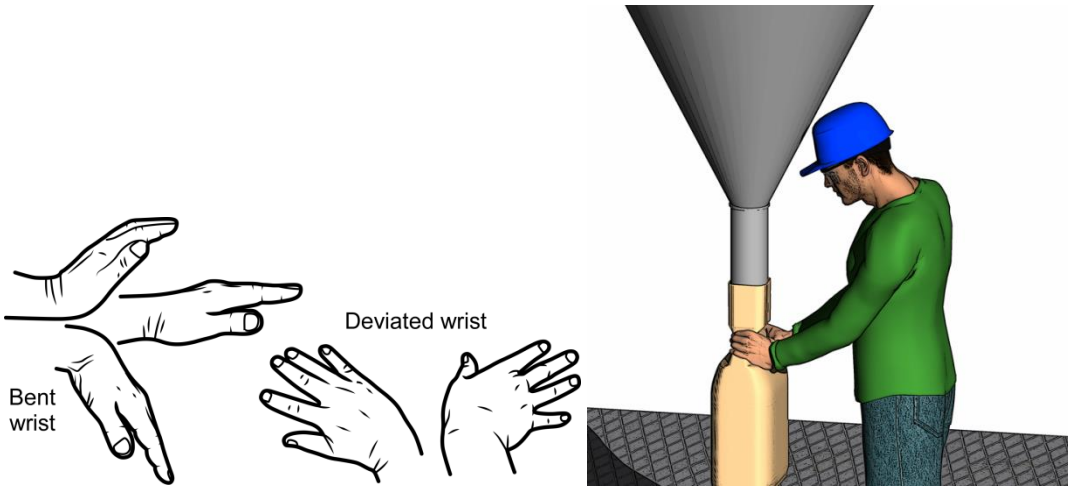

Figure 11. Types of wrist postures (left). Wrist bending and deviating during bag filling (right).

10. Module 10: Palletizing

This module asks questions about the characteristics of palletizing such as pallet dimensions and worker posture. This module should be completed for each small bag palletizing station. This module requires a tape measure. This module should be completed for each small bag palletizing station.

10.0. Input a name for the small bag palletizing station you are currently evaluating: _____

10.1. Part 1: Which most closely describes the palletizing station?

- **A. Bags are stacked on a single pallet on the ground**
- **B. Bags are stacked on a raised surface such as a stack of pallets**
- **C. Bags are stacked on a pallet that is on surface with adjustable height such as a lift table**

Part 2: What is the height of the lowest and highest bag on a full pallet (measured from the surface the worker is standing on to the middle of the bag; e.g., Figure 12)?
Fill in the blanks: **Lowest height: _____ in Highest height: _____ in**

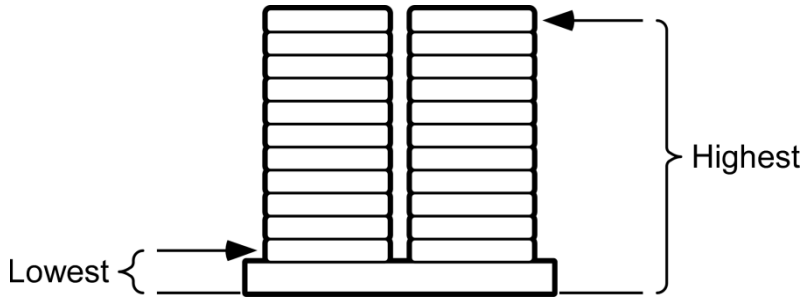

Figure 12. Lowest and highest bag measurement guidelines: Measure from the surface the worker is standing on to the center of the bag after it is placed on the pallet. Ensure that measurements of the bags are taken at the height they are loaded (e.g., if a lift table is used, the measurements of the bags are taken at the height they are loaded (e.g., if a lift table is used, the lowest and highest height may be the same).

10.2. How are empty pallets positioned for loading?

- **A. Mechanically (e.g., forklift)**
- **B. Manually**

10.3. What is the highest height of the hands when lifting bags from the conveyor (measured from the surface the worker is standing on to the middle knuckle of the highest hand when lifting the bag; e.g., Figure 13)?
Fill in the blank: **Height: _____ in**

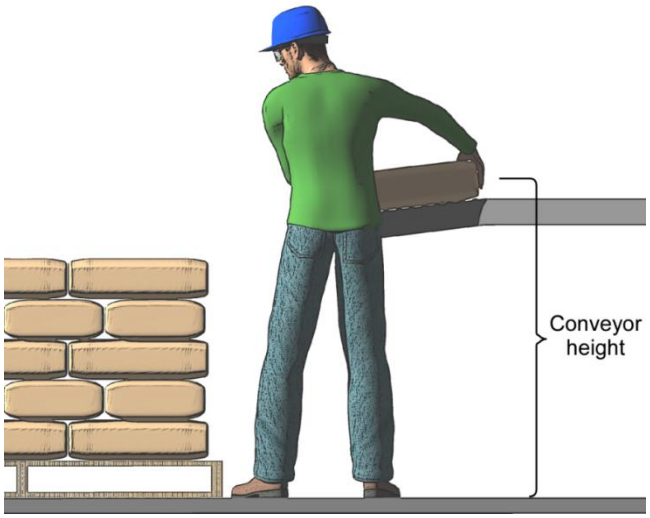

Figure 13. Bag height is measured from the surface the worker is standing on to the middle knuckle of the highest hand.

10.4. Relative to the worker's forward facing direction when retrieving bags from the conveyor, where is the pallet located? If multiple workers perform palletizing, evaluate the position for each worker. Choose all that apply:

- **A. In front of worker** (Figure 14 and Figure 15)
- **B. To the side of worker** (Figure 16 and Figure 17)
- **C. Behind worker** (Figure 18)

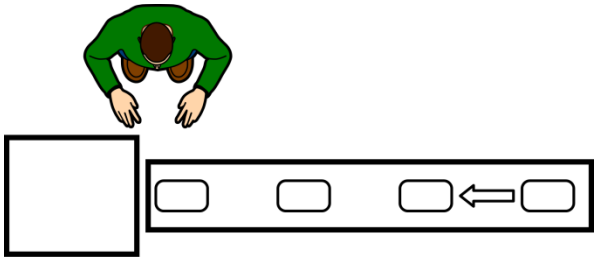

Figure 14. Pallet is in front of worker.

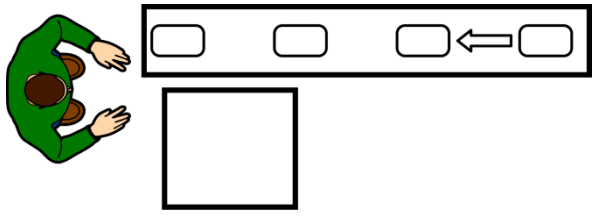

Figure 15. Pallet is in front of worker.

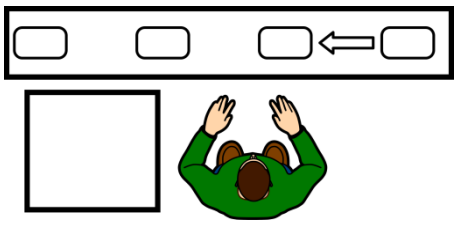

Figure 16. Pallet is to the side of worker.

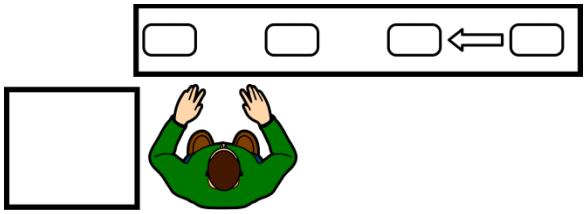

Figure 17. Pallet is to the side of worker.

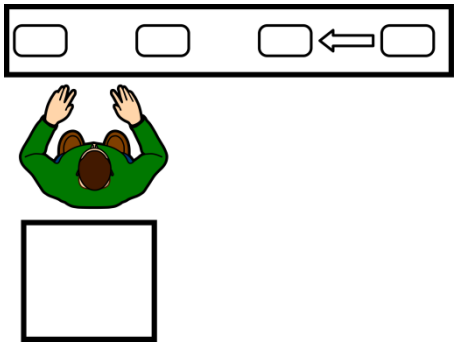

Figure 18. Pallet is behind worker.

10.5. Is a turnable lift table used (e.g., Figure 19)? **Yes / No**

Figure 19. Turntable lift table. this style of table rotates and lowers as bags are placed on it.

10.6. Is a vacuum hoist or other lift-assist tool always used for lifting the bags? **Yes / No**

10.7. Do workers ever slide bags while on the conveyor before they are lifted? **Yes / No**

10.8. Are there barriers or objects that prevent the worker from keeping the bags close to the body when lifting or placing the bags (e.g., Figure 20)? **Yes / No**

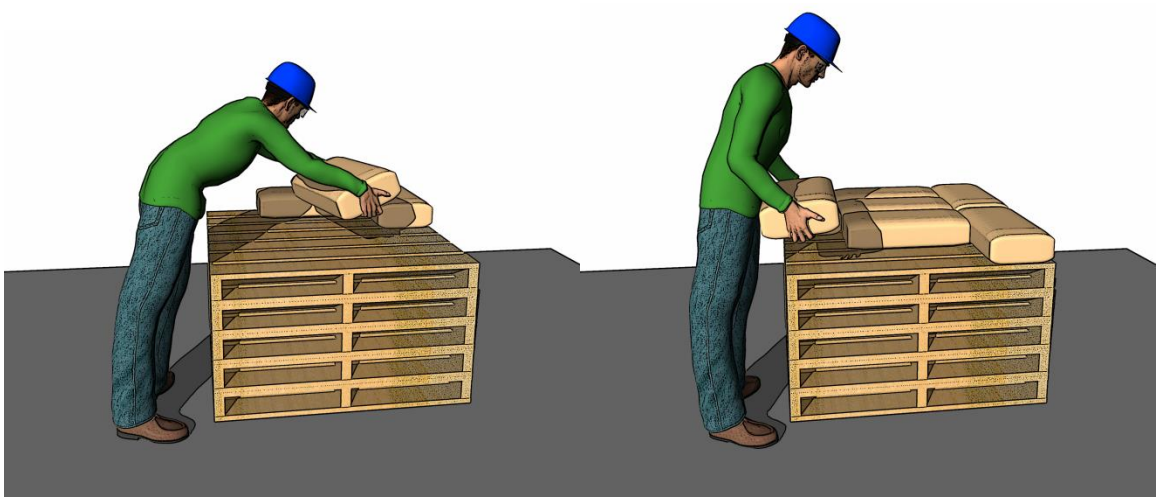

Figure 20. The pallet can be a barrier, requiring reaching away from the body to place the bag (left). The bag should be kept close to the body during all parts of the lifting/lowering process (right).

10.9. Is a corner frame or backboard used when palletizing (e.g., Figure 21)? **Yes / No**

- If yes: proceed to next question
- If no, proceed to question 10.11

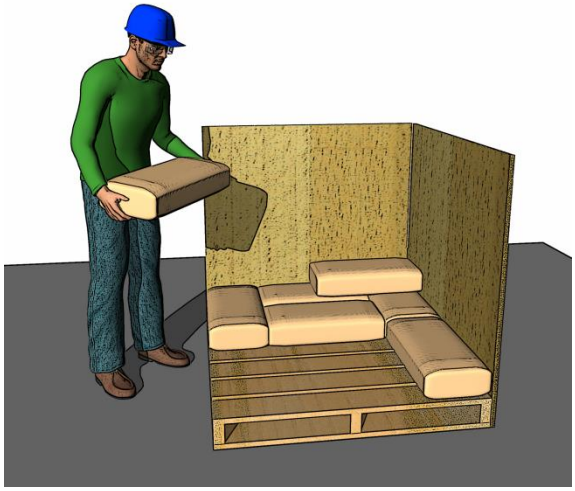

Figure 21. Corner frame used for palletizing.

10.10. Do workers ever bend their back or reach with their arms while palletizing? **Yes / No**

10.11. How often is wrist bending or deviating observed during palletizing (e.g., Figure 22)?

- **A. Rarely**
- **B. Sometimes or Frequently**

Figure 22. Types of awkward wrist postures (left), example of bent wrist during palletizing (middle), example of wrist bent and deviated during palletizing (right).

10.12. How often are pinch or wide finger grips observed during palletizing (e.g., Figure 23)?

- **A. Rarely**
- **B. Sometimes or Frequently**

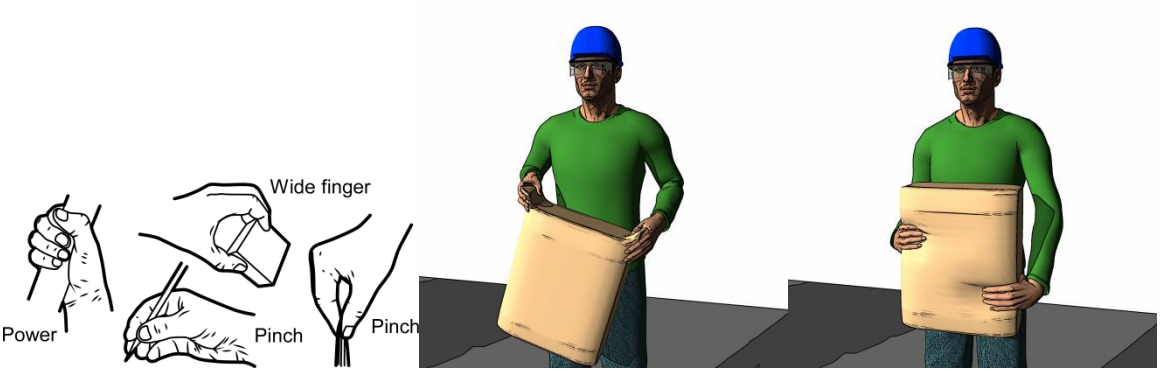

Figure 23. Types of awkward hand grips (left), example of pinch grip when holding a bag (middle), example of a wide finger grip when holding a bag (right).

III. Bulk Bag Modules

This series of modules asks about the characteristics of bulk bag filling stations.

11. Module 11: Hanging, Opening, and Filling

The module asks about attaching empty bulk bags to the filling station and the filling procedures. This module should be completed for each bulk bag filling station. This module requires a tape measure. This module should be completed for each bulk bag station.

11.0. Input a name for the bulk bag filling station you are currently evaluating: _____

11.1. How are empty pallets moved into position for loading?

- **A. Mechanically (e.g., forklift)**
- **B. Manually**
- **C. Pallet not used under bulk bag**

11.2. What are the lowest and highest heights of empty bags (measured from the surface the worker is standing on)?
Fill in the blanks: **Lowest height: _____ in Highest height:_____ in**

11.3. Part 1: What is the height of the hooks/forks on which the bags are hung for filling (measured from the surface the worker is standing on; e.g., Figure 24)?
Fill in the blank: **Height: _____ in**

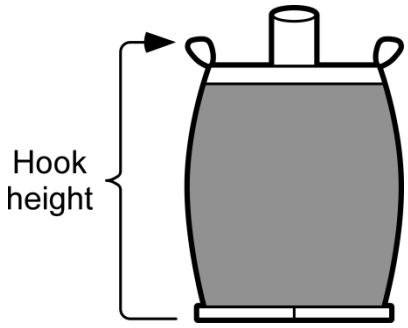

Figure 24. Height of hooks is measured from the surface the worker stands on to the top of the hooks.

Part 2: What is the highest height of the hands when attaching the bag to the filling spout (measured from the surface the worker stands on to the highest position of the middle knuckle; (e.g., Figure 25)? Fill in the blank: **Height:_____ in**

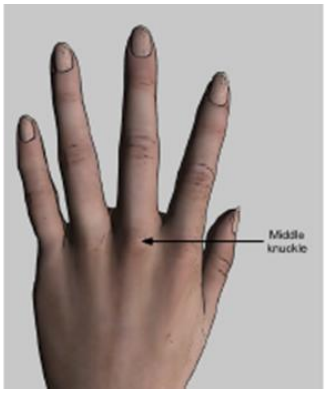

Figure 25. The middle knuckle is the knuckle between the middle finger and the back of the hand.

11.4. Part 1: How is the bag secured to the filling spout (e.g., Figure 26)?

- **A. Hook**
- **B. Clamp**
- **C. Tension cord**
- **D. Air bladder**
- **E. Not secured**
- **F. Other**

Part 2: Does the bag ever separate from the filling spout during filling? **Yes / No / NA**

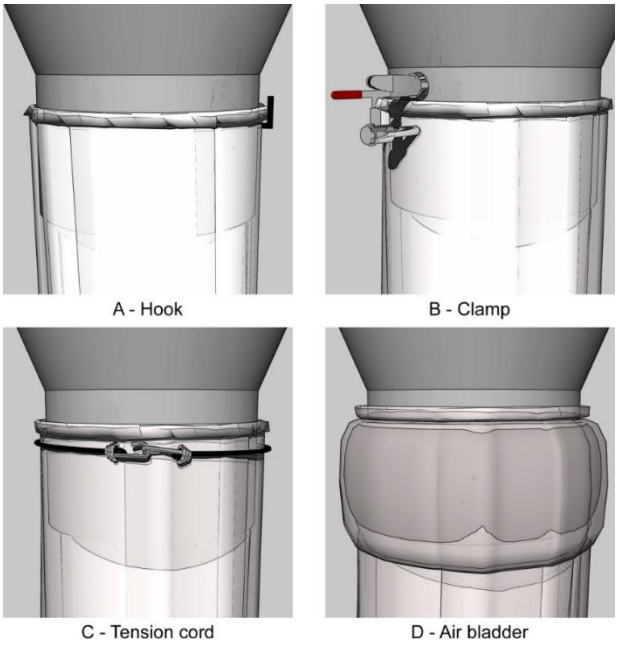

Figure 26. Methods of securing bag to filling spout.

