

Job:	Wheat Specialty
Description:	Loads grain into ships hatches and levels off load
Equipment Assessed:	AGT semi-automated operation and PECO at JRI

ESSENTIAL DUTIES

1. Loading Grain

- A. Semi-Automated Grain Loading
- B. Fully Automated Grain Loading
- C. Installing/Removing Jewelry
- D. Operating PECO

2. Machine Man

- A. Trimming the Hatch
- B. Keeping Decks Clear
- C. General Duties



Non Essential Duties:

- None

Shift Schedule:

There are two 8 hr shifts from 8am-4:30pm and 4:30pm-1am with a 30 minute lunch break and two 15 minute coffee breaks. There is also a graveyard shift of 6.5 hrs from 1am-8am with a 1/2hr lunch break. Owing to the nature of the operation scheduled breaks are hard to take and sometimes breaks are missed.

Staffing:

A wheat gang consists of 2 specialty and 1 machine man.

DESCRIPTION OF ESSENTIAL DUTIES

1. LOADING GRAIN

Frequency

- Continuous operation for 1-3 hours per hatch as it nears full and may have a few hours off in between hatches or may be working continuously for the majority of the 8hr shift if moving from hatch to hatch continuously finishing off.

Equipment

- Rope, remote control (certain docks), shovels, brooms, scooter, elbows, PECO controls (certain docks only), tarps, radio

Task Description

- Wheat specialty workers move the pipes used to fill the ships with grain to ensure grain is distributed evenly throughout the hatch. Depending on the dock, pipes may be moved

manually with ropes, mechanically with a remote control or with a PECO grain loading system. Attachments (elbows and scooters) may be installed on the end of the semi-automated or fully automated pipes to assist in directing grain offshore side or onshore side. Near the top of the hatch doling off is performed, where the pipe is moved methodically back and forth to ensure even distribution of the grain and a level fill prior to sailing. Ships typically do not fill a hatch completely at a single dock so workers may be filling the bottom part of the hatch or the top part depending on the ship and the day. Filling the top part of the hatch is significantly more work owing to the doling off required.

A	SEMI-AUTOMATED GRAIN LOADING			Equipment	Ropes
Duration	2-3 hrs per hatch	Frequency	1-3 hatches per shift	Force	Heavy to Very Heavy

Task Overview

- The workers pull on ropes attached to either side of the grain loading spout to direct the flow of grain.
- Flow rate and height of pipe are controlled in the gallery above and workers only move the pipes side to side. Wheat specialty workers use a radio and hand signals to communicate with the gallery operator.
- When filling lower in the hatch the pipe is moved less frequently and grain piles up and flows down into the hatch by the force of gravity.
- When doling off near the top of the hatch the pipe is moved methodically from side to side to try and get an even fill. Typically a wheat specialty worker is on either side of the hatch, each holding a rope and they take turns pulling the pipe towards their side of the hatch.
- High forces may be required to direct the pipe to the onshore side corner of the hatch and at times 2 workers are required to pull on the rope together owing to the force required.
- Deck can be slippery with grain which increases the risk of losing footing and can increase awkward postures required to maintain force.
- Filling a hatch may take up to 8 hrs depending on the dock and flow rate, but the majority of the work occurs near the top when doling off.
- Filling the top of the hatch may take 2-3 hrs of continuous work, doling off takes 1-2hrs of that time.
- Workers may then move immediately to another hatch to finish it off or may have some down time before the next hatch needs doling off.

B	FULLY AUTOMATED GRAIN LOADING			Equipment	Remote Control	
Duration	1-2 hrs per hatch	Frequency	1-3 hatches per shift	Force	Minimal	

Task Overview

- Worker holds a remote control and pushes buttons to move the pipe from side to side.
- Worker visually monitors the loading by standing at the edge of the hatch and looking in and moves the pipe accordingly to ensure an even fill.
- Worker also communicates with the gallery operator by radio to raise or lower the pipe or make other adjustments for best filling.

