MACHINE RISK ASSESSMENT

MACHINE: **Folder/Slitter**

HAZARD TO BE ASSESSED: **FOLDER CLAMP FALLS DUE TO CYLINDER MECHANICAL FAILURE**

Assessment by: Darren Monson Date: 11/05/2005

PART A
Assumed Machine Use:

- Hydraulic Power Pack Pressure does not exceed the factory setting of approximately 100 bar.
- Parts replaced are same specification as original, especially pivot pins, cylinders, hydraulic pump, valves, pipes replaced with pipes and not hoses.
- No mechanical modifications to allow force multiplication on the cylinders or machine structure.
- Machine is always operated with all cylinders installed, and all cylinders provide similar force.
- All cylinders are maintained in good condition so that all can exert an even share of the clamping force.

PART B
Incident History:

SWI are aware of three incidents over the past 5 years or so, where clamp cylinder, or cylinder mountings have failed, causing the clamp to fall. The speed or distance of the fall is unknown. These incidents occurred on Machine Makers folders and another local brand which is no longer available. Machine Makers folders have a history of such failures, but only two have resulted in the clamp falling unexpectedly.

PART C
Possible Injuries:

- Broken bones in hands (reversible)
- Minor amputation of fingers (irreversible)

If the clamp falls due to this failure, and the hands are caught under the clamp, the force on the fingers will be exerted by the weight of the clamp itself only, and there would not be any hydraulic pressure on the clamp. It is unlikely therefore that the injury would be more severe than indicated above.

PART D
Failure Mode Analysis:

Failure of these components will cause this hazard:

1. Hydraulic cylinder clevis structural failure
2. Hydraulic cylinder clevis pin failure (rod or base end)
3. Hydraulic hose bursting between valve and hard piping
4. Folder over arm clevis structural failure

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PART E

Objective of Risk Controls:

Prevent the clamp from falling as result of hose, cylinder or cylinder mounting failure where the failure occurs from machine wear and tear (ie not deliberate or external cause).

PART F

Previous Controls:

- Hose burst valve fitted to some cylinders
- Operator training
- Maintenance program

PART G

Risk Controls:

SWI have implemented the following engineering controls:

- Cross port pilot operated check valve at the hydraulic power pack
- Hard piping between cylinders
- High tensile clevis pins
- Heavy duty construction of cylinder mounts
- Self lubricating bushes at pivot points

Operational Controls:

- Frequent maintenance inspections
- Pre-start machine checks
- Operator training to demonstrate that all tasks can be done without placing fingers under the clamp bar
- The use of special hand tools to position and retrieve squash-fold work-pieces

PART H

Additional Hazards Introduced By Controls:

- Machine should be isolated during maintenance inspections.
- Startup checks should be performed from outside the machine rear guarding, or with the rear guarding gates open.

PART I

Residual Risk:

The likelihood of this failure occurring with the engineering controls is place is far less than the likelihood experienced with Machine Makers folders. To date, there is no evidence or suggestion to indicate that this type of failure could occur on a SWI Folder with the above mentioned assumptions and engineering controls in place.

The residual risk can be eliminated by using good operating practice. Operators should be trained, and develop the habit of never placing fingers under the Folder clamp. Any circumstance that apparently requires operators to place their fingers under the clamp should be analysed for alternative solutions, such as reaching from the back of the clamp, or using small hand tools to position the workpieces.

Assuming moderate success with these administrative controls, combined with the engineering controls, the residual risk is very low.

PART J

Discussion:

SWI Engineering is constantly investigating methods to improve their Folder design. Engineering controls continue to be investigated. In the interim, the residual risk can be eliminated by good practice and good maintenance. The inclusion of hose burst valves has been assessed as undesirable because of the variable flow function of the main hydraulic pump. Counterbalance valves have been considered but will cause additional strain on the machine frame as all cylinders would then likely operate at slightly varying times and speeds. SWI Engineering has investigated other makes of similarly priced Folder machines but are unaware of any system that could eliminate this hazard on other machines. Previous incidents of this hazard have been caused by poor machine structural design. The SWI Folders have a much sturdier structural character. Therefore the likelihood of this kind of failure on a SWI Folder would be much lower than has been seen on other Australian made folders. Furthermore, for the event to cause an injury, the incident must coincide with the presence of fingers under the clamp, making the combined likelihood of injury very low.

