Planer Safeguarding System Case Study

Planer Safeguarding techniques and how to use them as alternative control methods for minor servicing tasks.

Revision 1 of document

Revision History		
Date	**Description of Revision**	**Revision**
Feb-11-20	Distributed to BC Forest Safety Council	R1

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1.0 EXECUTIVE SUMMARY

UBSafe Inc. (referred to as UBSafe herein) was contracted by Conifex Timber Inc. (referred to as Conifex herein) to provide a turn-key safeguarding system on the planer and associated equipment in Fort St. James, British Columbia. Conifex in turn have approved supplying the BC Forest Safety Council with this case study on their planer safety system designed by UBSafe.

The scope of safety system starts at the planer infeed (pineapple roll #1) and ends at planer outfeed belt #1.

The safety system has been validated against the requirements of the BC OHS regulations, and where it meets or exceeds these requirements, the relevant machine safety standards including:

- CSA Z432-04 & -16 “Safeguarding of machinery”
- ISO 13849-1:2015 “Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design”
- ISO 13849-2:2012 “Safety of machinery – Safety-related parts of control systems – Part 2: Validation”

Conifex relied upon lockout as a safeguard in operational and maintenance activities in and around the planer equipment. Safeguarding around the planer system was a balance of procedure and some point of operation fixed guarding around rotating hazards. This approach has historically been the norm within the industry. Utilizing lockout in this fashion greatly increases the risk of injury due to complexity of lockout, motivation to circumvent procedure, and frequency of non-safe failure of energy isolating devices.

The results of the project are as follows;

1. Provision of three safeguarding approaches to suit different requirements at different sawmills within the industry.
2. Application of fully integrated safeguarding approach to Conifex Ft. St. James planer.
3. Significant enhancement of safety in operational activities, minor servicing activities, and maintenance activities.
4. Reduction of per occurrence planer entry time from 80 seconds to 20 seconds.
5. Reduction of planer downtime related to jam clearing by 50%.
6. Legislative compliance.

The purpose of this document is to explain the project phases, methodologies, challenges and process to aide future planer projects at other sawmills.

Report prepared by

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UBSafe Inc.

2.0 INTRODUCTION

2.1 Legislative framework within British Columbia applicable to this report.

BC OHS regulation requires safeguarding compliance under regulations 12.2, 12.3 and 12.4. Regulation 10 requires that lockout be applied for maintenance tasks. Where safeguarding is not adequately and effectively applied, regulation 10.2(b) requires that lockout be applied for production tasks as well as maintenance tasks.

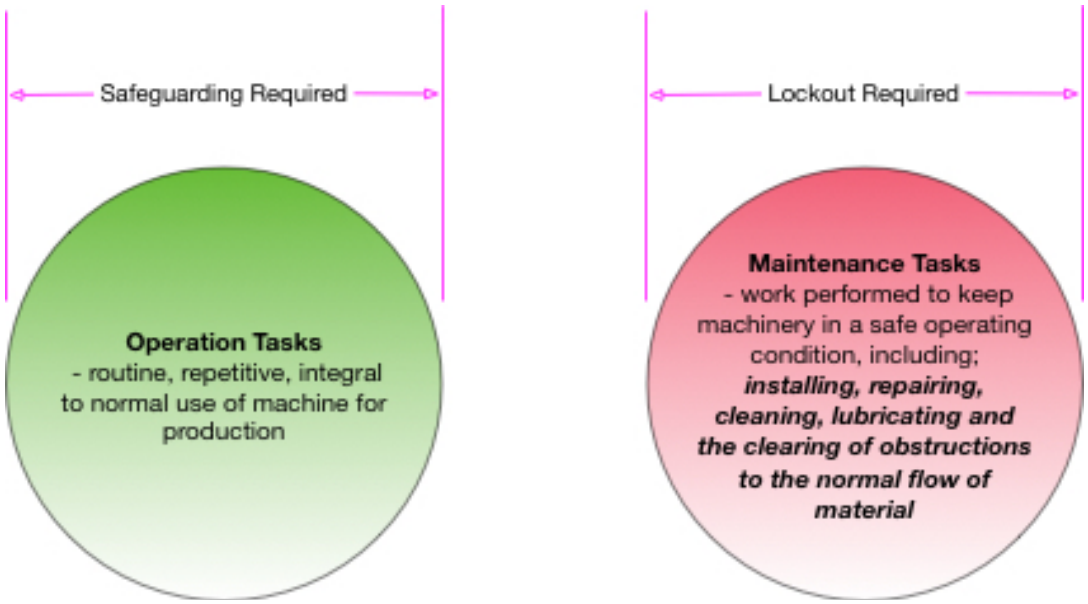


Figure 1 – legislation requirement

Per regulation 10.10, when a maintenance task is not practicable, pending board approval, a 'Control System Isolating Device' or CSID can be used instead of lockout to perform that specific task.