11.5. Prior to filling, Is the bag filled with air automatically by the filling machine? **Yes / No**

- If yes, proceed to question 11.7
- If no, proceed to next question

11.6. How is the bag opened prior to filling?

A. anually (e.g., bottom corners of bag spread apart)

B. With a tool (e.g., broom used to spread out bottom corners from inside bag, leaf blower used to fill bag with air)

C. Bag not opened prior to filling

11.7. How is filling of the bag controlled?

A. Automatic release/stoppage (e.g., push button or foot pedal)

B. Manual release/stoppage (e.g., hand lever)

11.8. Why are bags adjusted during the filling process?
Choose all that apply:

A. Bags are adjusted to prevent folds in the bag

B. Bags are adjusted because product isn't evenly filling bag

C. Bags are adjusted due to placement on the pallet

D. Bags are not adjusted during filling process

12. Module 12: Closing and Sealing

This module asks about how the bulk bags are closed and sealed after filling. This module should be completed for each bulk bag closing/sealing station. This module requires a tape measure. This module should be completed for each bulk bag closing and sealing station.

12.0. Input a name for the bulk bag closing/sealing station you are currently evaluating: _____

12.1. What is the highest position of the hands as the bags are closed/sealed (measured from the surface the worker is standing on to the highest position of the middle knuckle during closing/sealing)? Fill in the blank: **Height: _____ in**

- If 42 in ≤ height ≤ 57 in and answered yes to 1.2.1: proceed to next question 12.2
- If height < 42 in or height > 57 in and answered yes to 1.2.1: proceed to next question
- If 42 in ≤ height ≤ 57 in and answered no to 1.2.1: proceed to question 12.3
- If height < 42 in or height > 57 in and answered no to 1.2.1: proceed to question 12.3

12.2. Does the worker close the liner separately from closing the outer bag? **Yes / No**

12.3. Which of the following closure techniques is used for the bag and/or liner (Figure 27)? Choose all that apply:

A. Snaking (the bag/liner is gathered, twisted, and sealed)
B. Flowering (the bag/liner is gathered in the center and sealed)
C. Other

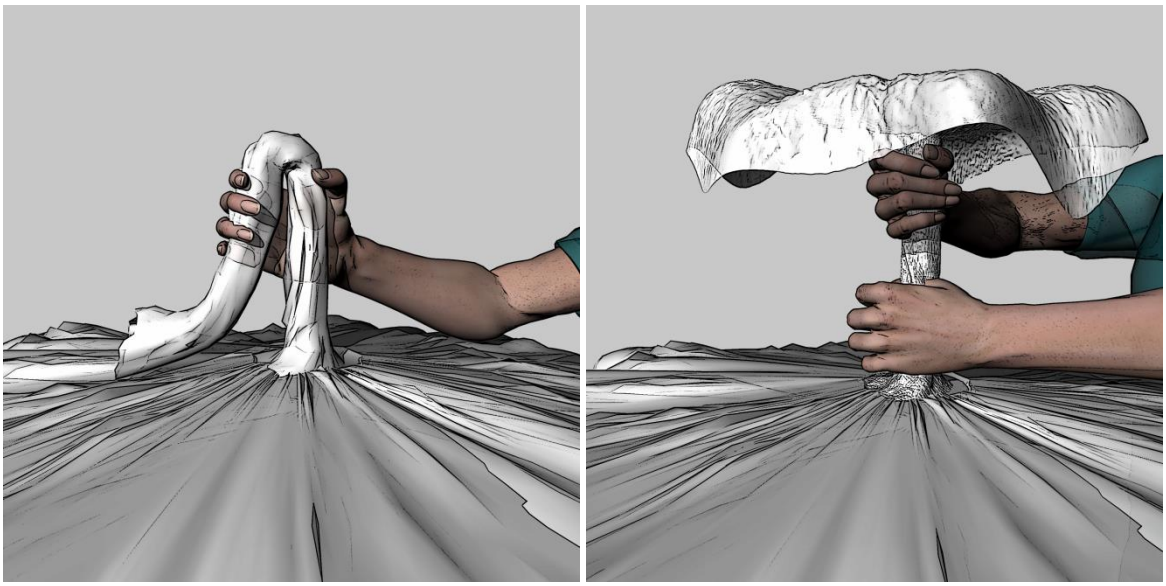

Figure 27. Snaking the liner of a bag (left) and flowering the liner of a bag (right).

12.4. How is the bag and/or liner sealed (e.g., Figure 28)?
Choose all that apply:

- **A. Manual cable or wire ties**
- **B. Cable tie gun**
- **C. Pneumatic cable tie gun**
- **D. Wire tie twist tool**
- **E. Cord or B-lock**
- **F. Drawstring or string**
- **G. Other**
- **H. Not sealed**

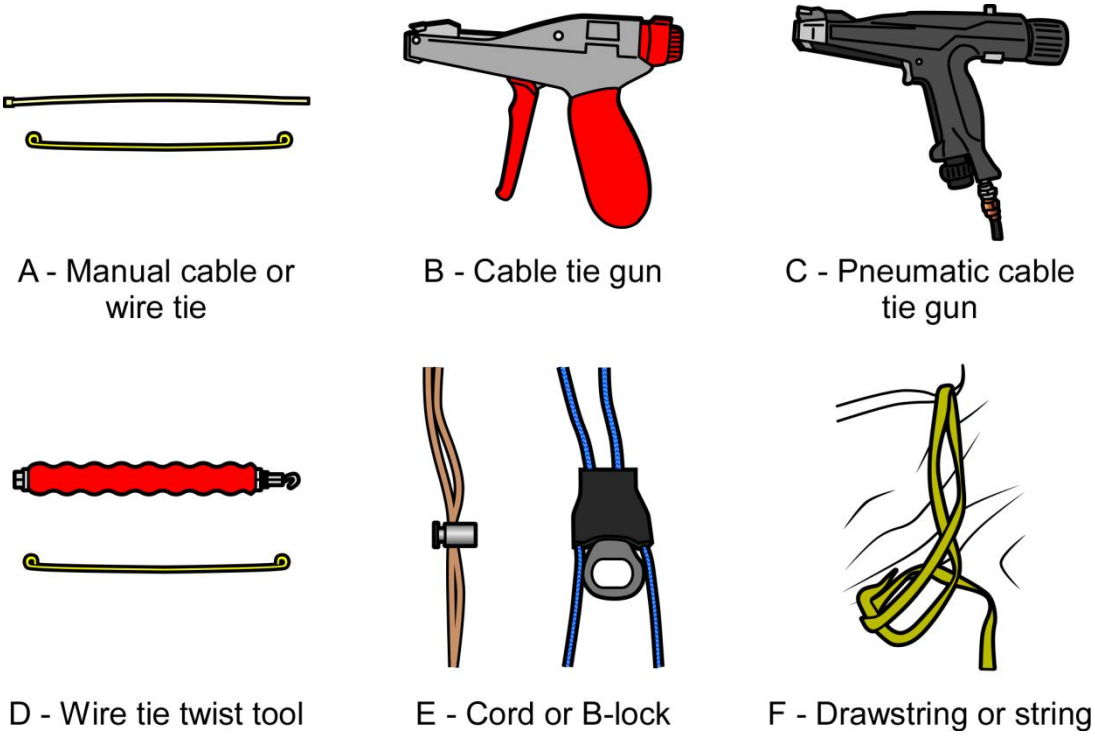

Figure 28. Methods of sealing bulk bags.

IV. Small and Bulk Bags Module

The following module is applicable to small and bulk bagging wrapping stations.

13. Module 13: Stretch and Shrink Wrapping

This module asks questions about procedures and tools for stretch- or shrink-wrapping pallets. This module should be completed for each wrapping station. This module should be completed for each bulk bag wrapping station.

13.0. Input a name for the wrapping station you are currently evaluating: _____

13.1. Do you stretch wrap or shrink wrap pallets?
Choose all that apply:

A. Stretch wrap

B. Shrink wrap

- If A, proceed to next question
- If B, proceed to question 13.3

13.2. Which most closely resembles the tool used for stretch wrapping (Figure 29)?

A. Stretch wrap held by hand
B. Stretch wrap held by end caps (hand savers)
C. Extended core
D. Mechanical brake (j-tool)
E. Pole wrapper
F. Portable stretch wrapper

- If you did not answer B to 13.1, end bagging audit
- If you did answer B to 13.1: proceed to question 13.3

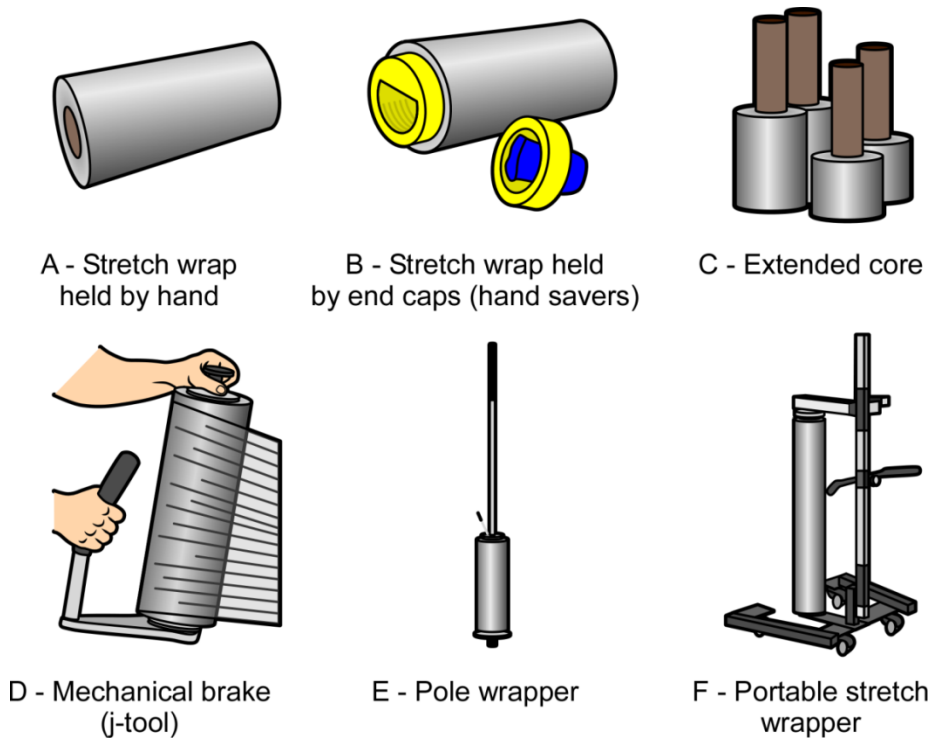

Figure 29. Tools used for stretch wrapping.

13.3. Are awkward arm or back postures used when applying shrink wrap (e.g., arms reaching up or to the side, back bending or twisting; e.g., Figure 30)? **Yes / No**

Figure 30. Awkward postures during shrink wrapping: workers' arms are reaching at or above shoulder (left), worker in back is bending and twisting back to the side (right).

13.4. What is the source of the heat used?

- **A. Gas/propane**
- **B. Electricity**

- If A, proceed to next question
- If B, end bagging audit

13.5. Does the worker ever move the gas tank?

- **A. Yes, worker carries gas tank**
- **B. Yes, worker uses rolling cart to move gas tank**
- **C. No**

13.6. Does the gas tank need to be moved while shrink wrapping a single pallet?

- **A. Yes, worker carries gas tank**
- **B. Yes, worker uses rolling cart to move gas tank**
- **C. No, gas tank has a long enough gas line to stay in one place**

Bagging Audit Recommendations

I. Facility Level Modules

Module 1: Bagging Operation Characteristics

- **(Bag Q 1.1.6 yes)** You indicated that bag failures occur. Bag failures increase waste and increase manual handling of bags, which can increase the risk of injuries. If the source of bag breakage cannot be identified, consider discussing bag breakage with your manufacturer to determine if any changes need to be made to the bag to reduce breakage.
- **(Bag Q 1.1.7 a)** You indicated that bag failures occur during filling. Bag failures may be caused by the product being dispensed too quickly, or by the filling valve coming into contact with the bag and breaking/tearing it. Adjust the dispensing speed and/or valve placement if this is the cause of your bag failures. If you are using perforated bags, consider instead using airflow extensible craft paper. This type of paper is porous and does not need perforations, which can reduce the strength of bags and increase the risk of bag breakage.
- **(Bag Q 1.1.7 b)** You indicated that bag failures occur during transportation along the conveyor. Identify and eliminate sharp edges or other areas that may be breaking or tearing bags.
- **(Bag Q 1.1.7 c)** You indicated that bag failures occur during weighing. Ideally, weighing should be incorporated into the filling station or conveyor (e.g., inline scale) to eliminate the need to manually handle the bags to weigh them. If this is not possible, ensure that bags are carefully transported onto the nearby scale (ideally the scale should be within a few steps) and that the scale has a smooth clean surface.
- **(Bag Q 1.1.7 d)** You indicated that bag failures occur during sealing. Bag failures may be occurring due to improper functioning of the sealing machine, which can be corrected with proper inspection and maintenance. If the sealing machine is working properly, ensure that workers are carefully prepping bags for the sealing machine, and that the conveyor belt has a smooth clean surface.
- **(Bag Q 1.1.7 e)** You indicated that bag failures occur during palletizing. Bag failures can be caused by nails or splinters on the pallet, which can be reduced by using a protective sheet (e.g., cardboard sheet) over the pallet before bags are loaded. Further, throwing or dropping bags onto pallets increases the potential for bag breakage. Palletizing at an optimal height (around 30 in from the floor) will reduce the need for throwing or dropping bags onto the pallet.
- **(Bag Q 1.1.7 f)** You indicated that bag failures occur during storage. Ensure that bags are stored separately from other work areas in a clean environment, that they are covered, and that they are not in the way of foot traffic or mobile equipment. In addition, ensure that stored bags are protected from water, as this can damage the structural integrity of the bags and lead to bag breakage, particularly for paper bags.
- **(Bag Q 1.2 no)** You indicated that bulk bags are not used in your facility. Ask your customers if they are amenable to receiving the product in bulk bags instead of small bags. Using bulk bags instead of small bags reduces manual handling of bags and can greatly reduce injury risk to bagging personnel.
- **(Bag Q 1.2.1 yes)** You indicated that liners are used inside bulk bags. Consider if liners are necessary or if a bag without a liner or a different bag material can be used to eliminate the need for a liner. Contact the bag manufacturer for more information on bag types and liner choices to determine if it would be appropriate to

package your material without a liner. If a liner is necessary, consider using a thinner liner and a spout or cone top bag (Figure 31); these bags have less material than a duffle/open top bag and may have reduced physical demands when closing the liner.

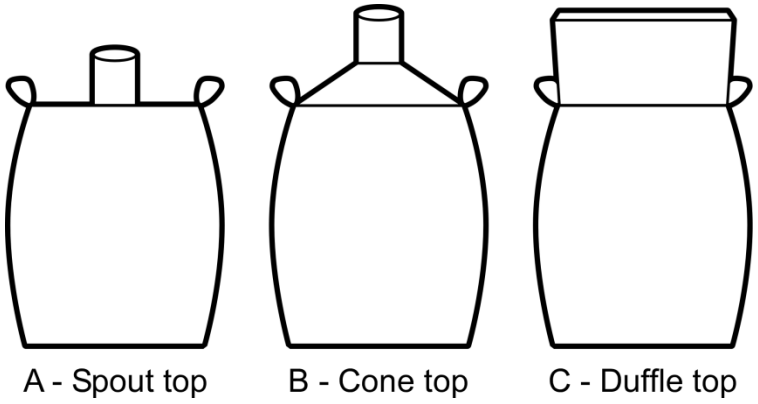

Figure 31. Types of bag tops.

- **(Bag Q 1.2.2 no or sometimes)** You indicated that the liner is not always attached to the bulk bag. Some attachment of the liner is preferable; an unattached liner can require awkward back and shoulder postures to spread the liner out in addition to spreading out the bag.
- **(Bag Q 1.2.3 b)** You indicated that you use a cone top bulk bag. Consider if the extra space at the top of a cone top is needed for even bag filling (Figure 32). If a cone top bag is not needed, consider using a spout top bag. Using a cone top bag increases the height of the top of the bag where it attaches to the filling spout. This increases the reach required by the arms, which can increase the risk of arm/shoulder injury.

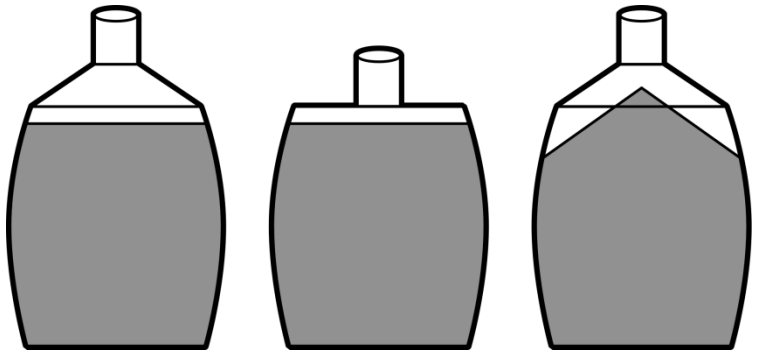

Figure 32. If the top of the product is flat during filling, the extra material at the top of the cone top bag is not filled and is unnecessary (left); product properly fills spout-top bag (center). A cone-top bag is only needed if the product piles in the center during filling (also referred to as having a high angle of repose, right).

- **(Bag Q 1.2.3 c)** You indicated that you use a duffle or open-top bulk bag. Consider using a spout or cone-top bag; these types of bags can be helpful in reducing dust exposure and may be easier to close. When choosing between a spout and cone-top bag, consider how the product piles when poured. A cone-top bag is only needed if the product piles in the center during filling (Figure 32). If the product stays flat on top during filling, a spout-top bag is appropriate.