C	INSTALLING/REMOVING JEWELRY			Equipment	Elbows and Scooters
Duration	5-15 minutes	Frequency	Occasional (4-8 times/shift)	Force	Moderate to Heavy

Task Overview

- Elbow and scooter attachments for the grain pipe help redirect the flow of grain and are installed periodically when filling needs to occur on the offshore side or onshore near corners of the hatch.
- The attachments are dragged by ropes to bring them to the pipe. Depending on the weight of the jewelry 1 or 2 men may pull them. At times the attachments may need to be lifted up onto the gangway to be brought on board if they are on the dock.
- Workers then lift the jewelry and attach it to the bottom of the pipe by tying it in place with ropes. The machine man may assist in installation of the jewelry as it can sometimes be heavy or awkward.
- Once the filling in that particular area is complete the jewelry is removed.

<i>D</i>	OPERATING THE PECO		Equipment	PECO Controls
Duration	up to 4 hours	Frequency	Constant	Force Minimal

Task Overview

- Wheat specialty workers on docks with a PECO share the operating over the course of the 8 hour shift. One operator is up in the PECO cab controlling the grain loading for 4 hrs and the other worker is down on the ship, monitoring or performing other lesser tasks or on break. After 4 hrs the workers switch positions.
- Workers are up in a cab above the hatch and control the pipe with a joystick, buttons and other hand controls in the cab.
- A seat is available and workers can operate sitting or standing although often standing is required in order to see out of the cab and down into the hatch to monitor the filling
- There is a radio in the cab for the worker to communicate with the machine man or other wheat specialty worker down on deck.
- Workers must climb up into the cab through a series of ladders and stairs.
- PECO pipes cannot be fitted with jewelry.



FUNCTIONAL DEMANDS with MSI POTENTIAL

Loading Grain

Neck

- Frequent neck extension is required to communicate with the gallery operator by hand signals or when looking up to view movement of the pipe.
- Static neck extension can stress structures in the neck.
- PECO operators must assume flexed and twisted neck postures when looking down to monitor the grain flow. These awkward postures can also stress structures in the neck.
- Rounded upper back and forward head posture from sitting hunched forward in the PECO can put stress on the neck and upper back.



Back

- Lumbar spine rounds when sitting (as in PECO) which places increased stress on the discs and other spinal tissues.
- Increased C-curve forward leaning postures place increased mechanical stress on the back.

- Twisting or side bending postures stress spinal tissues such as when pulling on ropes or attaching jewelry

Shoulder

- Elevated shoulder postures with force as when installing jewelry or tying off ropes can stress the structures around the shoulder.
- Pulling heavy loads with shoulder extended behind results in traction forces to the shoulder joint.



Elbow/Wrist/Hand

- Non-neutral wrist postures may be used to when tying off ropes which can stress small structures in the wrist and forearm.
- Static wrist extension when operating PECO controls can stress structures in the wrist and forearm.
- Static gripping such as when pulling and holding ropes can fatigue the wrist and forearm muscles.



Hips/Knees/Ankles

- Uneven footing from ropes or other equipment on deck can result in stress to the knees and ankles and cause a trip hazard.
- Climbing up/dn stairs and ladders to access PECO cab requires lifting body weight against gravity which can put stress on the hips, knees and ankles.
- Grain on deck can make footing slippery resulting in a risk of slippage.
- Boarding and disembarking the ship requires walking along a gangway which has uneven footing and may at times be slippery.



STRATEGIES TO MINIMIZE MSI Loading Grain

Neck

- Stretch the neck muscles often to allow tissue recovery resulting from awkward postures. Try tucking the chin to place the neck in proper alignment with the spinal column and then rotate the head to one side or the other. Hold the stretch for 20 seconds.
- Keep neck in neutral spinal alignment by avoiding forward head postures.
- As much as possible turn body rather than twisting neck for viewing out of the PECO.