CSID's and the requirements for their use / approval is contained in guideline 10.10 of the regulation. The 'CSID' in the case of the planer project are the door guard-locking devices, which are physical safety devices incorporated to a moveable barrier that creates an 'air gap' between its operating elements. The safeguarding system incorporated with the CSID must be designed and implemented to a minimum performance level that equals or exceeds the level of risk faced. As well, the CSID system must provide equal to or higher protection than lockout.

Another common term used for CSID is ACM or Alternative Control Method.

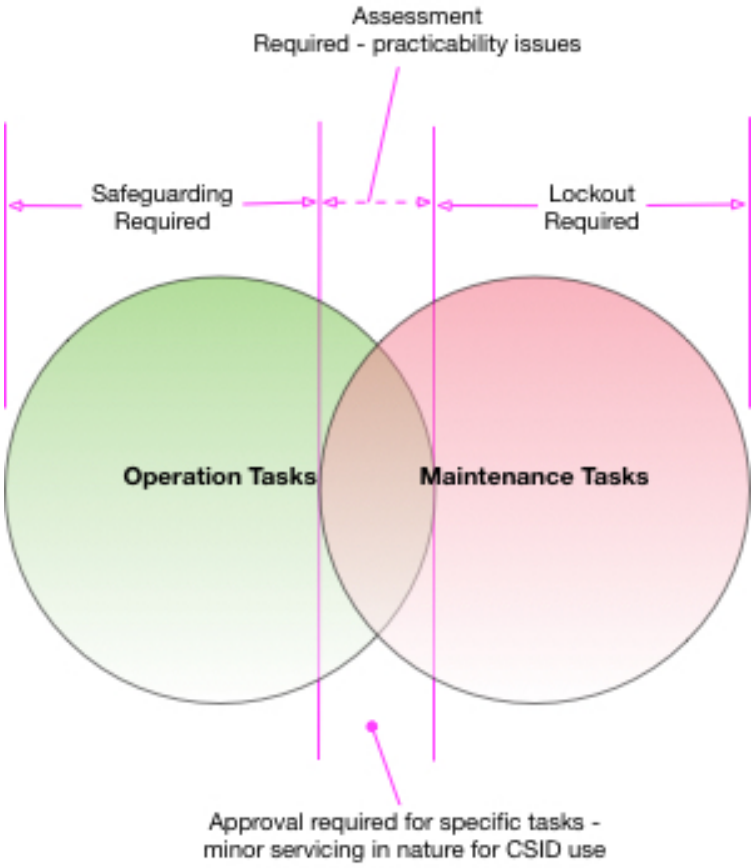


Figure 2 – Legislation requirement for CSID use when lockout is not practicable

2.2 Planer Equipment Layout

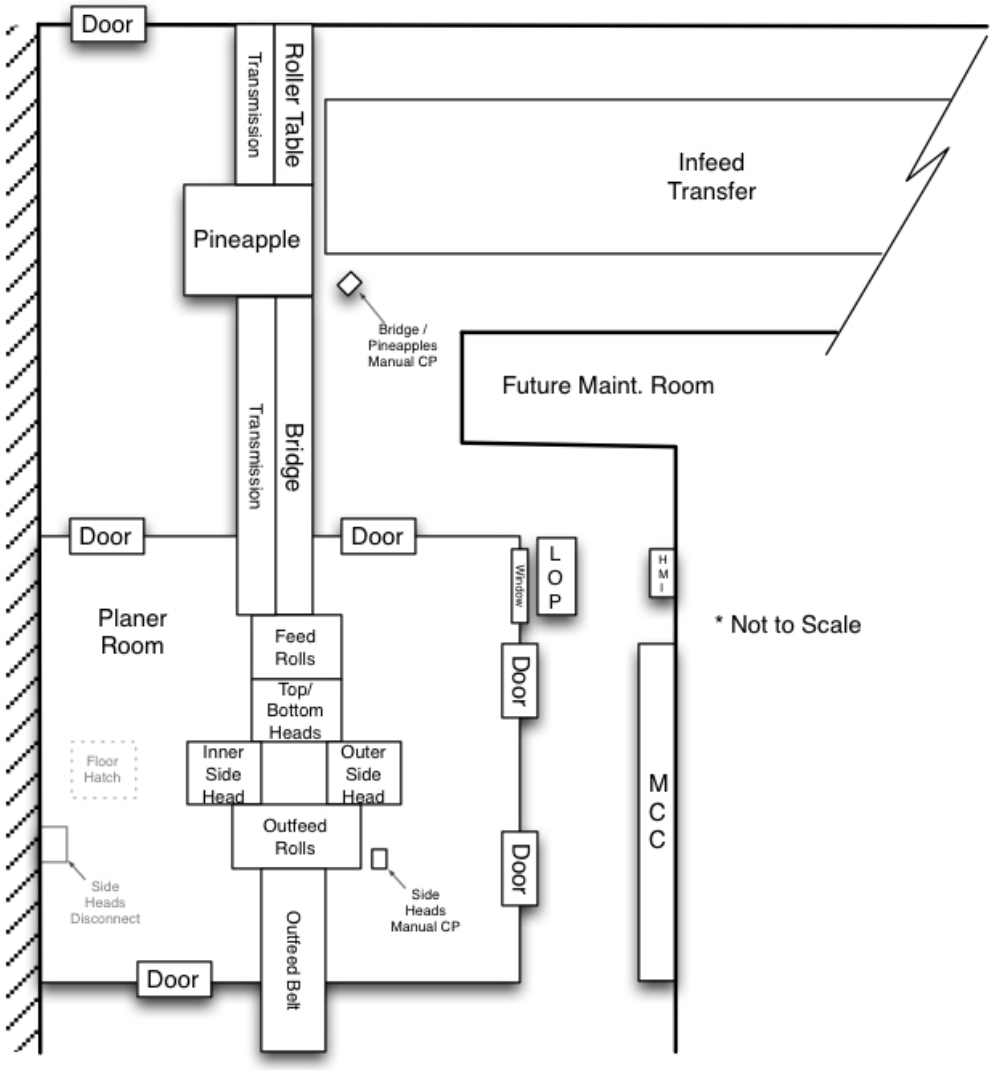


Figure 3 – Conifex Ft. St. James Planer equipment layout

The scope of the planer remediation project starts at the pineapple rolls hold down shoe (not shown – hangs above infeed transfer at pineapple rolls) thru to the Planer room outfeed belt.

2.3 Planer history, tasks and hazards

Some consider the planer to be the most hazardous piece of equipment in the modern sawmill. Due to lack of safeguarding and failure of lockout, there are multiple significant injuries per year in BC alone. Generally, these injuries are related to clearing of jams around the heads whereby the person is exposed to the hazard of the rotating head(s) as they coast to a stop (takes approximately 12 minutes). There are other hazardous energies as well.

2.3.1 Basic planer tasks

This is not a complete list. Basic tasks along the length of the equipment include;

1. Setup (adjustment of guides, etc. for different board sizes)
2. Jointing (performed with heads powered and spinning and jointing speed)