- **(Bag Q 1.4 no)** You indicated that workers do not rotate between tasks (e.g., driving fork lift, palletizing, bagging). Rotating between tasks every few hours is recommended as it allows workers to reduce the duration of repetitive tasks. If it is not possible to rotate between tasks, consider having workers involved in palletizing rotate between sides of the pallet.

Module 2: Personal Protective Equipment

- **(Bag Q 2.1 yes)** You indicated that respirators are required for bagging activities. Whenever respirators are required, mines must establish a respirator program. For more information on controlling dust, see NIOSH's Dust Control Handbook (https://www.cdc.gov/niosh/mining/works/coversheet2094.html) and the National Industrial Sand Association's Occupational Health Program for Exposure to Crystalline Silica (https://www.sand.org/page/Silicosis_Prevention).

  Whenever respiratory protective equipment is used, a program for selection, maintenance, training, fitting, supervision, cleaning, and use shall meet the following minimum requirements:

  a. Only respirators approved by NIOSH under 42 CFR § 84 which are applicable and suitable for the purpose intended shall be furnished and used in accordance with training and instruction.

  b. The program shall be consistent with the requirements of ANSI Z88.2-1969, published by the American National Standards Institute and entitled "American National Standards Practices for Respiratory Protection ANSI Z88.2-1969." This publication may be obtained from the American National Standards Institute, http://www.ansi.org. It also may be examined in any Metal and Nonmetal Mine Safety and Health District Office of the Mine Safety and Health Administration. A brief outline of the ANSI standard is below.

  Respirator protection programs should be administered by an individual having sufficient knowledge of the subject to properly supervise the program. Standard operating procedures must be written and cover respirator selection and respirator use. Respirator protection programs should include:

  1. Employee training – must cover employees and supervisors
     a. Nature of hazard and why protection is needed
     b. Engineering controls
     c. Respirator selection use, capabilities, and limitations
  2. Fit Testing. Performed for each employee using a respirator. Should include a written record of:
     a. Name of employee tested
     b. Date of testing
     c. Respirator manufacturer, model, style, and size
     d. Fit test protocol and name of person administering test
     e. Fit test results
  3. Respirator cleaning and disinfecting
     a. Cleaning and disinfecting respirators on a regular basis or after each use if shared.
     b. Employees should get a new disposable respirator if theirs becomes unusable, unsanitary, or makes breathing difficult.
  4. Respirator Storage. Convenient, clean, and sanitary storage.
  5. Respirator Inspection. Respirators should be inspected before and after each use and during cleaning.
     a. No written record of inspections are needed.
     b. Any deficiencies found during inspections must be corrected.
  6. Surveillance. Work area must be checked to ensure respirator use, monitor conditions, and employee exposure.

7. Program evaluation. The respiratory protection program must be evaluated regularly.

The MSHA inspector will evaluate the effectiveness of the respiratory protection in order to determine whether miners are protected from overexposure. Respiratory protection programs are evaluated in terms of proper selection, fit testing, training, cleaning, sanitizing, and maintenance of respirators.

Be aware that wearing a respirator may increase the risk of heat strain and fatigue. Any mask reduces work capacity to some degree, and it is important to reduce the pace of work and increase rest breaks accordingly.

Care and Use:

- Respirators should be stored in a clean place where they will not be exposed to dust.
- Respirators should be inspected for cracks, tears, punctures, etc. before each use. Additionally, seal checks should be performed on respirators before each use. Supervisors should be notified and respirators replaced if the respirator does not seal properly.
- If your respirators use cartridges, make sure they are not expired and that they protect you for the correct environment you are entering.
- Respirators are to be cleaned and maintained according to manufacturer's instructions.
- Bandanas, kerchiefs, headbands, or any objects that interfere with the seal must be removed before wearing a respirator, and workers must be clean shaven where the respirator's facial seal contacts the worker's face

- **(Bag Q 2.1 no)** You indicated that respirators are not required for bagging activities. The 30 CFR § 56/57.5001(a) requires that a miner's exposure shall not exceed the permissible limit of any substance on the threshold limit value (TLV) list. When the TLV is exceeded, 30 CFR § 56/57.5005 mandates that operators install all feasible engineering controls to reduce a miner's exposure to the TLV. Respiratory protection is required when controls are not feasible, as well as when establishing controls, and during occasional entry into hazardous atmospheres to perform short-term maintenance or investigations.

  If workers furnish their own respirators, they need to take precautions to be sure that the respirator itself does not present a hazard. See list below for guidelines for care and use of respirators.

  Care and Use:

  - Respirators should be stored in a clean place where they will not be exposed to dust.
  - Respirators should be inspected for cracks, tears, punctures, etc. before each use. Additionally, seal checks should be performed on respirators before each use. Supervisors should be notified and respirators replaced if the respirator does not seal properly.
  - If your respirators use cartridges, make sure they are not expired and that they protect you for the correct environment you are entering.
  - Respirators are to be cleaned and maintained according to manufacturer's instructions.
  - Bandanas, kerchiefs, headbands, or any objects that interfere with the seal must be removed before wearing a respirator, and workers must be clean shaven where the respirator's facial seal contacts the worker's face.

For organizations covered by OSHA, OSHA provides the following information:

Information for Workers Using Respirators When Not Required Under the Standard (Taken from 29 CFR § 1910.134 Appendix D - (OSHA))

Workers should:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirator's limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. The National Institute for Occupational Safety and Health (NIOSH) of the U.S. Department of Health and Human Services certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.
3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.
4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.

- **(Bag Q 2.2 yes)** You indicated that gloves are worn on the jobsite. Gloves can be beneficial in protecting workers, but may not be appropriate for all bagging tasks. If the task requires a high amount of dexterity (e.g., sewing), consider not wearing gloves for that task. If gloves can be worn while performing the task, ensure that the gloves fit workers' hands snuggly. Gloves with a loose fit can reduce grip strength and dexterity and can increase the possibility of gloves getting caught in equipment (e.g., sealing mechanism). It is also important to consider the type of task when choosing glove material. For bag handling tasks, ensure that the glove material provides sufficient grip and protection from the material being bagged. If heat sealing is used, consider heat-resistant gloves for sealing tasks. Ensure that gloves are well-maintained and replaced when any physical damage is visible.
- **(Bag Q 2.2 no)** You indicated that gloves are not worn on the jobsite. Consider providing gloves for workers. Wearing gloves can reduce the possibility of acute hand injuries (e.g., cuts/scrapes), and can protect workers' hands from exposure to chemicals and the drying effects of handling paper bags. However, gloves may not be appropriate for all bagging tasks. If the task requires a high amount of dexterity (e.g., sewing), consider not wearing gloves for that task. If gloves can be worn while performing the task, ensure that the gloves fit workers' hands snuggly. Gloves with a loose fit can reduce grip strength and dexterity and can increase the possibility of gloves getting caught in equipment (e.g., sealing mechanism). It is also important to consider the type of task when choosing glove material. For bag handling tasks, ensure that the glove material provides sufficient friction and protection from the material being bagged. If heat sealing is used, consider heat-resistant gloves for sealing tasks. Ensure that gloves are well-maintained and replaced when any physical damage is visible.

Module 3: Work Posture

- **(Bag Q 3.1 a)** You indicated that standing is the posture used for the task. Prolonged standing requires more energy and muscular effort and can lead to back and knee pain. Allowing workers to change postures frequently, by providing a sit/stand workstation, lean stand, or adding foot rests (Figure 33), can help unload these joints and reduce the stresses associated with prolonged standing.

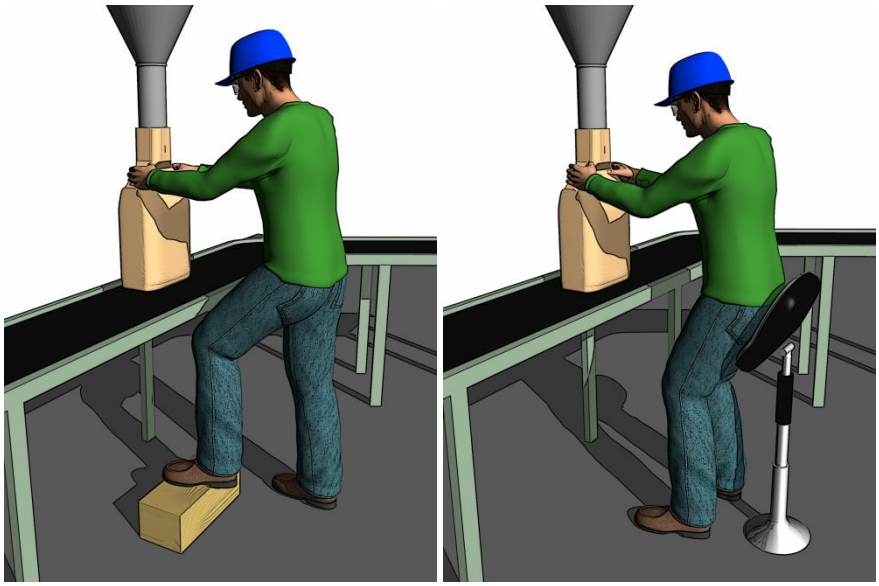

Figure 33. Possible solutions to prolonged standing postures: foot rest (left) and lean stand (right).

- **(Bag Q 3.1 b)** You indicated that sitting is the posture used for the task. Ideally sit/stand workstations should be used to allow workers to change postures frequently and reduce the stresses associated with prolonged sitting. Seated workstations constrain posture and do not allow for much movement, which contributes to injury risk. Further, seated workstations can require awkward arm and back postures to handle objects. To reduce these awkward postures, objects should be positioned so that workers can handle them at their side or to their front. Occasional reaches beyond this range are permissible but should be minimized.

- **(Bag Q 3.2 a)** You indicated that the worker is on a hard floor surface. If the worker is standing on a hard surface, a slip-resistant, anti-fatigue mat can be helpful in reducing stress on the body and increasing blood flow to the leg muscles, which can reduce fatigue. Be sure that mats are secured to the floor and do not create a tripping hazard. Also anti-fatigue insoles may provide additional comfort for workers and should be considered especially if the floor surface does not easily allow for securing a mat to the floor.

- **(Bag Q 3.2 b)** You indicated that the worker is on a cushioned floor surface. If a cushioned mat is used, be sure that it is secured to the floor and does not create a tripping hazard. Anti-fatigue insoles may provide additional comfort for workers and should be considered especially if the floor surface does not easily allow for securing the mat to the floor.

- **(Bag Q 3.2 c)** You indicated that the worker is on a mix of hard and cushioned floor surfaces. Consider adding slip-resistant, anti-fatigue mats to hard surfaces. Be sure that mats are secured to the floor and do not create a tripping hazard. Anti-fatigue insoles may provide additional comfort for workers and should be considered especially if the floor surface does not easily allow for securing a mat to the floor.

- **(Bag Q 3.3 a)** You indicated that the worker sits on a fixed seat for the task. Ideally, the seat should be sliding or swivel to reduce bending and reaching required by the worker. If a fixed seat is used, all objects handled should be directly in front or slightly to the side of the worker (e.g., Figure 34), and all controls should be located such that the worker does not have to bend or stretch to use controls.

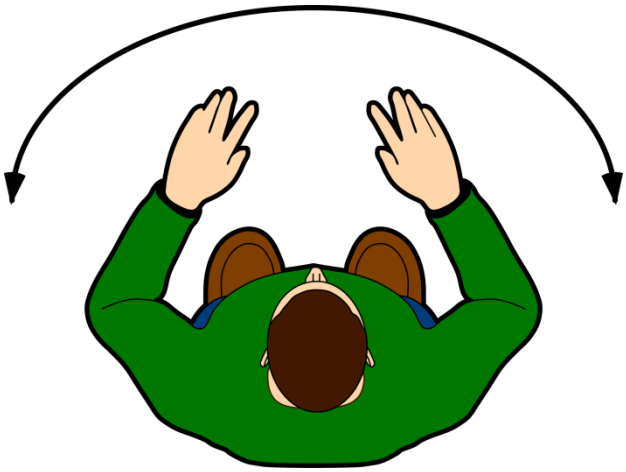

Figure 34. If a fixed seat is used, ensure that all objects handled frequently are within easy reach of the arms (within the area shown by the line).

- **(Bag Q 3.3 b)** You indicated that the worker sits on a sliding/swivel seat for the task. Ensure that the sliding/swiveling mechanism is maintained so that it doesn't require unnecessarily high effort to operate (e.g., forcefully pushing off to slide or heavy twisting to swivel).

- **(Bag Q 3.4 no)** You indicated that the worker is not able to rest their feet comfortably with near 90˚ angles at the hips and knees. Ensure that workers' chairs are at a height that allows for approximately 90˚ angles at the hips and backs of the knees (Figure 35) and that feet are supported comfortably; consider using an adjustable footrest if needed. Seats should have height adjustability so that each worker can modify the seat to assume the correct posture while sitting. If feet do not comfortably reach the floor, blood circulation and nerve sensations may be reduced resulting in numbness or pain (Figure 36 left). If necessary, provide a foot support (bar, platform, or footstool). Further, if the workers' seat is too close to the floor, excessive strain can be placed on the knees and hips (Figure 36 right).

Figure 35. Worker is sitting with the hips and knees at the same level. Both the hips and knees are at approximately 90˚ angles and the feet are supported.

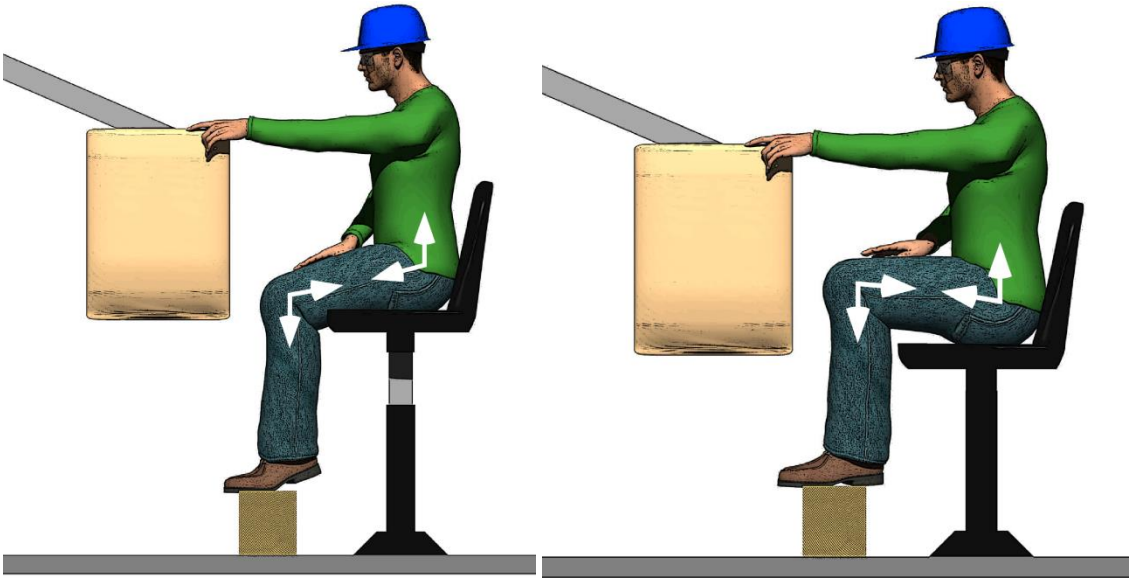

Figure 36. Worker is sitting too far from the foot support, resulting in the knee being below the hip and greater than 90˚ angles at the hips and knees (left); worker is sitting too close to the foot support, resulting in the knees being above the hips and less than 90˚ angles at the hips and knees (right).

- **(Bag Q 3.5 b)** You indicated that the seat condition is fair/poor. Consider replacing or repairing the seat or seat cover. A seat in poor condition may no longer provide proper body support and can lead to discomfort.

Module 4: Work Environment

- **(Bag Q 4.1 yes)** You indicated that work is performed outdoors during the summer months. During summer months, the risk of heat stress and heat exhaustion can be higher than the risk during the rest of the year. Heat stress and heat exhaustion can be hard to detect and are often detected too late. Prevention is essential to ensure workers remain healthy while working in high heat. MSHA provides seven key recommendations for preventing heat stress in workers.

    1. Arrange for miners who are to be exposed to heat stress to have a medical examination by a physician prior to assignment. Be sure that the physician is informed of the heat exposure so as to make the proper evaluation.
    2. Allow new workers in heat exposure a period of 5 to 6 workdays to become acclimatized by gradually increasing workload and exposure time during this period. Start by allowing new workers to work only 50% of regular work time in the heat. Check at the end of the 6-workday period to see how they are doing.
    3. Schedule rest periods during the work shift as necessary to avoid severe strain among acclimatized workers. Schedule the heaviest work, particularly manual labor, for the cooler parts of the shift if possible.
    4. Ensure that workers wear lightweight, loose-fitting clothing for protection against the sun and to allow for air circulation, and a hard hat with sun protection (e.g., consider a hard hat with a longer brim to offer more sun protection).
    5. Consider using air-conditioning inside the cabs of heavy equipment and ventilating and circulating fans, where appropriate. Provide shelters for protection against the sun during rest periods.
    6. Supply adequate quantities of drinking water, cooled if possible, and salt tablets to workers for their use as desired. Providing salt can help ensure workers maintain appropriate balance of electrolytes.
    7. Plan in advance to ensure that first-aid treatment for heat ailments is available, as well as transportation for medical treatment, if necessary. Workers should be allowed frequent rest breaks to remove them from the heat and rehydrate. Air-conditioned recovery areas are recommended. However, when this isn't feasible, a shaded area with airflow may be used. Hydration and rest are needed more frequently when working in high heat

- **(Bag Q 4.3 no)** You indicated that workers are not provided portable heat sources. Provide heat sources for employees. Adding additional layers of clothing may help to retain body heat but is likely to reduce flexibility and range of motion; therefore, providing heat sources is the most appropriate solution.