Summary:

SWI Folders have several engineering controls in place that were not in place on machines that have experienced these failures. These controls, combined with moderate vigilance in maintenance and operator training leave only a very small residual risk of this hazard causing an injury. Combining the engineering controls with effective maintenance will completely eliminate the hazard.

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MACHINE RISK ASSESSMENT

MACHINE: **Folder/Slitter**

HAZARD TO BE ASSESSED: **Finger crushed by clamp during normal operation**

Assessment by: Darren Monson Date: 11/05/2005

PART A
Assumed Machine Use:

- The customer regularly maintains the machine in good working order.
- Parts replaced are same specification as original, especially laser guard components, safety PLC and electrical wiring.
- No mechanical or electrical modifications are made to the original design.
- Machine is always operated with correct mute point and laser guard position settings as advised in the machine manual.
- Operators will stop machine use if they become aware of any problem with the muting or laser guard system.
- General principles of AS1219 can also apply to Folders.

PART B
Incident History:

Many incidents are known. Most occurred without any laser finger protection system. One incident is known to have occurred whereby a laser finger protection system was installed, but not being used correctly. With that particular system, the operator could over-ride the protection by depressing the clamp pedal multiple times. Presently, SWI are not aware of any finger crush injuries having occurred on any machines manufactured by SWI.

PART C
Possible Injuries:

- Broken bones in fingers (reversible)
- Minor amputation of fingers (irreversible)

PART D
Failure Mode Analysis:

Failure of these components/systems will cause this hazard:

1. Mute point set too high
2. Laser guard in wrong position
3. Laser guard system malfunction

PART E
Objective of Risk Controls:

Detect when the operators fingers are at risk of being crushed by the clamp beam and inhibit clamp movement in this case.

PART F
Previous Controls:

- Dual operator pedals
- Operator training

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PART G

Risk Controls:

SWI have implemented the following engineering controls:

- CAT 4 laser finger detection system monitored by Jokab Safety PLC
- Clamp lowering is controlled by the safety PLC as well as the machine control PLC.
- CAT 4 fail-safe mute point sensors also monitored by the safety PLC.
- The laser, if broken, cannot be over-ridden by multiple pedal depressions
- Instruction in machine manuals as to how to set the mute point and laser guard.
- Correct setting of mute point and laser guard before handover to the customer.

Operational Controls:

- Frequent maintenance inspections to ensure laser finger detection system is in good condition.
- Pre-start machine checks to check that mute point and laser guard positions are correct.
- Instruction in machine manuals as to how to set the mute point and laser guard.
- Correct setting of mute point and laser guard before handover to the customer.

PART H

Additional Hazards Introduced By Controls:

- The operators should not use their fingers to check the correct function of the laser finger detection system.

PART I

Residual Risk:

The residual risk can be eliminated by using good operating practice. Operators should be trained, and develop the habit of never placing fingers under the Folder clamp. Any circumstance that apparently requires operators to place their fingers under the clamp should be analysed for alternative solutions, such as reaching from the back of the clamp, or using small hand tools to position the workpieces.

Assuming moderate success with these administrative controls, combined with the engineering controls, the residual risk is very low.

The customer must be vigilant in maintaining the laser finger detection system in good working order and within the correct settings.

The use of a correctly set laser finger detection system does limit the folder functionality. Operators may be temped to over-ride or otherwise remove the effectiveness of the laser finger detection system to allow the folder to perform tasks which it cannot do with the laser finger detection system in operation (for example to unfold a work piece)

PART J

Discussion:

SWI Engineering is constantly investigating methods to improve their Folder design. The current design and function of the laser finger detection system uses the highest quality control components available. The function is as robust as any internationally available system. Presently, there is no manual over-ride,

which some laser finger detection systems do have. The correct setup and maintenance of the system is critical to its effectiveness and is the primary area of residual risk.