3. Inspection
4. Clearing of skews, jams and 'snipes' (small piece of broken off wood)
5. Cleaning
6. Vibration analysis
7. Lubrication
8. Maintenance PM and breakdown

2.3.2 Basic planer hazards

This is not a complete nor detailed list. Basic hazards along the length of the Conifex equipment include;

1. Pineapple area
    a. Gravity / crush at;
        i. hold down shoe (pneumatic cylinders)
        ii. pineapple rolls (hydraulic cylinders – RMC servo control)
        iii. boost roll (hydraulic cylinder – RMC servo control)
    b. Drawing in / in-running nips (can be run-on / coast related)
        i. Pineapple rolls (electric VFD)
        ii. Boost roll (electric VFD)
        iii. Live shear fence (hydraulic motor)
    c. Impact
        i. From board fed from up/downstream equipment
2. Bridge / infeed area
    a. Gravity / crush
        i. Bridge (2 sections) (pneumatic cylinders)
        ii. Boost rolls
        iii. Hold down arms (pneumatic cylinders – horizontal, no crush)
    b. Drawing in / in-running nips (can be run-on / coast related)
        i. Roll case
        ii. Boost rolls
3. Planer Room area
    a. Gravity / crush
        i. Planer infeed rolls (hydraulic cylinder – RMC servo control)
        ii. Planer top head (hydraulic cylinder – RMC servo control)
    b. Drawing in / in-running nips (can be run-on / coast related)
        i. Planer infeed rolls (electric VFD)
        ii. Planer top, bottom, inside and outside heads (electric VFD)
        iii. Outfeed belt at drum (electric FWD/REV contactor w/ softstart)

Many other hazards exist related to power transmission components (shafts, pulleys etc.), slips, trips, falls, etc. These were part of the risk assessment process but outside of the scope of this report.