- **(Bag Q 4.4 Air temperature < -1)** You indicated an air temperature below the acceptable range. Provide heating sources for employees. Adding additional layers of clothing may help to retain body heat but is likely to reduce flexibility and range of motion; therefore, providing heat sources is the most appropriate solution.

- **(Bag Q 4.4 Air temperature > 1)** You indicated an air temperature above the acceptable range. Heat stress and heat exhaustion can be hard to detect and are often detected too late. Prevention is essential to ensure workers remain healthy while working in high heat. MSHA provides seven key recommendations for preventing heat stress in workers.

    1. Arrange for miners who are to be exposed to heat stress to have a medical examination by a physician prior to assignment. Be sure that the physician is informed of the heat exposure so as to make the proper evaluation.
    2. Allow new workers in heat exposure a period of 5 to 6 workdays to become acclimatized by gradually increasing workload and exposure time during this period. Start by allowing new workers to work only 50% of regular work time in the heat. Check at the end of the 6-workday period to see how they are doing.
    3. Schedule rest periods during the work shift as necessary to avoid severe strain among acclimatized workers. Schedule the heaviest work, particularly manual labor, for the cooler parts of the shift if possible.
    4. Ensure that workers wear lightweight, loose-fitting clothing for protection against the sun and to allow for air circulation, and a hard hat with sun protection (e.g., consider a hard hat with a longer brim to offer more sun protection).
    5. Consider using air-conditioning inside the cabs of heavy equipment and ventilating and circulating fans, where appropriate. Provide shelters for protection against the sun during rest periods.
    6. Supply adequate quantities of drinking water, cooled if possible, and salt tablets to workers for their use as desired. Providing salt can help ensure workers maintain appropriate balance of electrolytes.
    7. Plan in advance to ensure that first-aid treatment for heat ailments is available, as well as transportation for medical treatment, if necessary. Workers should be allowed frequent rest breaks to remove them from the heat and rehydrate. Air-conditioned recovery areas are recommended. However, when this isn't feasible, a shaded area with airflow may be used. Hydration and rest are needed more frequently when working in high heat.

- **(Bag Q 4.4 Humidity = - 1)** You indicated humidity levels below the acceptable range. Low humidity allows the body to cool through sweating but may have drying effects on the skin and eyes which can cause discomfort. Air mists can be provided to add some moisture to the air, making it more comfortable for workers in hot, dry areas. Not only will the air mists increase the humidity in the air, but they will also provide a cooling effect by cooling the air in the working area.

- **(Bag Q 4.4 Humidity > 1)** You indicated humidity above the acceptable range. In addition to high air temperatures, outdoor workers are exposed to radiant heat from the sun, and sometimes high humidity as well. High humidity reduces heat loss from the body by evaporation of perspiration (sweat), the main avenue of heat loss in hot environments. In general, increased air velocity or movement increases the cooling effects of sweating. When reducing the humidity isn't possible, increasing the air velocity through fans may improve cooling of the body when air temperatures are less than 93° F.

- **(Bag Q 4.4 Thermal radiation > 1)** You indicated thermal radiation above the acceptable range. Provide a means to deflect radiation heat, such as sunlight or artificial light sources, away from workers through reflective shades or screens. Whenever possible, move work to a shaded area. Work scheduling may also need to be adjusted to ensure workers are not working in areas with high sun exposures during peak times (e.g., midday). This work should be scheduled earlier in the morning or later in the evening.

- **(Bag Q 4.4 Air movements < -1)** You indicated cold air movement above the acceptable range. Provide a means to reduce these cold air current through deflection. Add tarps over working areas when needed and provide a means to heat the area. Wind chill can affect the health and safety of workers even at temperatures above freezing and should be mitigated through heat sources and wind protection. MSHA provided the following chart with recommendations regarding cold weather working conditions (Table 2).

Table 2. Wind Chill Factor Chart

Wind Chill Factor Chart

Wind Speed (mph)	Actual Temperature Reading (°F)									
	50 °F	40 °F	30 °F	20 °F	10 °F	0 °F	-10 °F	-20 °F	-30 °F	-40 °F
Calm	50	40	30	20	10	0	-10	-20	-30	-40
5	48	37	27	16	6	-5	-15	-26	-36	-47
10	40	28	16	4	-9	-21	-33	-46	-58	-70
15	36	22	9	-5	-18	-36	-45	-58	-72	-85
20	32	18	4	-10	-25	-39	-53	-67	-82	-96
25	30	16	0	-15	-29	-44	-59	-74	-88	-104
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113
40	26	10	-6	-21	-37	-53	-97	-85	-100	-116
	NO WORKER RESTRICTIONS Little Potential Danger (for properly clothed person)				RESTRICTED WORK Increased Potential Danger (Danger from freezing of exposed flesh)			RESTRICTED WORK Great Potential Danger		

NOTE: Wind speed above 40 mph has little effect

- **(Bag Q 4.4 Air movements > 1)** You indicated hot air movement above the acceptable range. Provide a means to reduce these hot air currents through deflection. Add tarps over working areas when needed and provide a means to cool the area.

- **(Bag Q 4.4 Physical work load > 1)** You indicated physical work load above the acceptable range for employee's thermal comfort. In these working conditions fatigue may occur quickly. Environmental factors should be modified to be within a comfortable range to ensure worker health and safety at this level of physical exertion. Thermal Working Conditions scores should be between -1 and +1 for air temperature, humidity, thermal radiation, air movements, clothing, and opinions of workers.

- **(Bag Q 4.4 Clothing > 1)** You indicated a clothing score above the acceptable range. Many jobs require specialized clothing to protect workers from their hazards. However, specialized clothing can also become hazardous when it doesn't allow for natural cooling through the evaporation of sweat, is bulky and limits flexibility, or has an overall ill fit. Selection of suitable, moisture wicking, and properly sized clothing is essential to ensure proper functionality of specialized clothing and to reduce the risks of the clothing becoming its own hazard.
- **(Bag Q 4.4 Worker opinion < -1)** You indicated that workers feel the environment is too cold. Care should be taken to ensure that workers are provided necessary heating sources, protection from wind chill, and suitable cold weather clothing. Thermal Working Conditions scores should be between -1 and +1 for air temperature, humidity, thermal radiation, and air movements.
- **(Bag Q 4.4 Worker opinion > 1)** You indicated that workers feel the environment is too hot. Care should be taken to ensure that workers are provided necessary cooling sources, hydration, reduction in sun exposure, and rest breaks. Also, clothing should be suitable for working in hot environments. Thermal Working Conditions scores should be between -1 and +1 for air temperature, humidity, thermal radiation, and air movements.

Module 5: Lighting

- **(Bag Q 5.1 no)** You indicated that not all light sources are working. Properly illuminating work and travel areas is important to ensure worker safety. Replace all nonworking light sources as soon as possible.
- **(Bag Q 5.2 no)** You indicated that LEDs are not used for overhead lighting everywhere. Using cool-white LEDs can reduce glare for older workers in low-light conditions. Additionally, due to their long-life and associated decrease in maintenance requirements, using LEDs can reduce the potential for maintenance-related accidents that result from replacing spent bulbs/lamps in lighting systems.
- **(Bag Q 5.4 yes)** You indicated that flicker exists. Exposure to flicker can contribute to worker discomfort, headaches, and impaired visual performance. To ensure that lighting does not impair worker safety or health, replace the flickering bulbs or repair the light fixture to eliminate the flicker.
- **(Bag Q 5.5 no)** You indicated that light fixtures are not clean. Bulbs should be cleaned regularly so that they output the full amount of light and should be inspected regularly to ensure that they are staying clean.
- **(Bag Q 5.6 no)** You indicated light sources are not provided with shades or glare shields. Glare can impair vision and cause discomfort for workers, which can reduce task performance and safety. All light sources should have shades or glare shields to protect workers.
- **(Bag Q 5.7 no)** You indicated that additional lighting is not provided in areas with high spillage or near equipment. To improve hazard identification and detection, increase the light levels near walking areas and equipment, especially where there is a high chance of debris and contaminants accumulating. A minimum of 20 lux is recommended. Light meters can be purchased to measure lux levels. When adding lighting, ensure that it does not create glare for workers (e.g., do not aim light directly in workers' line of sight, use a glare shield).
- **(Bag Q 5.8 no)** You indicated that additional lighting is not provided around entrances/exits. It is important to consider the transition of light levels, especially in entrances to enclosed spaces from outside. A slow transition in lighting levels should be provided, allowing eyes to adapt to the changing light levels and reducing negative impacts on vision (e.g., sunlight from outdoors is likely much brighter than indoor light levels; providing extra lighting in the entrances/exits can reduce transition effects from going from brighter into darker areas). When adding lighting, ensure that it does not create glare for workers (e.g., do not aim light directly in workers' line of sight, use a glare shield).
- **(Bag Q 5.9 a)** You indicated that the provided light is insufficient and workers would choose to increase the amount of lighting. Evaluate the work environment and consult workers to determine specific areas that are in need of additional lighting. When adding lighting, ensure that it does not create glare for workers (e.g., do not aim light directly in workers' line of sight, use a glare shield). If portable lighting is added, ensure that it does not interfere with task performance or safety (e.g., if the worker needs both hands for the task, provide portable lighting that does not need to be held).
- **(Bag Q 5.9 b)** You indicated that the provided light is more than sufficient and that workers would choose to decrease the amount of lighting. Evaluate the work environment and consult workers to determine specific areas that need decreased lighting. When removing lighting, ensure that the remaining light sources evenly illuminate the work environment (e.g., ensure that shadows are not created). Ensure that the placement of

the light sources is not the cause of the lighting problem. Lighting should not be mounted at eye level or in the workers direct line of sight.

- **(Bag Q 5.10 yes)** You indicated workers report that shadows or glare are present that interfere with task performance or safety. Evaluate the work environment and consult workers to determine specific areas that have shadows or glare. Where shadows are present, consider re-directing current light sources to more evenly illuminate the area, or consider adding additional light sources to cover areas that are shadowed. Where glare is present, consider redirecting the light sources to eliminate the glare (e.g., ensure that light sources are not in the line of sight of workers) and ensure that all lights have shades or glare shields.
- **(Bag Q 5.11 yes)** You indicated that workers look from bright to dark places routinely. Transitioning from bright to dark lighting can impair vision, and therefore can reduce task performance and safety. Ensure that lighting within a work area is consistent, and that no glare or shadows are being created from current light sources. Consider adding or removing additional lighting, such as adding or removing task lighting (e.g., mounted lights near the task, head lamps) to make light levels more consistent.
- **(Bag Q 5.13 yes)** You indicated that hand-held lighting sources need to be held while walking or while holding other objects. Holding a light source while walking or holding other objects can decrease safety by increasing the risk of falling (e.g., worker might not be able to maintain three points of contact on stairs) or dropping objects. Wherever possible, provide sufficient ambient lighting so that portable lighting is not needed. If it is not possible to increase the ambient lighting, consider using head lamps instead of hand-held lighting. Ensure that additional light sources do not create shadows or glare (e.g., do not aim light directly in workers' line of sight, use a glare shield).
- **(Bag Q 5.14 yes)** You indicated that workers experience difficulties handling portable light sources due to the size or weight of lighting equipment. Wherever possible, provide sufficient ambient lighting that portable lighting is not needed. If it is not possible to increase ambient lighting and the worker primarily works in one area, consider providing floor lamps or the means to suspend light sources (e.g., hook or strap suspended from ceiling or attached to wall, magnetic attachments to attach lights to equipment). If the worker travels between areas frequently, consider providing lightweight headlamps. This will decrease the amount of manual handling needed to use light sources. Ensure that additional light sources do not create shadows or glare (e.g., Do not aim light directly in workers' line of sight, use a glare shield).

Module 6: Mobile Equipment

- **(Bag Q 6.1 yes)** You indicated that mobile equipment is used indoors in areas with foot traffic. Ensure proper visibility is given in these areas. Add domed mirrors around corners to ensure the workers can see mobile equipment traffic. Also, implement a process for providing other signals for mobile equipment in areas with corners and passageways (e.g., add a colored flashing light to mobile equipment in areas with high noise levels or where employees frequently wear hearing protection, honk horn when approaching corners and passageways in areas with low noise). If possible, paint mobile equipment travel lanes on the floor.
- **(Bag Q 6.2 no)** You indicated that propane cylinders are not properly secured and stored and mobile equipment not recharged in well-ventilated areas. Ensure that adequate ventilation is provided, especially in areas where there are risks for air contamination with hazardous vapors and gases.
- **(Bag Q 6.3 b or c)** You indicated that pre-shift inspection reports are not reviewed by someone other than the operator before the mobile equipment is put into operation each shift. Pre-shift inspection reports with any issues of concern should always be reviewed by a shift foreman, a designated management official, or a mechanic prior to the mobile equipment being placed into operation each shift.
- **(Bag Q 6.4 no)** You indicated that the mobile equipment driver does not have the option to not drive the equipment due to a safety concern which did not cause it to be out of service. All drivers should be given the option to not drive mobile equipment if they have concerns that it is unsafe.
- **(Bag Q 6.5 yes)** You indicated that someone other than a mechanic has the authority to put mobile equipment back into service. A mechanic should examine the mobile equipment to ensure all safety concerns raised by the driver on the pre-shift inspection report have been satisfactorily resolved and inform the shift foreman, maintenance supervisor, or designated management official who is responsible for returning the mobile equipment back into service. The authority to put mobile equipment back into service should only be held by the knowledgeable person responsible for making repairs to the mobile equipment.
- **(Bag Q 6.6 no)** You indicated that operators are not required to set the parking brake when parking. Operators must set the vehicle to the park position and use parking brakes, if provided, whenever parking per MSHA regulations (30 CFR § 56.14207). Moreover, equipment should be physically immobilized when not in use.
- **(Bag Q 6.7 no)** You indicated operators do not always physically immobilize mobile equipment when parking. Operators should physically immobilize equipment, such as by using wheel chocks, every time a vehicle is parked. Even in situations of little to no grade, mobile equipment can unexpectedly move and cause injuries. When using wheel chocks on level ground, use at least one pair of chocks on one wheel (Figure 37). When using wheel chocks on a grade, ensure that at least one chock is used below the center of gravity of the vehicle on the downhill side of two separate wheels.

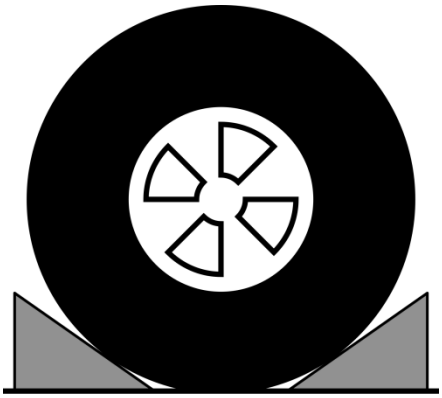

Figure 37. Correct placement of a pair of wheel chocks for level ground.

II. Small Bag Modules

Module 7: Filling

- **(Bag Q 7.1 part 1 is a and part 2 is d or f)** You indicated that bags are stored behind workers and are at an unacceptable height. Bags should be stored in front of or to the side of the worker and should be around workers' elbow height (e.g., Figure 38). Picking up a bag should not require twisting or bending of the back, and the arms should not have to fully extend or reach behind the body or above chest height (e.g., Figure 39). These postures can lead to increased risk of injury for the arms, shoulders, and back.

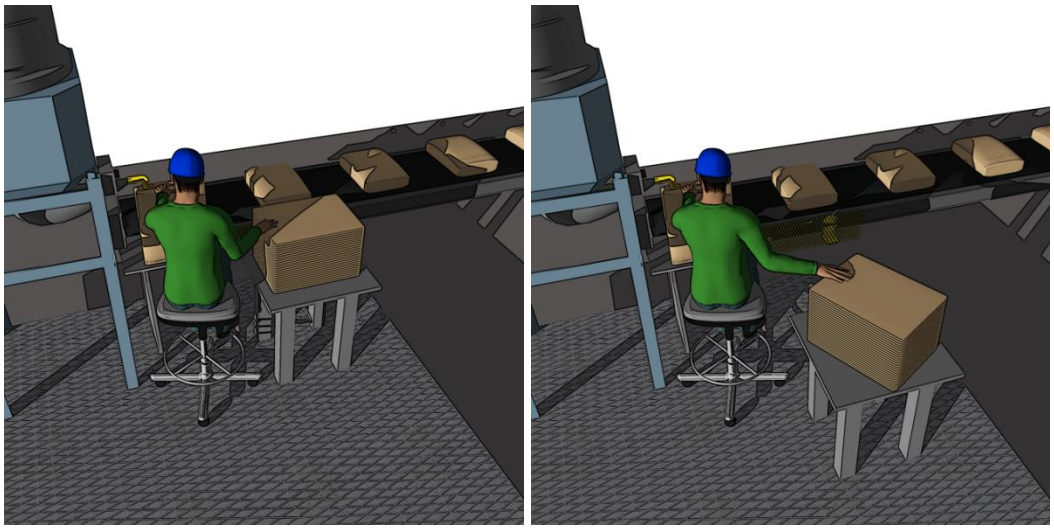

Figure 38. Bags are placed around elbow height and to the side of and close to the worker. Ideal bag placement is shown on the left, where the bag is close to the worker's side and slightly in front of the worker. This posture allows the worker to pick up bags without twisting/bending the back, or fully extending the arms. The placement shown on the right is not ideal; the worker is reaching slightly behind and must almost fully extend arm to reach the stack of bags.