File photos



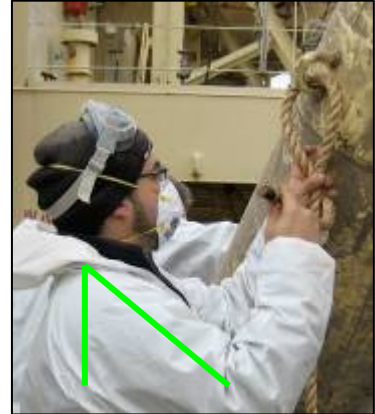
Back

- As much as possible, twisting when pulling on ropes. Keep feet apart and body facing the direction of pull to minimize twisting stress through the spine.
- If sitting to operate PECO, take the opportunity to stand and stretch during brief breaks from operating.
- Maintain neutral spine postures as much as possible when moving around with ropes.



Shoulders

- Stand or sit close to PECO controls to minimize forward reaching to access them.
- When attaching jewelry try to keep arms close to the side of the body during lifting and tying ropes to reduce stress to the shoulder joint.
- As much as possible keep hands below shoulder height when working



Elbow/Wrist/Hand

- Maintain neutral wrist posture when operating PECO controls. Try to keep elbows bent and wrists straight when operating.
- Tie off ropes when possible to reduce the need for static gripping

and pulling.

- Perform wrist and forearm stretches after periods of prolonged gripping.



Hips/Knees/Ankles

- Control speed of descent from PECO by using hand rails and arms to reduce stress to hips knees and ankles.
- Avoid jumping down from last step to reduce stress to knees and ankles
- Watch footing when on deck and gangway and avoid stepping on ropes or other equipment. Walk around obstacles to reduce lower extremity stresses.

2. MACHINE MAN

Frequency

- Varies depending on at what point the loading is at. There may be several hours of constant activity when trimming the hatch as well as frequent periods of down time in between.

Equipment

- Shovel, broom, jewelry, ropes, miscellaneous other tools

* Tarps were previously used to cover partially loaded hatches of grain from rain. They are not in use at the moment so are not addressed in this report, although they may return to usage in some way in the future.

Task Description

- The machine man is generally responsible to keep the site clean and to trim the hatch once the hatch is fully loaded. Trimming the hatch entails climbing out onto the grain and smoothing out lumps and bumps in the load with a shovel so that the hatch can seal tightly and full to capacity. The machine man also offers assistance to the wheat specialty workers as needed. He may get gear or assist in installing jewelry or pulling ropes on semi-automated pipes if extra force is required. The machine man also keeps the decks clear of grain by sweeping or shoveling. He also prepares the next hatch for finishing off by moving gear into position.

A	TRIMMING THE HATCH			Equipment	Shovel
Duration	15-20 mins per hatch	Frequency	1-3 times per shift	Force	Moderate

Task Overview

- The machine man climbs over the side of the hatch and down onto the load.
- Using a shovel he smoothes out lumps and bumps in the grain so that the hatch can close. If necessary he may shovel grain into less full areas to smooth out the load.

*Since PECO's cannot be fitted with scooters or elbows to redirect the flow of grain, the machine man may be required to manually shovel the grain towards the offshore side of the hatch on larger ships as the PECO has a limited range and may not be able to reach the offshore side on larger vessels. This typically occurs twice over the course of filling of a larger ship and the machine man shovels approximately 1hr total per hatch in this situation. 50% of ships being filled by the PECO may require assistance from the machine man to shovel grain into offshore side of hatches.

<i>B</i>	KEEPING DECKS CLEAR			Equipment	Shovel, broom	
Duration	up to 8 hours	Frequency	Occasional		Force	Minimal to Heavy

Task Overview

- The machine man keeps the decks clear of grain by shoveling or sweeping.
- If grain has been spilled over the side of the hatch and onto the deck during loading the amount of shoveling may be significant. The machine man is limited to 2hrs maximum of consecutive shoveling at a time.
- The machine man may also clear away gear (ropes, jewelry, etc) to keep the area around the hatches safe and free from obstacles as the wheat specialty workers are moving around.