Dust and explosion related hazards and rating of the various areas were considered in the system design but are outside the scope of this report.

2.4 Safeguarding methodology

Below are the basic steps to a safeguarding project;

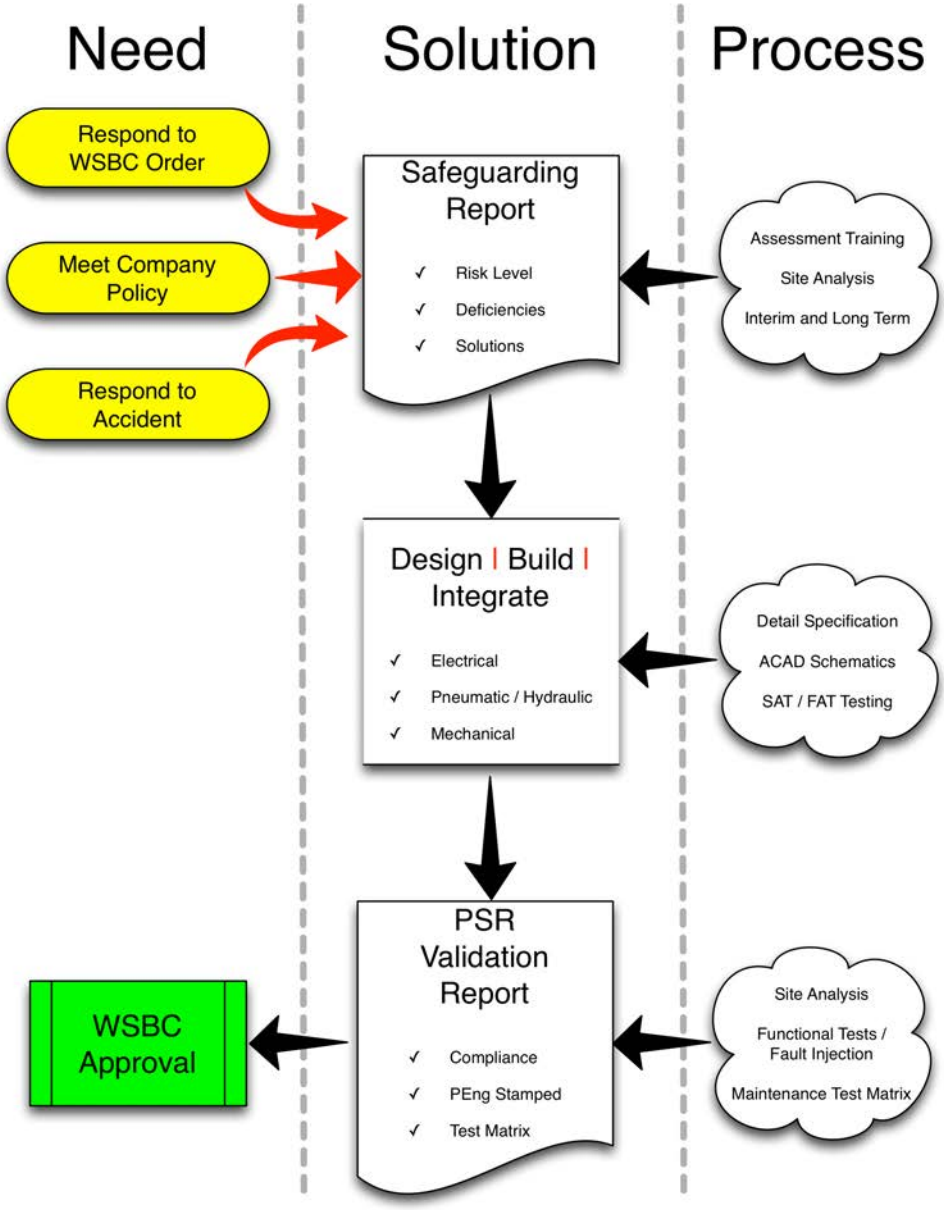


Figure 3 – UBSafe Process Model

2.4.1 Step 1 – Risk Assessment

UBSafe performed a task-based risk assessment. The process of risk assessment that was followed as detailed in CSA Z432-04. This method is simple and ensures that safeguarding solutions are considered in the hierarchal order of effectiveness (see CSA Z432-04 table 2) and that the safeguarding solution meets or exceeds the level of risk faced (see CSA Z432-02 table 1). There are other Risk Assessment models that can be utized.