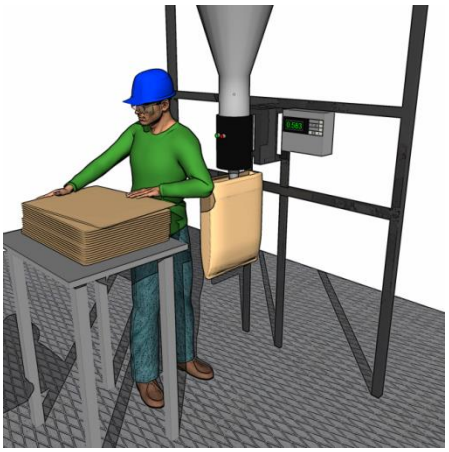

Figure 39. Bag placement behind the worker requires the worker to twist and reach behind to pick up empty bags

- **(Bag Q 7.2 yes)** You indicated that there are obstructions that influence posture. Obstructions such as handrails, pallets, and supplies can force workers to adopt awkward postures, including reaching with the arms and bending with the back (Figure 40). Obstructions should be moved or modified in order to minimize awkward postures.

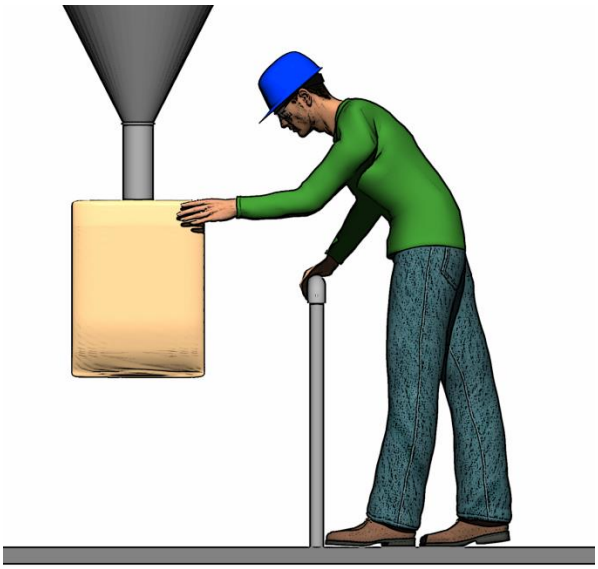

Figure 40. The guardrail is an obstruction. The worker must lean forward to place the bag on the spout. If the standing surface were closer to the spout, the worker may not need to bend over as far, and the guardrail could be modified to prevent the worker from falling onto the conveyor.

- **(Bag Q 7.3 b)** You indicated that bags are manually held by the worker during filling. Ideally, the worker should not need to support the bags during filling; consider installing a platform underneath the filling station or provide other means to support the weight of the bag during filling. This will reduce required muscular effort by the worker and reduce the risk of injury.

- **(Bag Q 7.4 a)** You indicated that the filling machine is activated by a hand button or switch. Ideally, the filling station should be automated so that the filling automatically starts when a bag is placed on the spout (e.g., adding a small switch or sensor to the spout that is activated when the bag is placed on the spout). If this is not possible, consider using a footswitch. Workers who repeatedly press a button/switch to fill each bag may develop musculoskeletal disorders. Further, placement of the button may require awkward bending of the back and/or reaching of the arms that can increase risk of injury (Figure 41).

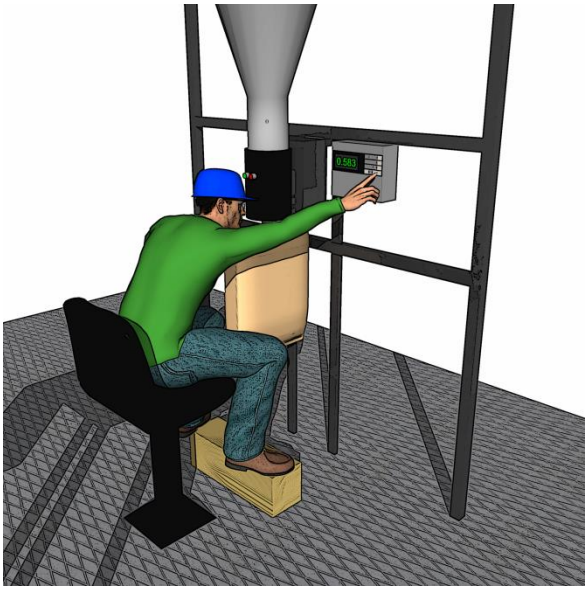

Figure 41. Location of controls requires worker to lean forward and reach with the arms, increasing injury risk for both the back and arms.

- **(Bag Q 7.4 b)** You indicated that the filling machine is activated by a footswitch or pedal. Ideally, the filling station should be automated so that the filling automatically starts when a bag is placed on the spout (e.g., adding a small switch or sensor to the spout that is activated when the bag is placed on the spout). Automatically starting the filling process will eliminate exposure to risk factors associated with manually pressing the footswitch/pedal.

- **(Bag Q 7.5 b)** You indicated that a pinch or wide finger grip occurs during filling. Prolonged use of these postures can cause inflammation and pain in the hands/fingers. Ideally the filling process should be automated to eliminate the need for manual handling of bags. If this is not possible, encourage workers to hold the bags with a neutral hand posture (straight wrist) or use a tool that requires a power grip.

- **(Bag Q 7.6 b)** You indicated that wrist bending or deviating occurs during filling. Prolonged wrist bending and deviation can cause inflammation and pain in the wrist and may lead to repetitive trauma disorders such as carpal tunnel syndrome or tendonitis. Ideally, the filling process should be automated to eliminate the need for manual sealing of bags. If this is not possible, encourage workers to maintain a neutral (straight) wrist whenever possible.

Module 8: Weighing

- **(Bag Q 8.1 height ≠ 30)** You indicated that the hands are not at an ideal height when placing bags on or lifting bags off scale. Ideally, weighing should be incorporated into the filling station or conveyor (e.g., inline scale) to eliminate the need to manually handle the bags to weigh them. Reducing manual handling of bags will reduce the risk of injury for the back and arms. If this is not possible, ensure that the scale is located close to the work area (within a few steps) and that the middle knuckle is around 30 in from the ground when placing bags on scale and lifting bags off of scale; scale placement above or below this height can result in awkward arm and back postures to move the bag (e.g., Figure 42, left). A possible solution for low scales is to add a table to raise the height of the scale (Figure 42, right). The same solution can be used for scales placed on tables or high surfaces that require lifting to heights above 30 in. Place the scale on the ground and use a table to permit the hands to be around 30 in from the ground while placing bags on the scale.

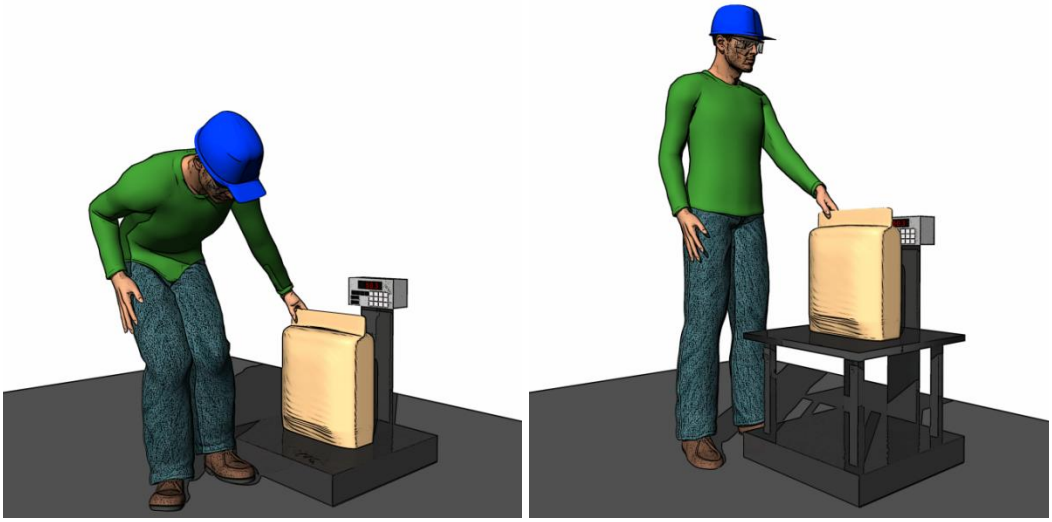

Figure 42. Scale placement on the ground requires worker to bend to pick up the bag from the scale (left). A table has been added on the scale to improve height and reduce bending required by workers (right).

- **(Bag Q 8.2 a)** You indicated that product is added or taken out of bag if the weight is not within tolerance. Small narrow shovels or trowels are useful for adding or removing product from bags through the spout openings. If bags have to be manually adjusted frequently, you may want to evaluate the filling station for recalibration.

- **(Bag Q 8.2 b)** You indicated that the bag and product are discarded or recycled if the weight is not within tolerance. Consider weighing the bag before sealing to enable adjusting the bag weight and avoid discarding bags. This can reduce waste of product and can reduce manual handling of rejected bags. If inline weighing is used, under or over weight should be diverted onto another conveyor line in order to reduce unnecessary handling of bags. If rejected bags need to be discarded, ensure that the dumpster (or other trash depository) is nearby and that the top of the dumpster is no higher than 70 in. Lifting bags above 70 in can increase the risk of worker injury.

- **(Bag Q 8.2 c)** You indicated that no change is made to filled bags if the weight is not within tolerance. Consider weighing the bags before sealing if this occurs frequently. This can prevent manual handling of unnecessarily heavy bags.

Module 9: Sealing

- **(Bag Q 9.1 a)** You indicated that bags are sealed using a manual process. Consider using self-sealing bags or sealing the bags through semi-automatic sewing or heat sealing. This will reduce repetitive motions during manual sealing.
- **(Bag Q 9.1 b)** You indicated that bags are sealed using a semi-automatic process. Consider automating the process to feed the bags through the sealing machine (e.g., a system that closes the bag and feeds it through a sealing device). If a hand-held tool is used to seal the bags, the tool should be supported from beneath, suspended from above, or mounted to support its weight while in use and eliminate the need for repetitive lifting. Ensure that the tool is stored around 30 in from the floor to eliminate unnecessary bending to access the tool, and that it is counterbalanced.
- **(Bag Q 9.2 part 1 is a and part 2 height ≠ 42 OR part 1 is b and part 2 height ≠ 9)** You indicated that sealing is performed at a non-ideal height. To reduce the risk of injury, sealing should be performed at approximately elbow height (around 42 in above the ground when standing or 9 in above the seat of the chair when sitting).
- **(Bag Q 9.3 yes)** You indicated that the worker supports the weight of the bag during sealing. Supporting the bag can cause excessive strain on the hands and arms. Install a platform for the bags to rest on during the sealing process or allow the sealing mechanism to move to the height of the supported bag.
- **(Bag Q 9.4 b)** You indicated that a pinch or wide finger grip occurs during sealing. Prolonged use of these postures can cause inflammation and pain in the hands/fingers. Ideally, the sealing process should be automated to eliminate the need for manual handling of bags. If this is not possible, encourage workers to hold the bags with a neutral hand posture (straight wrist) or use a tool that requires a power grip.
- **(Bag Q 9.5 b)** You indicated that wrist bending or deviating occurs during sealing. Prolonged wrist bending and deviation can cause inflammation and pain in the wrist and may lead to repetitive trauma disorders such as carpal tunnel syndrome or tendonitis. Ideally, the sealing process should be automated to eliminate the need for manual sealing of bags. If this is not possible, encourage workers to maintain a neutral (straight) wrist whenever possible.

Module 10: Palletizing

- **(Bag Q 10.1 part 1 is a and part 2 lowest < 30 or highest > 50)** You indicated that bags are stacked onto a single pallet at an unacceptable height. All lifting should be done between 10 and 50 in, and as close to 30 in as possible (30 in can be used when adjusting work to individual knuckle height is not possible). According to the revised NIOSH lifting equation, lifting capacity is highest at 30 in and decreases above and below this point; no lifting should be done above 70 in. For most people, lifting above or below 30 in can require back bending of more than 20 degrees and reaching with the arms above shoulder height, which increases risk of injury (Figure 43). The use of a lift table is recommended for palletizing tasks to keep the destination of the lifts as close to 30 in (near knuckle height) as possible. The lift table should be turnable, which will enable workers to reach all sides of the pallet without awkward reaching across the pallet, and self-leveling, which will eliminate the need to manually adjust the height of the lift table. If a lift table cannot be purchased, consider stacking several pallets on the floor to raise the height of the pallet being loaded. See Figure 44 and Figure 45 for a recommended method for using stacked pallets.

- **(Bag Q 10.1 part 1 is b and part 2 lowest < 30 or highest > 50)** You indicated that bags are stacked on a raised surface at an unacceptable height. All lifting should be done between 10 and 50 in, and as close to 30 in (near knuckle height) a possible. According to the revised NIOSH lifting equation, lifting capacity is highest at 30 in and decreases above and below this point; no lifting should be done above 70 in. For most people, lifting above or below 30 in can require back bending of more than 20 degrees and reaching with the arms above shoulder height, which increases risk of injury (Figure 43). The use of a lift table is recommended for palletizing tasks to keep the destination of the lifts as close to 30 in as possible. The lift table should be turnable, which will enable workers to reach all sides of the pallet without awkward reaching across the pallet, and self-leveling, which will eliminate the need to manually adjust the height of the lift table. If a lift table cannot be purchased, consider stacking several pallets on the floor to raise the height of the pallet being loaded. See Figure 44, Figure 45, and Figure 46 for a recommended method for using stacked pallets.

- **(Bag Q 10.1 part 1 is a or b and part 2 lowest ≥ 30 or highest ≤ 50)** You indicated that bags are stacked at an acceptable range of heights. However, all lifting should be done as close to knuckle height as possible (30 in can be used when adjusting work to individual knuckle height is not possible, Figure 44). According to the revised NIOSH lifting equation, lifting capacity is highest at 30 in (near knuckle height) and decreases above and below this point. For most people, lifting above or below 30 in can require back bending of more than 20 degrees and reaching with the arms above shoulder height, which increases risk of injury (Figure 43). The use of a lift table is recommended for palletizing tasks to keep the destination of the lifts as close to 30 in as possible. The lift table should be turnable, which will enable workers to reach all sides of the pallet without awkward reaching across the pallet, and self-leveling, which will eliminate the need to manually adjust the height of the lift table. If a lift table cannot be purchased, see Figure 44, Figure 45, and Figure 46 for a recommended method for using stacked pallets.

- **(Bag Q 10.1 part 1 is c and part 2 lowest < 30 or highest > 50)** You indicated that bags are stacked on an adjustable-height surface at an unacceptable height. All lifting should be done between 10 and 50 in, and as close to knuckle height as possible (30 in can be used when adjusting work to individual knuckle height is not possible) (Figure 44). According to the revised NIOSH lifting equation, lifting capacity is highest at 30 in and decreases above and below this point; no lifting should be done above 70 in. For most people, lifting above

or below 30 in can require back bending of more than 20 degrees and reaching with the arms above shoulder height, which increases risk of injury (Figure 43). Ensure that workers know how to properly adjust the height of the lift table, and that it is adjusted such that bags are placed at approximately 30 in. The lift table should be turnable, which will enable workers to reach all sides of the pallet without awkward reaching across the pallet, and self-leveling, which will eliminate the need to manually adjust the height of the lift table.

- **(Bag Q 10.1 part 1 is c and part 2 lowest ≥ 30 or highest ≤ 50)** You indicated that bags are stacked on an adjustable-height surface at an acceptable range of heights. However, all lifting should be done as close knuckle height as possible (30 in can be used when adjusting work to individual knuckle height is not possible, Figure 44). According to the revised NIOSH lifting equation, lifting capacity is highest at 30 in and decreases above and below this point. For most people, lifting above or below 30 in can require back bending of more than 20 degrees and reaching with the arms above shoulder height, which increases risk of injury (Figure 43). Ensure that workers know how to properly adjust the height of the lift table, and that it is adjusted such that bags are placed at approximately 30 in. The lift table should be turnable, which will enable workers to reach all sides of the pallet without awkward reaching across the pallet, and self-leveling, which will eliminate the need to manually adjust the height of the lift table.

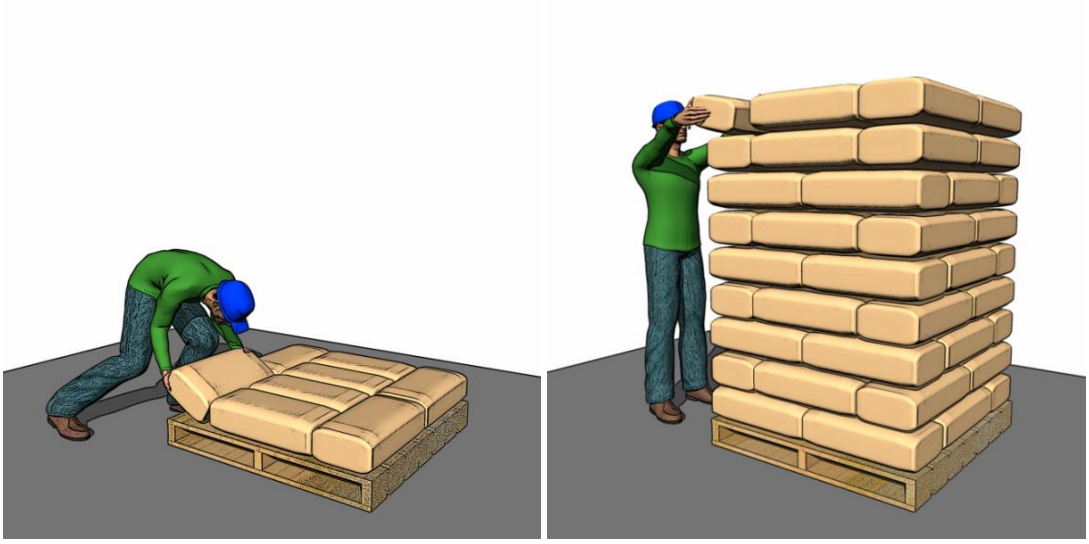

Figure 43. Awkward back and arm postures during palletizing: back bending forward (left), arm reaching forward with elbow raised above chest height (right).