Summary:

SWI Folders have engineering controls in place that are based on AS4024 and AS1219 principles. The laser finger detection system used highest quality components and cannot be manually over-ridden. If the operators maintain the laser finger detection system in its correct condition, the risk of injury is extremely low.

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MACHINE RISK ASSESSMENT

MACHINE: **Folder/Slitter**

HAZARD TO BE ASSESSED: **Operator hit or cut by the slitter**

Assessment by: Darren Monson Date: 11/05/2005

PART A
Assumed Machine Use:

- Parts replaced are same specification as original.
- Any modifications to the machine do not effect the control of slitter activation. The slitter can only be activated when the clamp and apron are in the fully down position.
- No mechanical or electrical modifications are made to the original design.

PART B
Incident History:

Few incidents are known and injuries tend to be minor, bruises etc as the slitter will generally knock the person away from the machine if they are struck by it during operation.

PART C
Possible Injuries:

- Broken bones (reversible)
- Minor amputation of fingers (irreversible)

PART D
Failure Mode Analysis:

Failure of these components/systems will cause this hazard:

1. Operator is unaware of slitter operation AND in a position where they will be struck by the moving slitter.
2. The operator is aware of slitter operation but cannot move to a safe location due to tables or trolleys in close proximity to the machine.
3. The main operator controlling the slitter does not check that the slitter is clear before activating it.
4. Operators place hands in areas near the end of the slitter travel that become pinch points while the slitter is nearing the end of its travel.

PART E
Objective of Risk Controls:

1. Ensure both the operator and any bystanders are aware of the slitter operation
2. Design the slitter in such a way that if it does strike anyone, they will be safely pushed aside.

PART F
Previous Controls:

- High visibility color used for the slitter head
- Flashing lights, sirens to activate when slitter in operation

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PART G

Risk Controls:

SWI have implemented the following engineering controls:

- Guards over the slitter wheels to prevent operators coming in accidental contact with the slitter blades should they be struck by the slitter.
- Slitter support arms have break-away detent so that they will fold away upon contact with any obstruction.
- Minimise pinch points at slitter end travel with chain guards and small end stops.

Operational Controls:

- Operator must check for others in the path of the slitter before activation.
- Pre-start machine checks to check that slitter blade guards are installed and in good condition.

PART H

Additional Hazards Introduced By Controls:

- None

PART I

Residual Risk:

There is still scope for bystanders to be struck by the slitter. Customers require the slitter to travel at speeds around 50 metres / minute. The design of the slitter and support arms is such that any collision causes only minor injury. There is no engineering control to prevent contact with the moving slitter. This is general practice throughout these types of machines world-wide. During the slitting operation, customers require their operators to stand close to the machine to handle the work piece during the slitting operation. The operators vigilance is the primary defense against collision.

PART J

Discussion:

The current machine design is consistent with generally accepted practice for this kind of machine. While operator vigilance is important to prevent collision of the slitter, the slitter has been designed to minimize injury if such a collision does occur. Lights and sirens have been considered. The operation of the slitter itself does make significant noise which is equally audible as any siren or bell that would be tolerable in a manufacturing environment.

Summary:

Injury from this hazard is rare. There are no engineering controls preventing the slitter from striking a bystander. Operators must be aware of the machine's position at all times while working, and the operator must check the working area before activating the slitter. The slitter has been designed to minimize potential injury if a collision occurs.

MACHINE RISK ASSESSMENT

MACHINE: **Folder/Slitter**

HAZARD TO BE ASSESSED: **Operator injured by backgauge**

Assessment by: Darren Monson Date: 11/05/2005

PART A
Assumed Machine Use:

- Rear guards are in place and interlocked with machine.
- Any modifications to the machine do not effect the control of slitter activation. The slitter can only be activated when the clamp and apron are in the fully down position.
- No mechanical or electrical modifications are made to the original design.

PART B
Incident History:

No known incidents.