2.5 Maintenance mode selection

Conifex requested to provide complimentary protection to enhance lockout for certain maintenance tasks such as jointing, vibrations analysis and sizing/set-up. These tasks require working on energized equipment under the provisions and requirements of OHS Regulation 10.12 (residual hazards present). The safety circuits installed for these maintenance modes are control reliable (PLd). These maintenance modes are an enhancement to lockout – isolating the hazardous energies that can be isolated and keeping the required energies live for the maintenance task at hand. Lockout is also required to be applied to the isolated energies to remain within regulatory requirements.

An application could be made to WorkSafeBC to rely on the safety system for isolation of the hazardous energies that are not required for the task being performed as opposed to lockout. At Conifex this is the how the hazardous energies not related to the task are isolated. The tasks are performed under a combination of safety system isolation and energized work procedure (see regulation 10.12 requirements).

It is important to recognize that in modern machinery there are typically three levels of isolation required;

1. Lockout
2. Safeguarding
3. Combination of Lockout and Safeguarding

To enter a maintenance mode, a Pilz safety mode selector was integrated into the system whereby RFID tags are distributed to personnel. Each tag has an access level and to change modes a procedure incorporating acknowledgement from the HMI is followed. Different functions require different access levels.

While the safety system provides complimentary protection, the maintenance modes of the safety system are all an enhancement to lockout procedures, with tasks being performed under BC OHS Regulation 10.12 (working on energized equipment). It is Conifex's responsibility to properly train its employees to recognize the residual hazards and enforce safe operating procedures for each maintenance task.

Conifex must enforce the use of safety system for the intended tasks. Because millwrights will potentially have access to multiple levels of maintenance modes, the use of a maintenance mode for its intended task must be strictly enforced. The HMI / SCADA system is capable of logging this data and it could be

Over time as users become more comfortable with the system, there may be temptation to increasingly use the safety system instead of Lockout. Lockout, and also the scope of tasks that are being performed with the safety system, must always be enforced; this remains solely a Conifex responsibility.

2.6 Gravity Hazards

Conifex Safe Work Procedures requires the use of tools and visual confirmation that the restraint devices are engaged to handle material that is located under any vertically restrained equipment (6 feed rolls, bridge sections 1 and 2, top head and hold-down arm). The gravity residual hazard could be present if lack of bridge maintenance result in erroneous indication of shot-pin extension (i.e. bridge is so loose that it can be displaced by a shotpin's pressure).

2.7 Acknowledged forced entry function

Due to certain sequencing and process conditions, abnormal circumstances could occur whereby the unlock conditions will not be met during a normal request to enter sequence. To deal with this, indication of the RTE requirements are displayed on the HMI and a forced entry function has been incorporated into the safety system at Conifex's request. In conjunction with the forced entry function, an 'acknowledge' screen has been incorporated into the HMI to give users a means of visually confirming which hazards may be present, then acknowledging the forced entry. This function will only allow ignoring of process conditions and shot pins not engaged. Safety functions such as the zero-speed sensing of the heads, etc, cannot be ignored to gain entry under any circumstances. Lockout would be required to unlock / open the doors if a safety function's requirements are not met.

2.8 Personal locks on guard doors

Each person that enters the guarded areas must put their own personal lock on the door when under protection of the safeguarding system. This is to ensure that the person remains in exclusive control of the isolation mechanism. This is also a requirement of the approval process under regulation 10.10.

The guard locks used in the safety system have an emergency release handle on the inside of the guarded area to allow egress in the case that a person fails to follow the procedure of locking the guardlock and becomes trapped inside the safeguarded space (would require two or more people and several steps performed with intent such as closing and locking the guard locked door and resetting the safety system).

2.9 Use of enabling device for setup / sizing mode

Within the standards a methodology is used to protect personnel when performing setup, sizing, maintenance and feeding of material type activities (see CSA Z432-16 clause 7). Hazardous motion of the bridge and infeed rolls is controlled by requiring the millwright to engage and maintain both an enabling device (which forms part of the safety circuit) and engaging hold to run push button controls.