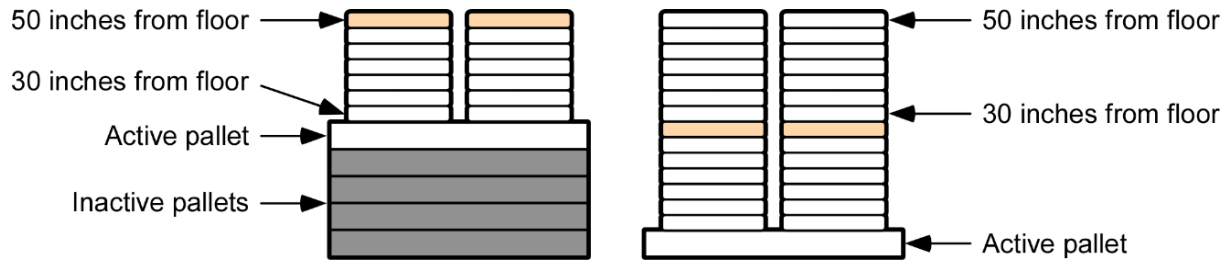

Figure 44. Method for using stacked pallets to improve postures during palletizing when a lift table is not possible. Step 1: Use 4 inactive pallets (shaded gray) to raise the height of the active pallet that is loaded so that the height of the first layer of bags is around 30 in. Load the active pallet until the top layer of bags is around 50 in (end of step 1 shown on left). Step 2: Use a forklift to move the active pallet from the top of the stack of inactive pallets to the ground and continue loading until midpoint of top layer of bags is around 50 in (end of step 2 shown on right; top bag at end of step 1 is shaded tan).

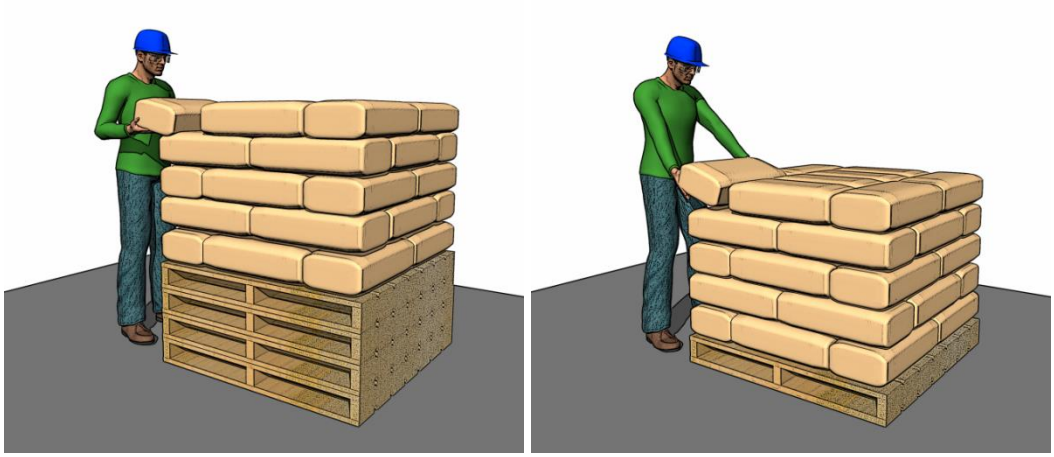

Figure 45. Method for using stacked pallets. Active pallet (fourth up from the ground on left) is placed on stack of inactive pallets and loaded until the top layer of bags is at 50 in from the ground (left), and pallet is moved by forklift to ground (right) and loading continues. Pallet on right should be loaded until the top layer of bags is 50 in from the ground.

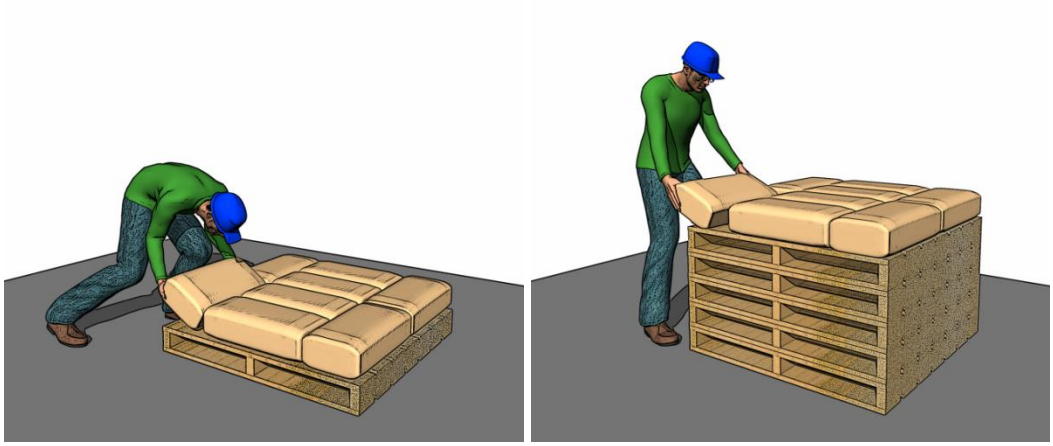

Figure 46. Loading a pallet on the floor can require extreme back bending (left), which is reduced using the stacked pallet method (right).

- **(Bag Q 10.2 b)** You indicated that empty pallets are positioned manually. Ideally, a forklift should be used to place pallets in position for loading to eliminate manual handling of pallets. If it is not possible to use a forklift, ensure that pallets are stored around 30 in from the floor and reduce the distance that a worker must travel while carrying the pallet. In addition, consider requiring multiple workers to lift the pallets together.
- **(Bag Q 10.3 height ≠30)** You indicated that bags are lifted from the conveyor at a nonideal height. Set the conveyor height as close to 30 in as possible from the ground and add an adjustable tilt end (Figure 47) to the conveyor that can be easily adjusted to knuckle height (Figure 48) for each worker. For most people, lifting above or below 30 in can place workers at greater risk for arm and back injuries. If two workers are lifting from the same conveyor, set the conveyor height to the average of the two workers' knuckle height.

Figure 47. Worker standing at conveyor belt with an adjustable tilt end.

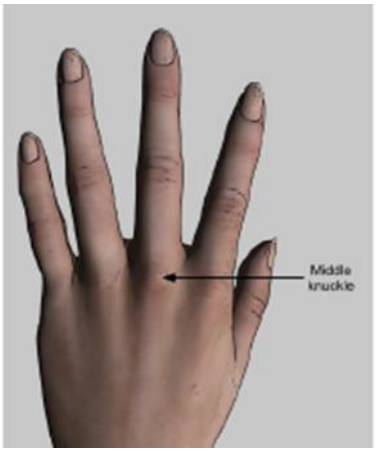

Figure 48: The middle knuckle is the knuckle between the middle finger and the back of the hand

- **(Bag Q 10.3 height = 30)** You indicated that bags are lifted from the conveyor at an acceptable height. To improve posture, an adjustable tilt end should be added to the conveyor so that the conveyor can be adjusted to knuckle height for each worker (Figure 47 and Figure 49).

- **(Bag Q 10.4 b)** You indicated that the pallet is located to the side of the worker when the worker is facing the conveyor belt. Ideally, pallets should be placed in front of workers (Figure 49 and Figure 50). This will reduce the amount of twisting required to lift and place bags, which can reduce the risk of injury (Figure 51).
- **(Bag Q 10.4 c)** You indicated that the pallet is located behind the worker when the worker is facing the conveyor belt. Ideally pallets should be placed in front of workers (Figure 49 and Figure 50). This will reduce the amount of twisting required to lift and place bags, which can reduce the risk of injury (Figure 51). If it is not possible to place the pallet in front of workers, the pallet can be placed beside the worker.

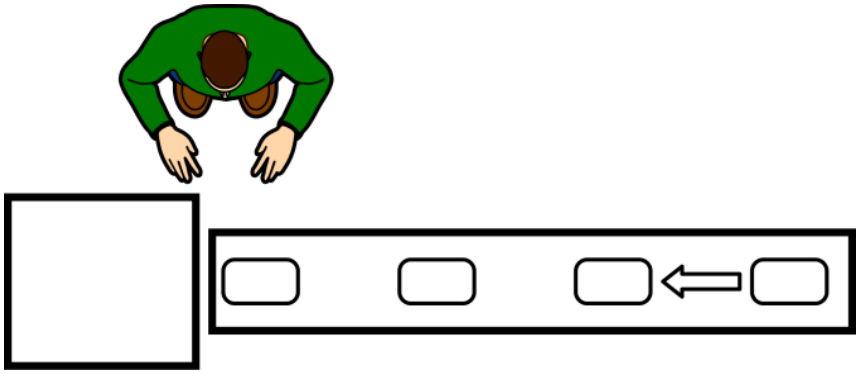

Figure 49. Pallet is in front of worker.

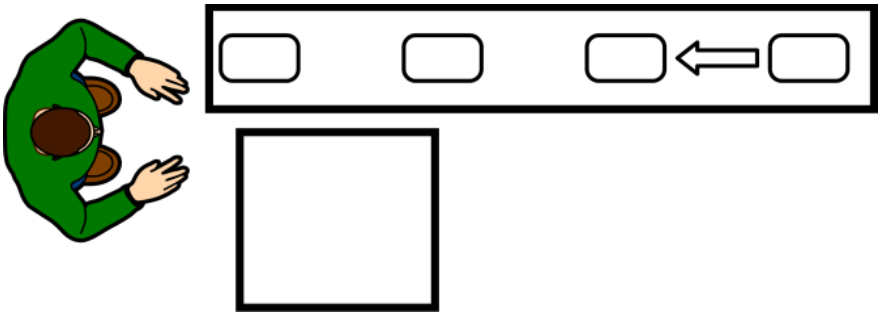

Figure 50. Pallet is in front of worker.

Figure 51. Worker is twisting to the side to pick up a bag from the conveyor belt.

- **(Bag Q 10.5 no)** You indicated that a turnable lift table is not used. Ideally, a turnable lift table should be used for all palletizing. Turnable lift tables can prevent awkward arm postures required to reach across a pallet (Figure 52), which can reduce the risk of injuries.

Figure 52. Awkward arm posture during palletizing.

- **(Bag Q 10.6 no)** You indicated that a lift-assist tool is not used to lift the bags. Ideally, a vacuum hoist or other lift-assist tool should be used to help in moving the bags. Using a lift-assist tool can reduce repetitive lifting, which increases risk of musculoskeletal disorders. One study reported a 39% reduction in peak spine loads when performing palletizing activities using a vacuum hoist (https://journals.sagepub.com/doi/abs/10.1177/1071181311551209). Even with a vacuum hoist, the height of work is still important to reduce awkward postures, and all lifting should occur around 30 in.
- **(Bag Q 10.7 yes)** You indicated that workers slide bags on the conveyor before the bags are lifted. Ideally, a multidirectional roller table should be used to aide in sliding bags toward the worker. Make sure the sliding surface is maintained (waxed, clean, and free of debris) to reduce the amount of friction and allow bags to slide more easily.
- **(Bag Q 10.8 yes)** You indicated that barriers are present that prevent the worker from keeping bags close to the body. Remove any barriers that prevent the worker from getting as close to the bag as possible and ensure that workers are able to lift and lower bags directly in front of them without needing to reach to the front or side of the body. Barriers can require workers to adopt awkward arm and back postures, which can increase risk of injury.
- **(Bag Q 10.10 yes)** You indicated that workers bend their backs or reach with their arms while palletizing with a corner frame. A corner frame can limit access to lower layers of the pallet that sit close to the frame, which can increase reach required to place bags in those areas. Consider placing a lift table inside the corner frame to reduce awkward postures required during palletizing.
- **(Bag Q 10.11 b)** You indicated that wrist bending or deviating occurs during palletizing. Encourage workers to keep the wrist in a neutral posture whenever possible (e.g., Figure 53). Prolonged wrist bending and deviation when lifting can cause inflammation and pain in the wrist and may lead to musculoskeletal disorders such as carpal tunnel syndrome or tendonitis.

Figure 53. Ideal hand and wrist posture while carrying bag.

- **(Bag Q 10.12 b)** You indicated that pinch or wide finger grips occur during palletizing. Encourage workers to avoid using pinch and wide finger grips whenever possible (e.g., Figure 53); these grips can contribute to hand injuries.

III. Bulk Bag Modules

Module 11: Hanging, Opening, and Filling

- **(Bag Q 11.1 b)** You indicated that pallets are moved into position for loading manually. Ideally, a forklift should be used to place pallets in position for loading to eliminate manual handling of pallets. If it is not possible to use a forklift, ensure that pallets are stored between 10 and 50 in from the floor and reduce the distance that a worker must travel while carrying the pallet. In addition, consider encouraging two workers to lift the pallets together.

- **(Bag Q 11.2 lowest < 10 or highest > 50)** You indicated that empty bags are stacked at an unacceptable height. All bags should be stored between 10 and 50 in from the ground. Place the bags in an area with no barriers that would require workers to reach or twist to retrieve them and minimize the distance that empty bags need to be carried to the filling station. Discuss with bag manufacturer different options for delivery of bags (e.g., 40-inch-tall stacks that will fit the 10 to 50-inch range, bags stacked on their side).

- **(Bag Q 11.3 either part 1 or part 2 height < 42 or > 57 and part 2 > part 1)** You indicated that the hooks/filling spouts are at a nonideal height. The hooks and filling spout should be between 42 and 57 in (between elbow and shoulder height when standing) from the surface on which the worker stands. Ideally, a filling station with adjustable height hooks/filling spout that can be lowered to attach the bag should be used (e.g., Figure 54).

  If an adjustable station is not possible, consider the following alternatives in order of preference:

  1. The bag hooks can be mounted on a frame that can be removed and lowered with a forklift (Figure 54). These systems would eliminate awkward postures required to attach the bag to the hooks and filling spout (Figure 58).
  2. Consider adding a platform for workers to stand on that is 42 to 57 in below the spout (Figure 55). If a platform is used, ensure that the horizontal distance between the worker and the hooks/filling spout is no more than 25 in; according to the revised NIOSH lifting equation (https://www.cdc.gov/niosh/docs/94-110/pdfs/94-110.pdf), no lifting should be more than 25 in horizontally from the body. If the horizontal distance is greater than 25 in, consider using rotating hooks that enable the worker to reach all hooks from one side of the bag (Figure 57).
  3. Consider a movable platform that can be placed underneath the hooks/filling spout. The worker should not have to step or climb on the filling machine to hang the bag or attach it to the filling spout.

- **(Bag Q 11.3 either part 1 or part 2 height < 42 or > 57 and part 1 > part 2)** You indicated that the hooks/filling spouts are at a nonideal height. The hooks and filling spout should be between 42 and 57 in (between elbow and shoulder height when standing) from the surface on which the worker stands. Ideally, a filling station with adjustable height hooks/filling spout that can be lowered to attach the bag should be used (e.g., Figure 54).

  If an adjustable station is not possible, consider the following alternatives in order of preference:

1. The bag hooks can be mounted on a frame that can be removed and lowered with a forklift (Figure 54). These systems would eliminate awkward postures required to attach the bag to the hooks and filling spout (Figure 58).
2. Consider adding a platform for workers to stand on that is 42 to 57 in below the spout (Figure 55). If a platform is used, ensure that the horizontal distance between the worker and the hooks/filling spout is no more than 25 in; according to the revised NIOSH lifting equation (https://www.cdc.gov/niosh/docs/94-110/pdfs/94-110.pdf), no lifting should be more than 25 in horizontally from the body. If the horizontal distance is greater than 25 in, consider using rotating hooks that enable the worker to reach all hooks from one side of the bag (Figure 53).
3. Consider a movable platform that can be placed underneath the hooks/filling spout. The worker should not have to step or climb on the filling machine to hang the bag or attach it to the filling spout.

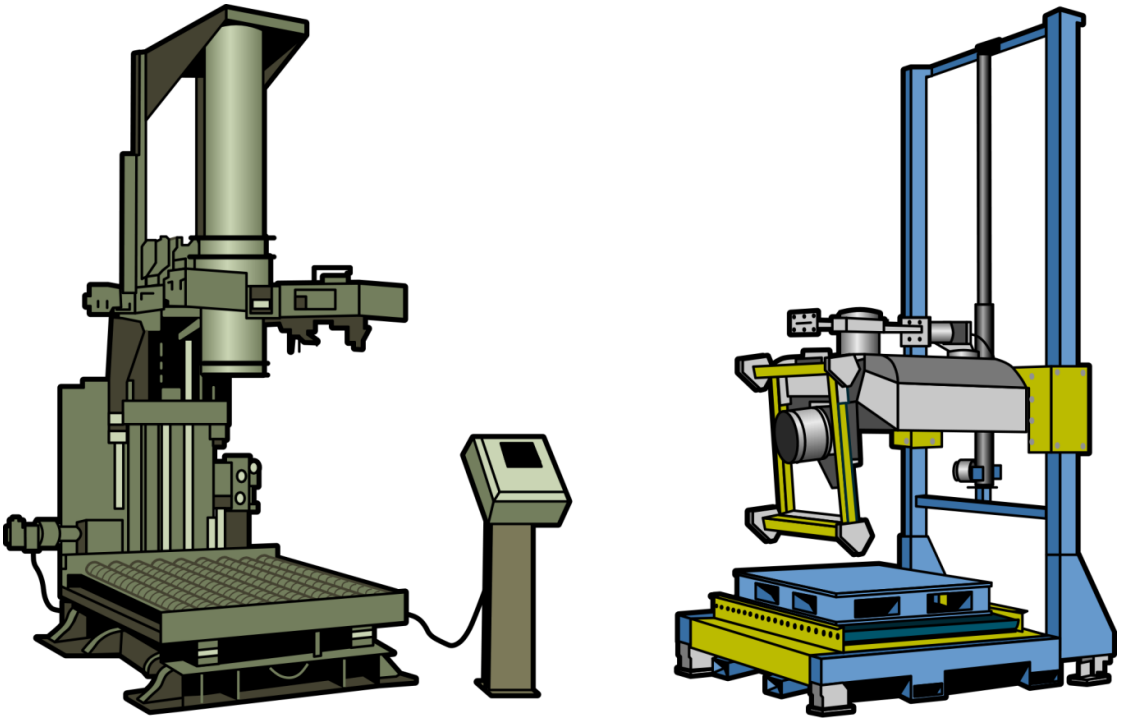

Figure 54. Examples of an adjustable height filling machine: National Bulk Equipment's cantilevered models are standard with height adjustment (left), Flexicon's SWING-DOWN® Bulk Bag Filler (right).

