

**Post Project Ergonomic Evaluation
Vanguard Technologies, Inc
Heat Exchanger Coil Transfer and Insertion Tool
May, 2001
By Rob Strickland, OTR**

An on-site ergonomic evaluation of the task of lifting and moving a heat exchanger coil using the new transfer and insertion tool was completed on May 10, 2001. Joseph Junker, PE., Mfg. Consultant, OMEP, and Steve Kujawa, President of Vanguard were present. A video tape and digital photos were taken during the evaluation and are available for review. Symptom surveys were completed by employees.

Purpose/Background:

The purpose of this evaluation is to provide an assessment and documentation of the improvements in the musculo-skeletal disorder (MSD) risk factors associated with the use of the new device.

Device Description:

The heat exchanger coil transfer and insertion tool (also called the "coil lifter") is the engineering control designed and built for this project. It was built using a "Genie Lift" model GL-8 re-chargeable, battery powered lift device with a 400 pound lifting capacity. The lifting function is controlled by a remote hand pendant with push button controls. The framework of the device is on lock-able casters that are 4.75" diameter x 2" wide. Over-all foot print of the device is 41" front to back, 28.5" wide and is 69" high. The horizontal handle used to maneuver the device is height adjustable and was set at 54" high. The end device was custom designed and built to receive, hold and move the heat exchanger coil into the heater shell. It is mounted on the lifting arm of the Genie Lift and glides forward and backward to easily insert the coil into the shell. It is also capable of minor side to side and angular movements to assist in placing the coil into minimal clearance positions. It has a stop lock to secure the coil on the arm during transport.

Observations/conclusions:

This task is one of several activities involving the heat exchanger coils. The copper tubing with fins is coiled onto an electric powered coil roller drum. The coil lifter is positioned with wheels locked, next to the coil winder drum. The completed coil (weighing 110 lb.) is then slid off the drum onto the coil lifer. The lifter is then pushed close to the heat exchanger shell which is resting on a wood pallet atop another cart. (Push/pull forces were measured at 32-40 pounds of initial force, 15-20 pounds sustained force on level concrete floors). With the coil lifter wheels again locked, the end device stop-lock is released and the coil is gently pushed to glide and insert into the heater shell. Side to side or angular adjustments can be made to the end device to adjust the position of the coil as it is inserted into the tight space of the shell. At current production levels this task is performed 15 to 20 times per month. With future increases in production it is expected that the frequency will increase to 10 times per day.

The improvements in risk of musculo-skeletal injury due to the implementation of this new tool include:

1. Elimination of forces and loads from manual lifting- 110 lb. is excessive for any one individual to safely lift and handle. This physical requirement has been eliminated. Using the NIOSH Guide Program for Manual Lifting, it is predicted that 100% of males and females are capable of safely performing the coil insertion task using the new coil lifter/insertion tool. (Previously, using the manual method only 1% of the male population was predicted to be capable of safely doing the task.)
2. Awkward trunk postures- previously, the worker would bend forward at the trunk, while holding the 110 lb. coil primarily on one arm and reach forward to insert the coil. These awkward postures (along with the excessive load) have been eliminated.
3. Contact Stress- Previously the hard/sharp edges of coil fins rested on soft tissues of lower arm while lifting and holding the coil during manual insertion. This has been eliminated by use of the insertion tool.

Employee Discomfort Survey Results: (Post Project)

Job Title- **Coil insertion** Number of surveys completed= **3**

No discomfort was reported among the three employees using the new coil lifter/insertion tool.

Employee Discomfort Survey Summary

At the time of the baseline ergonomic assessment, 1 employee completed the discomfort survey. This is the only employee assigned to this task based on his physical strength and ability to handle the coil. (Results are listed below). The post project discomfort survey indicates no discomfort in relation to the use of the new device so, for this employee there was a definite improvement in comfort reflecting the reduced physical demand with the task.

Discomfort Area	Number of employees with discomfort	Percentage of the total ()	Average Rating (0-10 scale)
Shoulder	1	100%	4
Hand/wrist	1	100%	3
Neck			
Elbow/forearm	1	100%	3
Upper back			
Lower back	1	100%	1
Knee	1	100%	1
Hip/thigh	1	100%	1

Worksite Redesign Project Completion Summary

The reduction in risk factors identified above, combined with the discomfort survey results indicate that the engineering controls instituted by the new heat exchanger transfer/ insertion tool and related processes have been very successful. The MSD risk factors have been eliminated or substantially reduced and safety has been enhanced. The employees report very high satisfaction in the over-all outcome of the engineering improvements.

For further assistance or questions regarding this report please contact Rob Strickland, 503-667-3564.

Respectfully,

Rob Strickland, OTR
Ergonomic Specialist



The coil lifter is moved into position so that the coil can be slid from the winder drum onto the end device. (No manual lifting involved)



The coil lifter is pushed into position and the end device is raised by remote pendant control to insert the coil into the heater shell.



The end device of the coil lifter is pushed forward and easily glides the coil (weighing 110 lb.) into the heat exchanger shell. This eliminates all manual lifting and handling of the coil while inserting it.