3.0 FAULT EXCLUSIONS ASSUMED THE SAFETY ANALYSIS

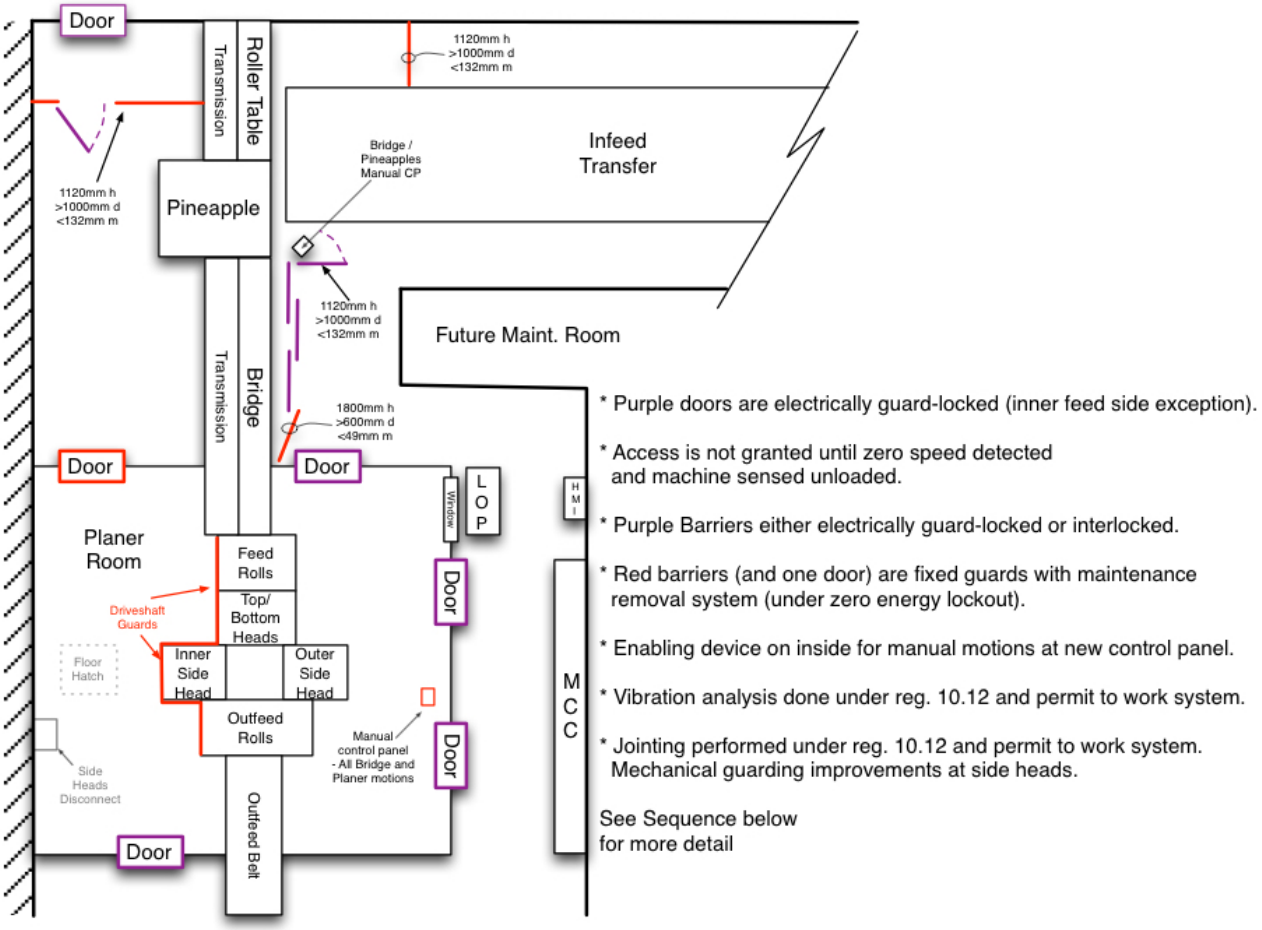
The following faults have been considered in the analysis of the safety circuit. Note that this list is not necessarily exhaustive.