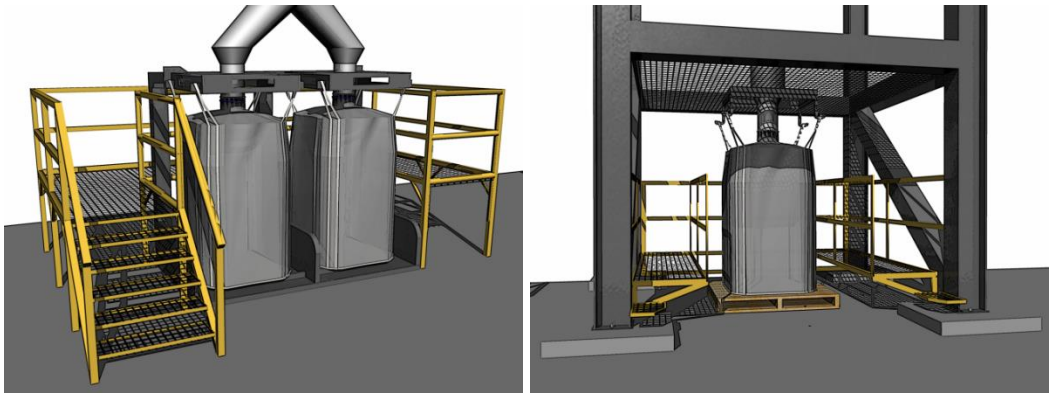

Figure 55. Platforms used to improve access to hooks and filling spout.

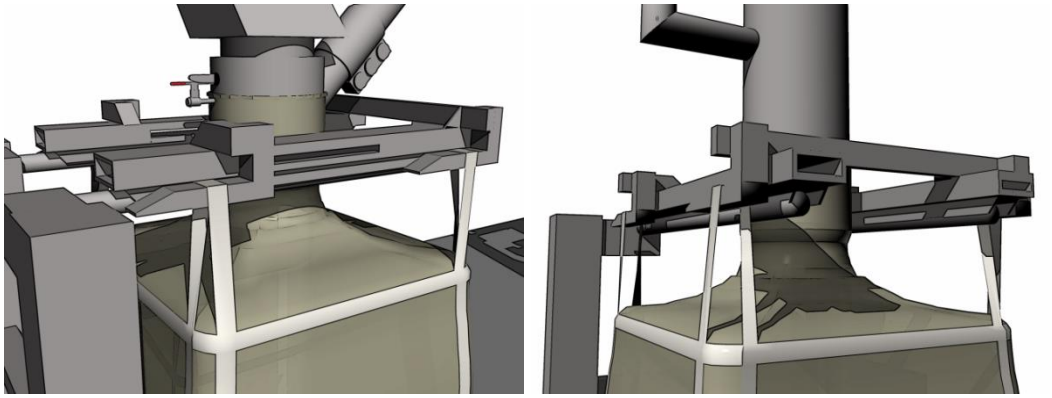

Figure 56. Bag filling stations with hooks mounted on frame that can be removed and lowered with a forklift.

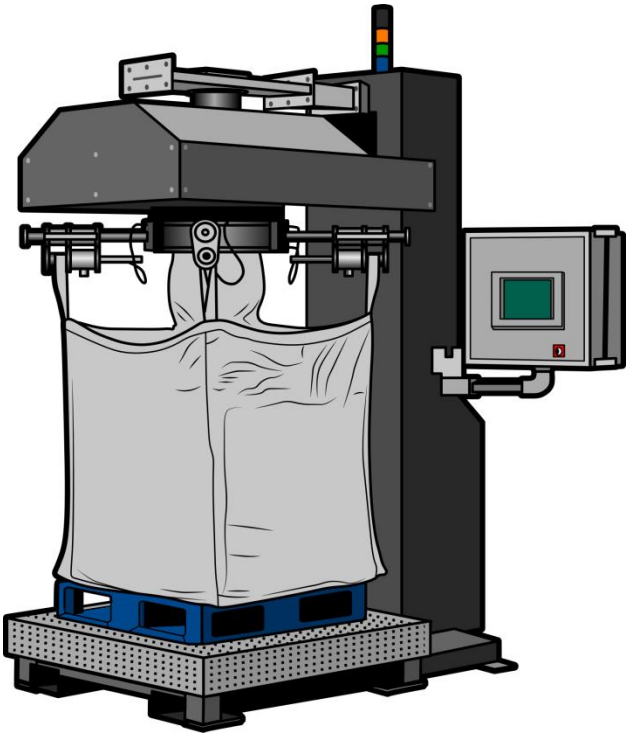

Figure 57. Example of filling station with rotating hooks.

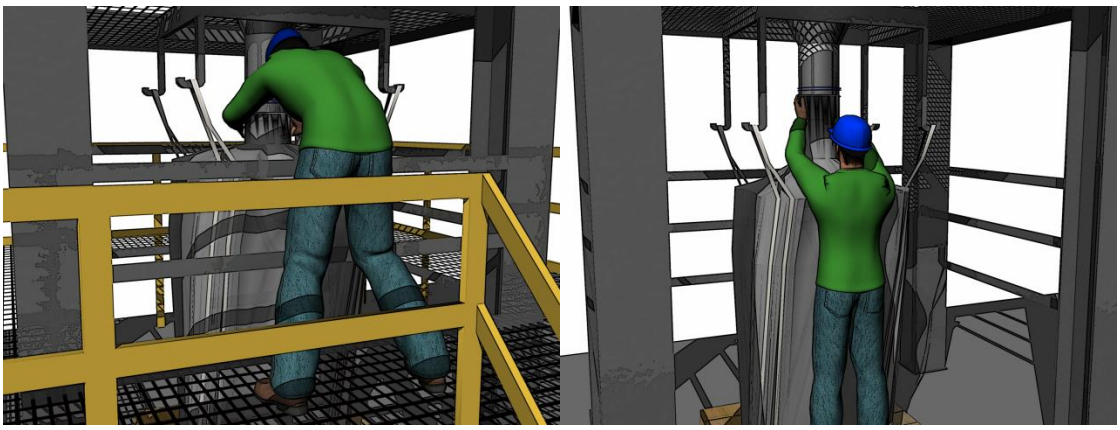

Figure 58. Filling spout is too low and worker must bend down to attach bag (left); filling spout is too high and worker must reach up to attach bag (right).

- **(Bag Q 11.4 part 1 is a or f and part 2 is yes)** You indicated that a hook or other mechanism is used to attach the bag to the filling spout, and that the bag sometimes separates from the filling spout during filling. Ideally, an air bladder should be used to secure the bag to the filling spout. Using an air bladder can eliminate risks associated with manually securing the bag to the filling spout and can reduce the risk of the bag separating from the filling spout during filling. This can prevent the need for cleaning and removing spillage caused by the separation of the bag from the filling spout and can also prevent the need to reattach a partially filled bag to the filling spout. If it is not possible to use an air bladder, consider using a clamp to secure the bag.

- **(Bag Q 11.4 part 1 is b and part 2 is yes)** You indicated that a clamp is used to attach the bag to the filling spout, and that the bag sometimes separates from the filling spout during filling. Ideally, an air bladder should be used to secure the bag to the filling spout. Using an air bladder can eliminate risks associated with manually securing the bag to the filling spout and can reduce the risk of the bag separating from the filling spout during filling. This can prevent the need for cleaning and removing spillage caused by the separation of the bag from the filling spout and can also prevent the need to reattach a partially filled bag to the filling spout. If it is not possible to use an air bladder, consider increasing the surface area of the clamp, using a clamp contoured to the filling spout, or using a hook to secure the bag (provided the bag has built-in loops at the top of the spout).

- **(Bag Q 11.4 part 1 is c and part 2 is yes)** You indicated that a tension cord is used to attach the bag to the filling spout, and that the bag sometimes separates from the filling spout during filling. Ideally, an air bladder should be used to secure the bag to the filling spout. Using an air bladder can eliminate risks associated with manually securing the bag to the filling spout and can reduce the risk of the bag separating from the filling spout during filling. This can prevent the need for cleaning and removing spillage caused by the separation of the bad from the filling spout and can also prevent the need to reattach a partially filled bag to the filling spout. If it is not possible to use an air bladder, consider using hooks or a clamp to secure the bag. If you choose to continue using a tension cord, ensure that the tension of the cord is the lowest possible tension that will securely attach the bag to reduce the amount of force required by workers to attach it.

- **(Bag Q 11.4 part 1 is d and part 2 is yes)** You indicated that an air bladder is used to attach the bag to the filling spout, and that the bag sometimes separates from the filling spout during filling. Check bladder size/pressure to ensure that the bag is being secured properly.
- **(Bag Q 11.4 part 1 is e and part 2 is yes)** You indicated that the bag is not secured to the filling spout, and that the bag sometimes separates from the filling spout during filling. Ideally, an air bladder should be used to secure the bag to the filling spout. Using an air bladder can eliminate risks associated with manually securing the bag to the filling spout and can reduce the risk of the bag separating from the filling spout during filling. This can prevent the need for cleaning and removing spillage caused by the separation of the bag from the filling spout and can also prevent the need to reattach a partially filled bag to the filling spout. If it is not possible to use an air bladder, consider using hooks or a clamp to secure the bag.
- **(Bag Q 11.4 part 1 is c and part 2 is no)** You indicated that a tension cord is used to attach the bag to the filling spout. Ideally, an air bladder should be used to secure the bag to the filling spout. Using an air bladder can eliminate risks associated with manually securing the bag to the filling spout. If you choose to continue using a tension cord, ensure that the tension of the cord is the lowest possible tension that will securely attach the bag to reduce the amount of force required by workers to attach it.
- **(Bag Q 11.6 a and answered a or b to 1.2.3 (use spout or cone-top bag))** You indicated that you open bags manually prior to filling. Consider using a tool that produces forced air (e.g., compressed air, leaf blower) to open the bags. This will reduce awkward bending and reaching required when opening the bags (Figure 59). Ideally, the tool should be supported from beneath, suspended from the ceiling or mounted to support its weight while in use and should eliminate the need for repetitive lifting (e.g., Figure 60 and Figure 56). Ensure that tools are stored around 30 in from the floor to eliminate unnecessary bending to access the tool and that tools are counterbalanced so workers do not need to support the tool's weight.
- **(Bag Q 11.6 a and answered c to 1.2.3 (use duffle or open-top bag))** You indicated that you open bags manually prior to filling. Consider using a tool that produces forced air (e.g., compressed air, leaf blower) or a tool such as a broom or hockey stick that the worker can put in the bag and move around to help open the bag. Ensure that tools are stored around 30 in from the floor to eliminate unnecessary bending to access the tool and, ideally, the tool should be counterbalanced, supported from beneath, suspended from the ceiling, or mounted to support its weight while in use and to eliminate the need for repetitive lifting. The tool should not require the worker to bend to reach the bottom of the bag when standing upright.
- **(Bag Q 11.6 b)** You indicated that you use a tool to open bags prior to filling. Ensure that tools are stored around 30 in from the floor to eliminate unnecessary bending to access the tool and that the tools are counterbalanced. Further, tools should be supported from beneath, suspended from the ceiling or mounted to support its weight while in use and should eliminate the need for repetitive lifting (e.g., Figure 60, Figure 56). The tool should not require the worker to bend to reach the bottom of the bag when standing upright.

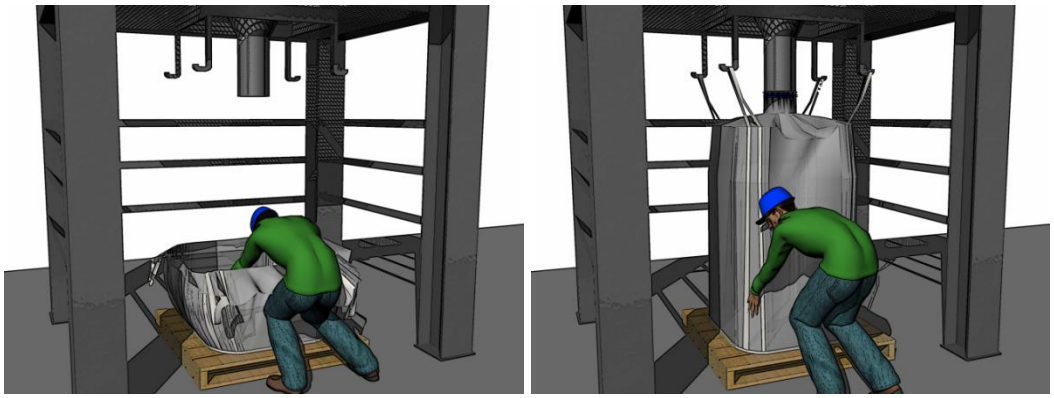

Figure 59. Worker is bending forward to reach inside and open the bag manually (left); worker is bending down to spread out the bottom corners of the bag during filling (right).

Figure 60. A leaf blower is used to force air into the bag to open it. The leaf blower is supported from beneath and is at a height that allows the worker to control it without bending over.

- **(Bag Q 11.7 a)** You indicated that bag filling is controlled using automatic release/stoppage (e.g., push button or foot pedal). If a push button is used, it should be located around 42 in from the floor and the worker should be able to reach it without bending, reaching, climbing, or twisting. Foot pedals should be protected from accidental activation using a cover and should not be a tripping hazard.
- **(Bag Q 11.7 b)** You indicated that bag filling is controlled using manual release/stoppage (e.g., hand lever). Ideally, the filling system should be automated, such as through a push button or foot pedal, to eliminate the need to manually control the release of material. This is particularly important if a large amount of force is required to open and close the valve (e.g., with coarse product). If it is not possible to automate the system, ensure that the pull lever is located around 42 in from the floor (around elbow height) and that the worker doesn't need to bend or twist to operate the lever or read weight information. This level can also be mechanized (e.g., hydraulics) to reduce the force requirement of the worker.
- **(Bag Q 11.8 a)** You indicated that bags are adjusted during filling to prevent folds in the bag. If the bag isn't opening properly during filling because of folds in the bag, consider opening the bag using forced air before attaching the bag to the filling station. If this is not possible, consider pausing filling when less than 10% of

product has entered the bag and adjusting the bag. This will reduce the weight of the product in the bag while it is adjusted and may reduce the need to adjust the bag for the remainder of the filling process.

- **(Bag Q 11.8 b)** You indicated that bags are adjusted during filling because the product isn't evenly filling the bag. If the product doesn't fill the bag properly due to product piling in center during filling (also referred to as a high angle of repose; Figure 61) consider using a cone-top bag. The shape of the cone-top bag allows for it to be filled completely with product of this type and will require less adjusting to the product to flatten out the surface.

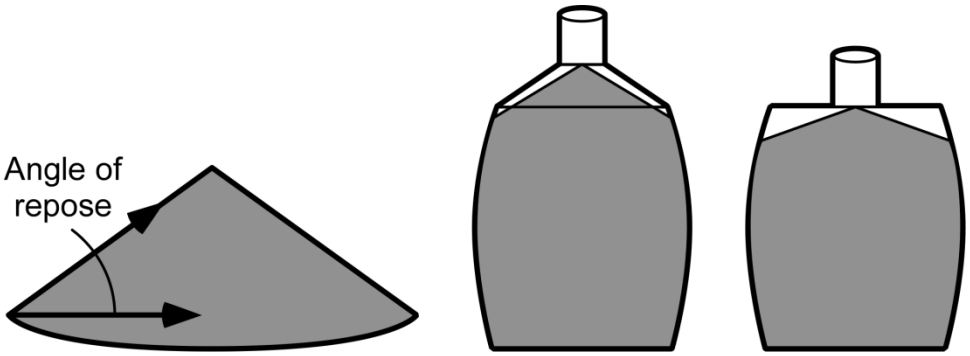

Figure 61. The angle of repose refers to the angle between a horizontal line and the surface of product (also referred to as the natural slope; left). A product with a high angle of repose will evenly fill a cone-top bag (center), but will leave unused space at the top corners of a spout-top bag and will require adjusting to evenly fill the bag (right).

- **(Bag Q 11.8 c)** You indicated that bags are adjusted during filling due to placement on the pallet. If the bag is loaded while on the pallet, ensure that bags are placed properly on the pallet before filling is started. Check placement of the pallet after less than 10% of the product has entered the bag and make adjustments if necessary. If the bag is suspended during loading, adjust the placement of the pallet before lowering the bag onto the pallet. Pallets should be sized such that the bottom of the bag is approximately the same size as the pallet and when filled bags are placed side by side, the sides of the bags should touch, but the sides of the pallets should not touch (Figure 62). This will increase the stability of the bags in packing containers or trailers. Adding markings to the floor beneath the filling spout to serve as a pallet placement guide will also improve pallet placement.

