

Glove Stop

Further development of Glove Stop technology to make head removal a safer option

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1.0 Executive Summary

To utilize the known safety technology of body contact with equipment control circuitry to protect the operators hand whilst using the single hand operated manual head cutters. This circuitry is incorporated into the control system to respond with the same functionality as if an emergency stop is activated.

2.0 Introduction

Recently our plant has been replacing and upgrading band saws used in its meat processing facilities. A feature of this new machinery are specially designed gloves that run a low current through them, enabling them to form a circuit when contact is made with the blade initiating the machinery's emergency stop automatically and with incredible decisiveness. The potential for this type of effective and autonomous safety measure to be implemented in other areas was discussed and hydraulic cutters were put forward as prime candidates for such an additional safety measure. Hydraulic cutters don't have a current emergency stop and with how rapidly they complete their operation the window for manual intervention is essentially nil. If the operator accidentally commits to a cut without clearing their person from the cut path, there is no recourse. To mitigate the chances of this where possible use dual anti-tie down controls for hydraulic cutters which require both hands on the device and hence clear of blades in order to cut (Two trigger system); with each operation requiring two separate inputs to remove the temptation for operators to tie down one of the controls. This setup is an effective industry practice but not feasible for all operations and can be un-ergonomic for the operator. Previous attempts at additional safety measures have revolved around proximity sensors but these are inherently limited to certain incorrect procedures as they can only discern if the operator is attempting a valid cut.

3.0 Project Objectives

3.1 Establish a system trigger

Establish a system trigger that reliably activates when a person's protected area makes contact with the metal of their operating machinery, specifically the blade.

3.1.1 Permanently Restrict Closing Speed

The hydraulic cutter jaw closing speed will need to be permanently restricted by mechanical hydraulic means as to allow for system response time delays.

A reservoir of stored hydraulic energy needs to be accessible to open the jaws in advent of emergency stop.

Hydraulic system assembly

The hydraulic cutter, pump and power units have been assembled and function as expected in operating conditions without the new glove stop safety system implemented.



Switchboard Assembly

The electrical switchboard that will run and monitor the system has been assembled to specification. Will not know for certain until the testing stage if there are any defaults as unlike the hydraulic system it cannot be fully tested independent of the rest of the project.



Steps

- Design glove stop
- Integrate to existing hydraulic cutters
- Complete drawings
- Complete software

4.0 Methodology

A 5vdc control circuit detects if the operators hand comes in contact with the cutter blades or any metallic part of the cutter hand unit. If triggered this control circuit disables the hydraulic power pack unit and utilizes stored hydraulic energy to open the cutter jaw. The contact mentioned above is detected when a conductive glove worn by the operator on the exposed hand comes in contact with the metallic sections of the hand piece but most importantly the cutter blades. The hand used by the operator to trigger the cutter is electrically isolated from the equipment by a suitable non-conductive glove. The cutter hand piece and the conductive glove are separately connected to the control circuit via cabling attached to a belt worn by the operator. This cabling (usually tucked within the sleeves of the operator's shirt) is clipped onto the glove and hand piece via separate 10mm press on fittings. From the belt the cabling is connected via a coiled cable to a socket allocated for the final connection to the control cabinet circuitry.



5.0 Project Outcomes

Increased health and safety levels for skilled operators of hazardous machinery in the workplace, reducing the likelihood of laceration or even amputation.

6.0 Discussion

7.0 Conclusions / Recommendations

The original concept of the operator wearing the silver impregnated glove allowed for minimal contact with the cutter surfaces before the safety features activated. This concept proved effective in a clean environment. Unfortunately testing the system with animal product produced an issue with the glove detection. It was found that a gradual build-up of blood contamination reduced the effectiveness of this function and the need for regular glove changes highlighted the fact that this approach was not suitable or practical.

The next approach was to protect the hand with a mesh glove, covered by the silver impregnated glove, covered by a thin blue glove. The theory was that the cutter would pierce the outer blue glove and trigger the safety functions of the cutter and eliminate the glove contamination issue. This function worked effectively but relied on the fact that the cutter blades would be sharp at all times. It was found during testing that if that was the case then the cutter would minutely pierce the glove and the damaged portion of the glove would be no longer than 1mm in length. Even though the safety devices were triggered and this system would most likely eliminate an amputation, it couldn't be guaranteed not to cause some form of unacceptable injury. Due to this unacceptable risk of personnel injury in the form of a fracture or laceration the obvious decision was to abandon this equipment concept and to concentrate further efforts on eliminating personnel from this manual task.

One such way to achieve this is by the use of factory automation in the form of robotics. Robotics in conjunction with vision and x-ray technology has been utilized in similar environments so it is planned to contact one of these companies to investigate the implementation of such technology to replace this manual process.