Fault considered	Comments
Mechanical faults	
Bolts loosening. Examples: ▪ Loosening of shot pin cylinder against planer frame, resulting in the entire shot pin assembly coming off the frame, potentially resulting in false indication of engagement ▪ Loosening of proximity switch nuts, potentially resulting in the prox switch moving forward and giving false indication of shot pin engaged ▪ Disconnect between guard lock and the door allowing door to be opened without detection	Can be excluded, in the case of carefully selected material, manufacturing process, locking means and treatment, according to the specified lifetime. Ultimately, the justification (and subsequent documentation) will be Conifex's responsibility. However, it is in UBSafe's opinion that Conifex not rely on fault exclusion in this case, and instead enforce SWPs that require checking the shotpin is engaged in order to deal with the residual hazard. To rely on a fault exclusion, regular maintenance inspection, documentation and preventative maintenance schedules become essential controls to the related safety functions. It is the responsibility of Conifex to ensure this is effectively applied.
Mechanical disconnect between motor and rotating medium (for example, planer head)	This could result in false indication of zero speed and expose personnel to rotating hazards. Further justification for checking all hazards (part of SWPs) before performing work in the area.
Breakage of guard lock locking element (bolt)	Holding force of bolt is considered sufficiently large to withstand all expected operating forces, with an appropriate safety factor. Guard lock holding force (ISO 14119) F_{zh} = 2000N.

Electrical faults	
Unintentional energization of shot pin solenoids during production mode request to enter, resulting in loss of gravity control	Short circuits may be excluded due to the use of dedicated (armored) cables for each solenoid.
Electrical disconnect between back EMF relay and motor terminals	This could result in false indication of zero speed, and potentially expose personnel to rotating hazards. UBSafe does not recommend excluding this fault, and measures to address the residual hazard must be taken (visually confirm rotating hazard is stationary prior to working on or near).
Pneumatic / hydraulic faults	
Catastrophic failure of cylinder or seal resulting in equipment drift	Generally, not excluded (at least for cylinder seals). In this case, the operator/millwright is considered the 'monitor' since it would be readily apparent upon entering the guarded area if the cylinder is starting to drift. For tasks where reach in is required, a tool must be used to remove the user from the hazardous area, or the load must be separately restrained.
Failure of hose/pipe connection between cylinder port and check valve	For the top head cylinders, the check valve is mounted directly to the cylinder port and so it can be reasonably justified to exclude the fault in this case. The connection between the hold-down arm load hold valves and cylinder is hard piped, so it is reasonable to exclude the fault of breakage of the connection between load hold valve and cylinder.
Catastrophic failure of load hold valve (either on top head or hold-down arm), or catastrophic failure of cylinder seal resulting in drift.	The check-valve-based load hold systems on the top head (hydraulic) and hold-down arm (pneumatic) are effectively dual channel systems, although this is based on the assumption that in both pieces of equipment, a single load hold valve is sufficient to handle the entire load. Hydraulic system: observed 1500PSI operating pressure at setworks HPU. Assuming top head cylinders are identical, a single check valve must sustain at least 3000PSI under normal conditions (likely less under static load). The cartridge valve is rated to ~5000PSI (350bar). Pneumatic system: hold-down regulator pressure not known, and static load of hold-down arms not known. Pneumatic load hold valves are rated to 150psig.

4.0 OVERVIEW OF THE SYSTEM

4.1 Layout diagram



4.2 Major components used

1. Guard lock – AB 442G multifunctional access box
2. Safety PLC –
   - AB Compact GuardLogix 5370 L3
   - Point Guard I/O 1734-IB8S and 1724-OB8S via Ethernet adaptor 1734-AENT
3. Contactors – AB 100S-C series force guided
4. Pneumatic isolation valve – SMC
5. Hydraulic isolation valve – Sidner
6. Load hold (hydraulic) - ATOS
7. Load hold (pneumatic) – Ross Controls
8. Enabling device – ABB Safeball
9. Trapped key – Schmersal
10. Shot pins (gravity control) - Wolftek

4.3 Other system components (process system)

1. Mitsubishi 760 series VFDs
2. Wolftek tensioning system (Rockwell and RMC) - hydraulic proportional valve control
3. GLC Setworks System (Rockwell and RMC) - hydraulic proportional valve control
4. Control Logix Process controller

4.4 Photos

	The cost to change the Mitsubishi Drives to the newer series where 'Safe Torque Off' on board safety is included was cost prohibitive. Conifex selected the option of redundant, monitored contactors in the safety circuit. The left-hand panel contains the safety controller, local safety I/O and power supplies. The right-hand panel contains primarily contactors.
	This is the main operation control panel at the planer room. The left-hand monitor is dedicated to the safety system. The small panel under the monitor contains the mode selection controller, an Estop, the jointing enable key, two blue reset push buttons (one for each zone), and a white 'request to enter' push button.

