

**Ergonomic Evaluation  
Luhr Jensen & Sons Inc.  
Hook Soldering Station  
November 2000**

A work site visit was conducted for the hook soldering area at Luhr Jensen Inc. at the request of Mark Biederbeck, Manufacturing Consultant and Project Director from OMEP. Videotaping and digital photos of the work tasks were conducted and are available for review. Employee discomfort surveys were completed.

**Purpose/Background:** The purpose of this evaluation is to provide an initial assessment of the Musculoskeletal Disorder (MSD) risk factors associated with this activity. This is done as part of the Oregon OSHA Worksite Redesign Program Grant which has been awarded to Luhr Jensen. The intended goal of this project is to make engineering improvements to reduce the identified health, safety and MSD risk factors in order to prevent work injury.

**General Description:** The following description was adapted from information provided from Luhr Jensen and Patrick Kraft, Manufacturing Consultant from OMEP: Luhr Jensen is a fishing tackle manufacturer and as such makes a lure called the "Silver Minnow". Unique to this lure is the process of soldering the hook, weed guard and integral line pull to the backside of the brass blade. This involves accurately, structurally and aesthetically placing a solder joint between the hook and the blade. The current hand operation requires the employees to perform the following job steps:

1. Pre-cut and stock 5 different lengths of wire-type solder
2. Soak solder in acid flux
3. Drain solder to remove excess flux
4. Load blade and hook into locating fixture
5. Hand apply (with the aid of tweezers) solder to both sides of hook
6. Heat the part with a propane torch until the solder melts
7. Allow part to cool before unloading

**Work Environment and Equipment: Relevant dimensions**

Soldering workstation table- 48" square, 34" high  
Indexing fixture holder 33" diameter (round) in center of workstation table  
12 locating fixtures spaced around the round holder, arranged like the numbers on a clock  
Effective work height of each blade on locating fixture is 43", reach distance 3" to 5"

Employees work for 8 hours per day with occasional overtime, taking breaks and lunch at normal intervals. Typically one employee stands on one side of the workstation loading the blade and hook in each locating fixture and removing the completed lure. The other employee stands opposite, using tweezers in one or both hands to pick up and apply solder strips to each side of the hook as the lure pauses on the way to the heating torch. It is this second task which is targeted for ergonomic improvement due to the health, safety and ergonomic risks which are present. Cotton gloves with latex gloves over are worn to protect the employee's hands from the acid flux and solder. Tweezers are used to grip the strips and locate them. The employee has a bath of acid flux and a tray of solder strips in front of him, to be applied to the hook assemblies as they index to

the loading position. The completed hook assemblies rotate around the fixture pausing to pass over a fixed propane flame which heats and melts the solder to fix the hook to the blade.

**Health and safety issues include:**

1. Close proximity to solder and flux fumes
2. Handling and working in close proximity to open container of acid flux
3. Handling solder with flux residue
4. Close proximity to heating flame

**The primary physical demands likely to contribute to risk of musculo-skeletal injury include:**

1. Static postures- significant, prolonged, static positioning- standing in place at the soldering fixture
2. Awkward postures- while manipulating solder strips with tweezers (wrist flexion, extension, supination and pronation, neck flexion)
3. Forces and Loads- sustained muscle loading of the shoulders, forearms, hands and fingers to reach and operate tweezers
4. Repetition- high rating of repetitive movements of upper extremities to manipulate solder strips with tweezers due to the large number of completed units (output is 2,000- 2,400 pieces per day= 250- 300 per hour or 4.2- 5.0 per minute)
5. Pressure points- hard metal tweezers against soft tissues of hand and fingers

These results indicate a strong need for engineering controls to eliminate or greatly reduce worker exposure to the health/safety and ergonomic risks associated with this task.

**Preliminary Recommendations:**

**Engineering controls**

Design and build a new soldering tool/workstation which eliminates the close proximity and exposure of the worker to open containers of flux, handling flux, flux and solder fumes, proximity to heating flame and repetitive handling and placement of solder strips. The device should be efficient, simple to operate and not create additional MSD risk factors. Several alternative designs involving automation of the task are currently under consideration. This approach would nearly eliminate exposure to the identified hazards and free the employee to perform other duties within the company.

For further assistance or questions regarding this report please contact Rob Strickland, 667-3564.

Respectfully,

Rob Strickland, OTR  
Ergonomics Consulting

**Addendum**



**Figure 1** Worker is exposed to health and safety risks of acid flux, solder/flux fumes, residue and proximity to heating flame.



**Figure 2** Worker uses tweezers in both hands in a highly repetitive manner involving awkward postures of the forearms and wrists.