C	GENERAL DUTIES			Equipment	Steps, ropes, jewelry
Duration	Up to 8 hrs	Frequency	Occasional	Force	Minimal to Moderate

Task Overview

- The machine man assists the wheat specialty workers as necessary. He may assist pulling heavy ropes on a semi-automated pipe, or may assist with moving and installing jewelry.
- The machine man may move steps to different locations and other gear as necessary to prepare hatches for filling.
- The machine man may also perform other general duties as directed such as getting gear or tidying the lunch room.



FUNCTIONAL DEMANDS WITH MSI POTENTIAL

Machine Man

Neck

- Significant neck flexion may occur as the machine man looks down when shoveling or sweeping.
- Rotated and awkward neck postures may occur when moving gear or assisting on pulling ropes.

Back

- Flexed and twisted back postures are encountered with shoveling and sweeping which can put stress on the structures in the spine.
- High forces pulling on ropes combined with potential for twisting can increase rotational forces through the structures in the spine.
- Lifting equipment can stress the structures in the low back if low risk postures are not used.
- Static bent postures when trimming the hatch on hands and knees can put increased pressure on the spine discs and other back structures.

Shoulder

- Reaching above shoulder when climbing up ladder to side of hatch can put stress on the shoulder joint.
- Dragging jewelry requires non-neutral shoulder extension which puts increased stress on the structures in the shoulder.

Elbow/Forearm/Wrist

- Static grip force on shovels and brooms can fatigue the structures in the forearm and hand.
- Awkward wrist postures lifting, pulling, carrying jewelry and other gear can stress the wrist and arms.
- Working on hands and knees when trimming the hatch results in weight bearing through and extended wrist which can stress the structures in the wrist joint.

Hip/Knee/Ankle

- Significant hip flexion is required when stepping up to or down from the bottom step to the hatch.
- Jumping down from the bottom step may place stress on the tissues around the knee and ankle.
- Working on hands and knees when trimming the hatch can put compression stress on the knee joint.
- Grain on deck can make footing slippery resulting in a risk of slippage.
- Boarding and disembarking the ship requires walking along a gangway which has uneven footing and may at times be slippery.



File Photo



STRATEGIES TO MINIMIZE MSI

Machine Man

Neck

- Avoid sustained neck flexion shoveling or sweeping. Look down at work and then return gaze to back in front briefly.
- Take frequent short breaks from shoveling or sweeping. Perform stretches during breaks.

Back

- As much as possible maintain neutral back postures for work tasks. Keep inward curve low back and avoid twisting.
- Perform back stretches after periods of prolonged hunching or bending such as might occur with trimming, or sweeping.

Shoulder

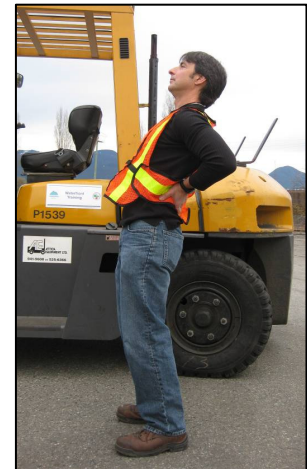
- As much as possible use underhand grip when lifting to keep shoulder in a more stable position.
- Keep arms as close as possible to the side of the body when working to reduce shoulder stress.

Elbow/Forearm/Wrist

- Keep wrists straight when grasping tools
- Perform stretches after periods of prolonged static gripping such as with shovels or brooms.
- Periodically sit back on heels for a few seconds when trimming to take pressure off the arms and hands

Hip/Knee/Ankle

- Push off with toes when stepping up to bottom step when climbing up to hatch to reduce force requirements for the quadriceps.
- Control speed of descent when climbing down from edge of hatch to reduce impact stress to the lower extremity
- Avoid jumping down from bottom step
- Watch footing and avoid stepping on ropes or equipment when moving around the decks.