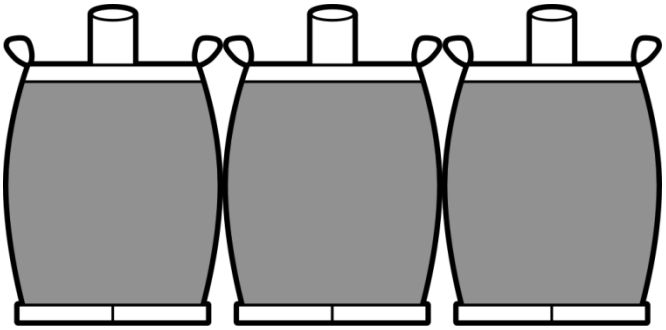

Figure 62. Example sizing of pallets for bulk bags: Pallets are approximately the same size as the bottom of the bag, and when placed side by side the filled bags touch (and the pallets do not touch).

Module 12: Closing and Sealing

- **(Bag Q 12.1 height < 42 or > 57)** You indicated that the hands are raised above or reach below acceptable limits during closing and sealing. Make sure the maximum hand height is between 42 and 57 in (between elbow and shoulder height). Consider adding a platform on which the worker could stand to improve access to the top of the bag.
- **(Bag Q 12.2 yes)** You indicated that the liner is closed separately from the outer bag. If the liner must be closed separately from the outer bag, consider if folding the liner is sufficient for closing. Closing both the outer bag and liner will increase overall physical demands during bag closing.
- **(Bag Q 12.3 a)** You indicated that the bag is closed using the snaking method. Closing the bag using the snaking method increases the amount of effort required by the hands and arms to close the bag which may increase risk of injury to the hands and arms when compared to the flowering method. Unless the bag needs to be sealed using the snaking method (e.g., to keep moisture out of the bag), consider using the flowering method (Figure 63).
- **(Bag Q 12.3 c)** You indicated that the bag is closed using a method other than snaking or flowering. Consider closing bags using the flowering method (Figure 63); this method requires a minimal amount of physical effort, which may help decrease risk of injury to the hands and arms.

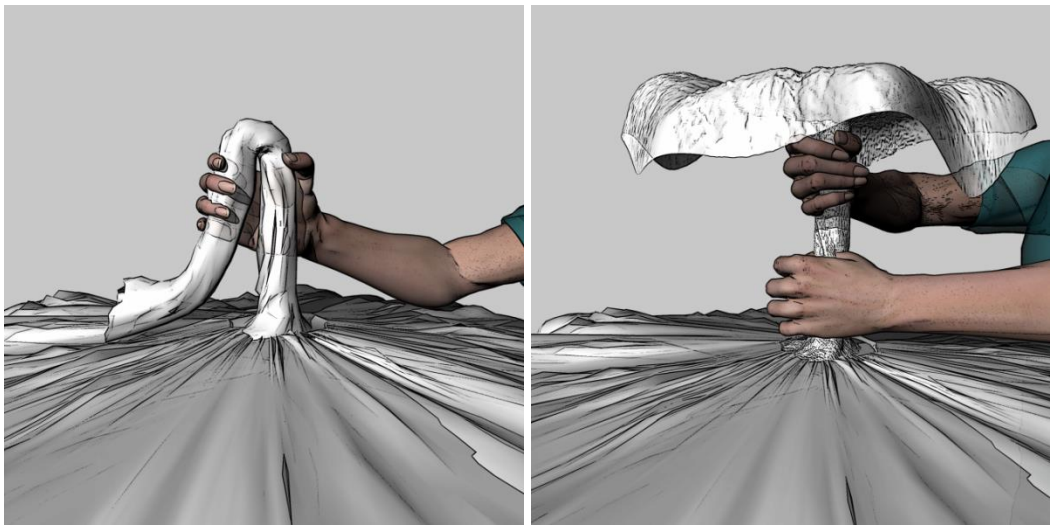

Figure 63. Snaking the liner of a bag (left) and flowering the liner (right)

- **(Bag Q 12.4 a, b, d, e, f, or g)** You indicated that you use a method other than a pneumatic cable tie gun to seal bags. Consider using a pneumatic cable tie gun instead of your current method (Figure 64); research shows that this method requires less exertion of the hands and arms, which may help decrease the risk of injury. Research also shows that pneumatic cable tie guns are perceived to be easier and more comfortable to use, and overall are preferred over other methods.

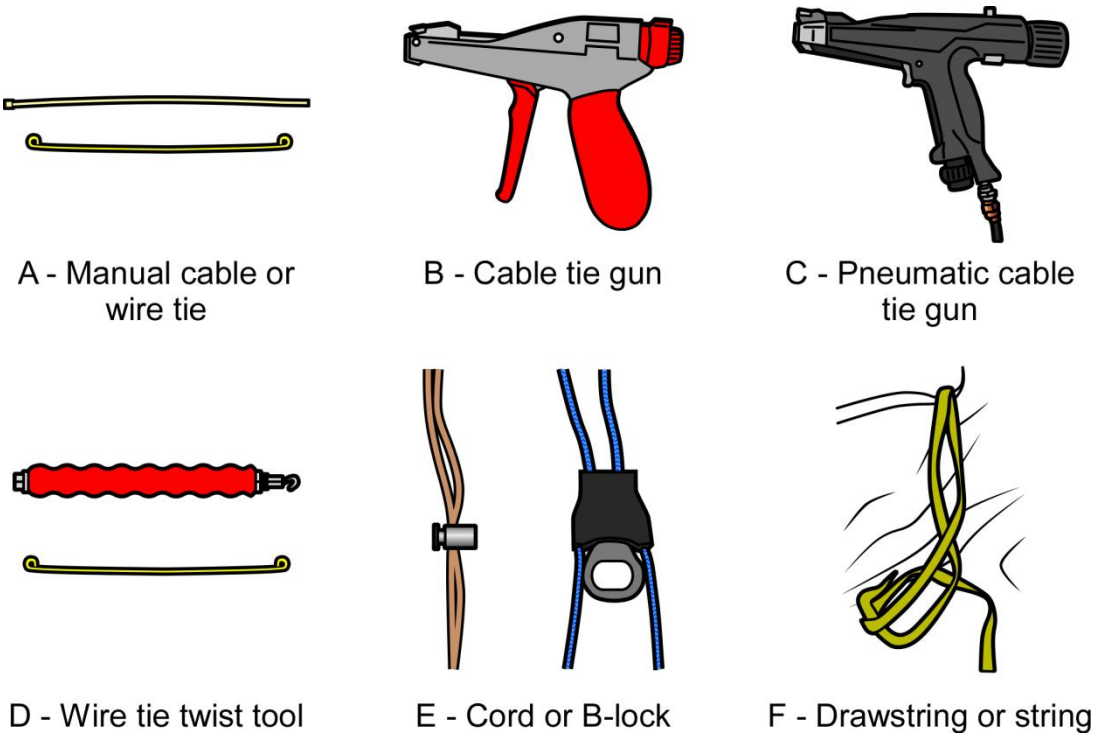

Figure 64. Methods of sealing bulk bags.

IV. Small and Bulk Bags Module

Module 13: Stretch and Shrink Wrapping

- **(Bag Q 13.2 a, b, c, or d)** You indicated that you use stretch wrap held by hand, hand saver, extended core, or mechanical brake to stretch wrap (Figure 65). Ideally, the stretch wrapping process should be automated to eliminate exposure to awkward arm and back postures associated with manual stretch wrapping. If this is not possible, the most ideal tool to use is a portable stretch wrapper. This type of tool eliminates the awkward postures required to apply stretch wrap to the bottom portion of the pallet and also eliminates manual handling of the stretch wrap. If this is not possible or if the pallet is too tall for the portable stretch wrapper, consider using a pole wrapper. A pole wrapper enables the worker to walk around the pallet and adjust the height of the wrap on the pole, eliminating the need to bend the back to wrap the bottom portion of the pallet. If none of these options are possible, discuss obtaining lighter-weight stretch wrap with your supplier.

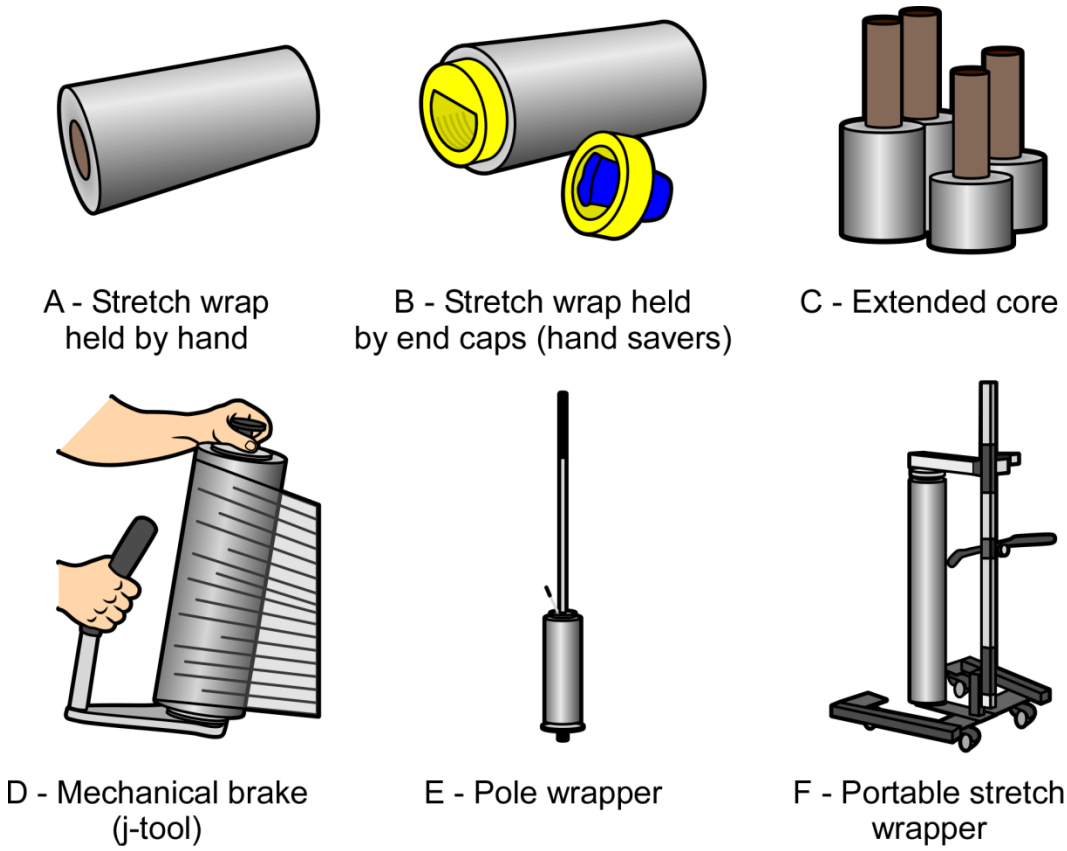

Figure 65. Tools used for stretch wrapping.

- **(Bag Q 13.2 e)** You indicated you use a pole wrapper to stretch wrap. Ideally, the stretch wrapping process should be automated to eliminate exposure to awkward arm and back postures associated with manual stretch wrapping. If this is not possible, consider using a portable stretch wrapper. This type of tool eliminates manual handling of the pole and stretch wrap. If the pallet is too tall for the portable stretch wrapper, the pole wrapper you currently use is a good alternative.

- **(Bag Q 13.2 f)** You indicated you use a portable stretch wrapper for stretch wrap. Consider automating the stretch wrapping process to eliminate the need to manually push the stretch wrap around the pallet.
- **(Bag Q 13.3 yes)** You indicated awkward arm or back postures are used when applying shrink wrap. Manually applying the shrink wrap can require awkward arm and back postures to lift and place the shrink wrap. Encourage workers to apply the wrap without reaching with the arms or bending/twisting the back (Figure 66). To encourage this, a forklift can be used to raise the pallet while workers hold the corners of the shrink wrap over the pallet (Figure 67). As the pallet is raised, the shrink wrap is pulled down over the stack of bags. If this method is used, ensure that workers stay clear from the area underneath the pallet, and that the hand/arm closest to the forklift is clear of any moving parts. Opening the shrink wrapping using a tool (e.g., leaf blower) may also help reduce exposure to awkward postures. If a tool is used, it should be supported from beneath, suspended from the ceiling, or mounted to support its weight while in use and eliminate the need for repetitive lifting.

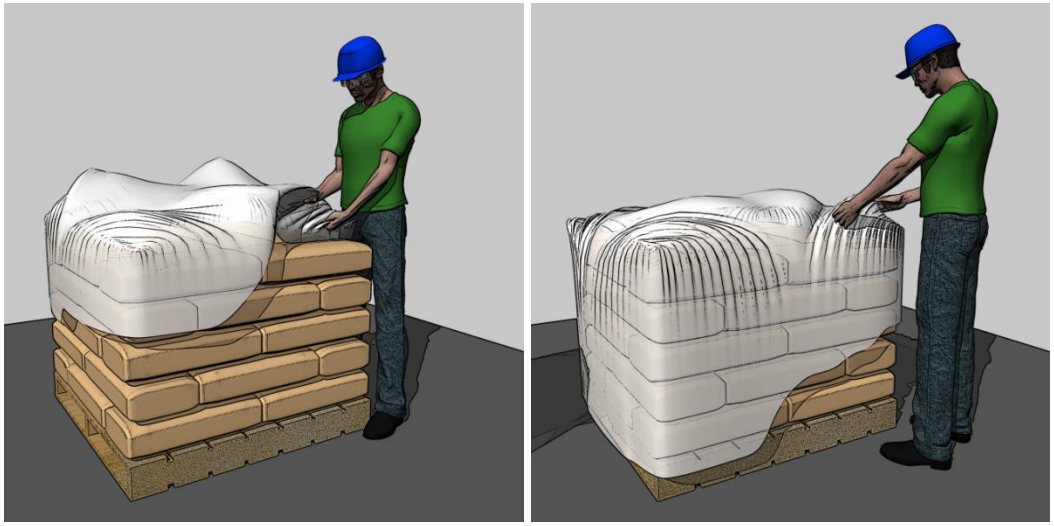

Figure 66. Worker is applying shrink wrap without awkward reaching with the arms or extreme bending/twisting of the back.

Figure 67. Forklift is used to raise pallet while worker stands still holding corners of shrink wrap. As the pallet is raised, the shrink wrap is pulled down over the stack of bags (beginning of process is shown on left; end is shown on right). As shown, this method does not require awkward reaching with the arms or bending/twisting the back.

- **(Bag Q 13.4 a)** You indicated that you use gas or propane heat for shrink wrapping. Ensure that the wand used to apply the heat is long enough that workers do not have to bend forward to reach the bottom of the pallet (Figure 68).

- **(Bag Q 13.4 b)** You indicated you use electric heat for shrink wrapping. Ensure that the heat applicator is long enough that workers do not have to bend forward to reach the bottom of the pallet (Figure 68). Also, ensure that the cord is not a tripping hazard. See hand tool checklist in Module 14 of Maintenance and Repair Audit.

Figure 68. Short wand requires worker to bend forward to reach bottom of pallet (left). Long wand enables worker to reach bottom of pallet without bending forward (right).

- **(Bag Q 13.5 a)** You indicated that the worker carries the gas tank. Ideally, the gas tank should not need to be manually handled. Consider storing the gas tank in an area close to where pallets are shrink-wrapped and use a long gas line to eliminate the need to move the tank. If this approach is used, ensure that the gas line

does not become a tripping hazard. Consider using a self-retracting wheel to keep the line taut or mount the gas line overhead to remove it from the walking area and prevent it from becoming a tripping hazard. If this is not possible, consider using a rolling cart to support the weight of the gas tank while it is moved.

- **(Bag Q 13.5 b)** You indicated that the worker uses a rolling cart to move the gas tank. Ideally, the gas tank should not need to be manually handled. Consider storing the gas tank in an area close to where pallets are shrink-wrapped and using a long gas line to eliminate the need to move the tank. If this approach is used, ensure that the gas line does not become a tripping hazard. Consider using a self-retracting wheel to keep the line taut or mount the gas line overhead to remove it from the walking area and prevent it from becoming a tripping hazard.

- **(Bag Q 13.6 a)** You indicated that the worker carries the gas tank while shrink wrapping. Ideally, the gas line should be long enough to allow the tank to stay in one place to eliminate the manual handling associated with carrying the tank. If this approach is used, ensure that the gas line does not become a tripping hazard. Consider using a self-retracting wheel to keep the line taut or mount the gas line overhead to remove it from the walking area and prevent it from becoming a tripping hazard. If this is not possible, consider using a rolling cart to support the weight of the gas tank while shrink wrapping is performed (Figure 69).

Figure 69. Worker carrying gas tank while shrink wrapping pallets (left). Manual handling is reduced by placing the gas tank on wheeled cart (right).

- **(Bag Q 13.6 b)** You indicated that the worker uses a rolling cart to move the gas tank while shrink wrapping. Ideally, the gas line should be long enough that the worker does not need to move the gas tank during shrink wrapping. If this approach is used, ensure that the gas line does not become a tripping hazard. Consider using a self-retracting wheel to keep the line taut or mount the gas line overhead to remove it from the walking area and prevent it from becoming a tripping hazard.

- **(Bag Q 13.6 c)** You indicated that the gas tank uses a gas line long enough for the tank to stay in one place during shrink wrapping. Ensure that the gas line does not become a tripping hazard. Consider using a self-retracting wheel to keep the line taut or mount the gas line overhead to remove it from the walking area and prevent it from becoming a tripping hazard.

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