PART C
Possible Injuries:

- Broken bones (reversible)
- Minor amputation of fingers (irreversible)

PART D
Failure Mode Analysis:

Failure of these components/systems will cause this hazard:

1. Operator reaches through into back gauge path while backgauges are moving.
2. Someone working at the rear of the machine and the backgauges are moved.

PART E
Objective of Risk Controls:

1. Reduce the possibility of someone contacting the moving backgauge.

PART F
Previous Controls:

- Rear perimeter guards.
- Isolation procedures.

PART G
Risk Controls:

SWI have implemented the following engineering controls:

- Close fit guards over backgauge drive shaft.
- Interlock switches provided for customer to fit rear fence on site.
- Customers are offered the rear fence with the folder.
- Machine must be fully RESET if someone opens the rear fence interlock.
- Slower backgauge speed.

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Operational Controls:

- Isolation procedures.

PART H

Additional Hazards Introduced By Controls:

- None
- It is possible for someone to close themselves in the rear fence area and have another person operate the backgauge.

PART I

Residual Risk:

Some customers elect not to install a rear fence. The backgauges can also be contacted through the front of the machine. Operators should develop a habit of keeping hands clear of the backgauges. When backgauge adjustment is required, the machine should be isolated at the main power switch. Some customers also request for faster backgauge speed, which does increase the risk of inadvertent contact.

PART J

Discussion:

The current machine design is consistent with generally accepted practice for this kind of machine. It is important that the machine is isolated while working on the backgauge. During normal operation, operators should have a habit of not putting hands near the backgauge.

Summary:

There is no known injury from this type of hazard. There are no engineering controls that completely eliminate the possibility of accidental contact with the moving backgauge. Operators must be aware of the machine's position at all times while working, and the operator must check the working area before activating the backgauge.

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MACHINE RISK ASSESSMENT

MACHINE: **Folder/Slitter**

HAZARD TO BE ASSESSED: **Operator crushed by folding apron**

Assessment by: Darren Monson Date: 11/05/2005

PART A
Assumed Machine Use:

- Any modifications to the machine do not effect the control of apron activation. The apron can only be activated when the clamp is fully down and the slitter in its home position.
- No mechanical or electrical modifications are made to the original design.

PART B
Incident History:

There are no known injuries from this hazard.

PART C
Possible Injuries:

- Broken bones (reversible)
- Minor amputation of fingers (irreversible)

PART D
Failure Mode Analysis:

Failure of these components/systems will cause this hazard:

1. Operator is unaware of apron operation AND in a position where they will be struck by the moving apron.
2. The operator is aware of apron operation but cannot move to a safe location due to tables or trolleys in close proximity to the machine.
3. The main operator controlling the apron does not check that the apron is clear before activating it.
4. Someone is working under the apron while it is lowered.

PART E
Objective of Risk Controls:

1. Ensure both the operator and any bystanders are aware of the slitter operation

PART F
Previous Controls:

- Operator training
- Isolation of hydraulic and potential energy while working under the apron.

PART G
Risk Controls:

SWI have implemented the following engineering controls:

- Operators are trained in the correct use of the folders during commissioning.

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Operational Controls:

- Operator must check for others in the path of the apron before activation.
- Machine must be isolated when working under the apron.
- The space between the apron and any trolleys or materials handling tables should be sufficient to allow the operators to stand safely clear of the apron during folding.

PART H

Additional Hazards Introduced By Controls:

- None

PART I

Residual Risk:

There are no engineering controls to eliminate the possibility of contact with the moving apron.

PART J

Discussion:

The current machine design is consistent with generally accepted practice for this kind of machine. Operator vigilance is important to prevent accidental contact with the moving apron. The action of the apron does tend to push obstructions away rather than cause any pinching or crushing. If anyone is working under the raised apron for maintenance or cleaning purposes, then the machine should be isolated.

Summary:

There are no known injuries caused by this hazard. There are no engineering controls preventing the apron from striking a bystander. Operators must be aware of the machine's position at all times while working, and the operator must check the working area before activating the apron. Fixed tables and trolleys should be positioned far enough away so as not to cause a crush point with the apron.

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