File Photo

3. ENVIRONMENTAL CONSIDERATIONS

Exposure to Elements

- The wheat specialty workers and machine man are exposed to the elements on the deck of the ship for the duration of the shift. Grain loading does not occur in inclement weather so although it may be cold or hot, it is typically not wet unless rain begins in the course of loading, at which point loading ceases. The exception is the PECO operator who works inside the cab for the duration of the 4 hrs he/she spends operating.

Uneven/Slippery Surfaces

- The deck may be slippery if there is grain on it, particularly certain grains such as canola. If it begins to rain or is damp the mixture of water and grain becomes even more slippery. The wheat specialty workers also have to negotiate obstacles at times such as ropes or jewelry on the decks. To get on and off the ship the workers have to climb up and down a gangway which may also be slippery.

Vibration

- Vibration is not an issue for this job.

Other

- Wheat specialty workers are required to wear a respirator when working owing to grain dust in the air. They may also wear goggles and coveralls to protect their eyes and clothing from the grain dust. The grain dust can make the work more difficult.

4. PHYSICAL DEMANDS SUMMARY TABLE

Job Demands		Max. Weight/ Avg. Weight (Kg)	Duration per exposure h=hrs s=secs, m=mins	Frequency	Comments
STRENGTH	Lifting/Carry	40/20	<1m	O	Lifting jewelry to attach, typically a 2 man lift so heaviest item is 80lb steel scooter (40lbs/worker)
	Push/Pull	200/20	<30	O	Repetitive pulling on ropes at to move semi-automated pipes, dragging jewelry
	Supporting Body Weight		<1m	O	Climbing up/down gangway or stairs to edge of hatch
	Gripping / Handling		V	F	Varies from a few seconds on PECO controls to several minutes when holding ropes or longer when holding remote at fully automated pipes
	Fine Motor Skills		<5m	O	PECO only when using joystick controls to move pipe into corners or filling edges
POSTURE & MOBILITY	Sitting		V	V	Never for auto/semi-auto & occasionally in PECO
	Driving		n/a	N	
	Standing		V	F	Varies between potentially 4hrs standing in PECO and few seconds at a time for others
	Walking		V	V	Never for PECO operator, Freq for others
	Bending/ Stooping		<30s	O	Shoveling, sweeping, lifting, bending over side of hatch to see inside
	Sustained Crouching/ Kneeling		15m	O	For machine man only when trimming the hatch
	Climbing Stairs		<30s	O	Steps to side of hatch, in/out of PECO cab
	Climbing Ladders		<30s	O	In/out of hatch and in/out of PECO cab
	Crawling		15	O	For trimming the hatch only
	Balancing		<30s	O	On stairs and ladders sometimes on pipes on desk when pulling ropes
	Throwing		n/a	N	
	Overhead Reach		<1m	O	When attaching jewelry
ENVIRONMENT	Exposure to Elements		4-8h	V	Never when operating PECO, constant for others
	Uneven Surfaces		V	F	Gangway, obstacles and grain on decks, duration of exposure varies depending on circumstances from few seconds to few hours.
	Proximity to moving objects		4-8h	V	Ropes, pipes, flowing grain, varies depending on speed of loading, downtime, etc.
	Vibration (upper extremity)		n/a	N	
	Vibration (whole body)		n/a	N	

* PECO is operated for 4 hrs by each worker per shift. The other 4 hrs is on deck moving, walking, exposed to the elements.

Frequency Ratings:

- N:** Never
- R:** Rare - Not daily or up to 1% of shift (<5mins/day)
- O:** Occasional - 1%-33% of shift (up to 2.5hrs)
- F:** Frequent - 34%-67% of shift (2.5-5hrs)
- C:** Constant ->67% of shift (>5hrs)