	This is the Rockwell multi-function gate switch which incorporates a solenoid guard locking function. When the switch is opened, two lockout points are presented for personal locks which disable the device from being able to be closed or reset.
	This is the Stetson Ross planer at Conifex. If you look closely you can see one of the several shot pins (yellow cylinder cap) which is controlled and monitored by the safety system. The shot pins were used on many gravity loads such as the boost rolls, pineapple rolls and bridge. Hydraulic monitored load holding valves were used for the top head, and pneumatic load holding valves were used for the infeed shoe.

Photo of the bridge and one of the load holding shot pins.

Reaching under the bridge to clear ‘snipes’ was still not considered a task that should be done. It was found that if the bridge was not maintained that it was possible for a shotpin to displace the bridge (if the bridge is out of position) and give a false indication that the pin is engaged.

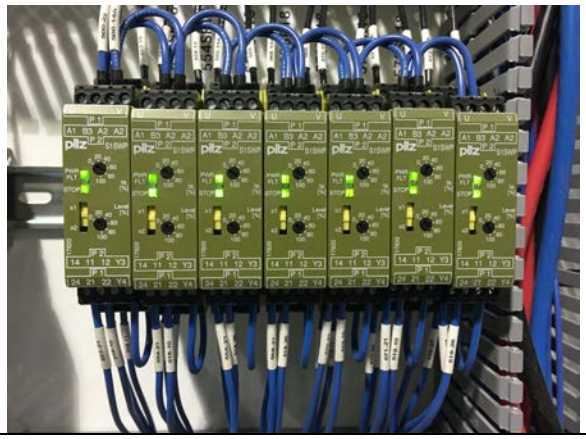
While the hazard associated to lack of maintenance of the bridge could be excluded by application of ISO 13849 part 2 fault exclusions requiring regular maintenance and documentation, to the project team it seemed still very easy for an operator to utilize the existing chains for secondary mechanical restraint (which effectively ‘locks out’ the gravity hazard) when reaching under the bridge is required.

Enhancements to the shot pin system and adding a pneumatic load holding device on the bridge cylinders as a secondary device is a method that would control most of the residual hazard, though no safety device can circumvent all hazards related to failing structural components and lack of machine maintenance.

Backside of bridge and pineapple rolls.

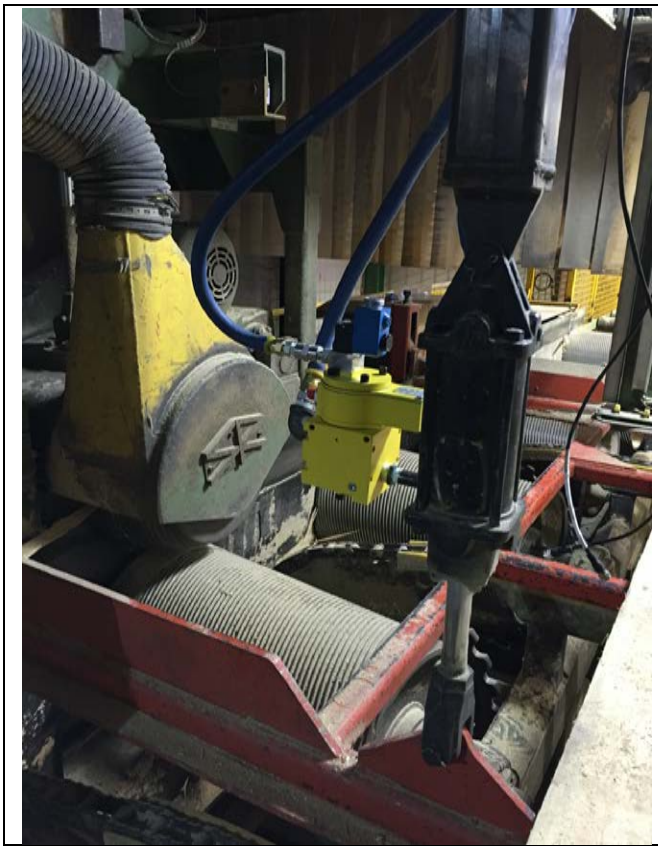
In the lower right end of the picture you can see the exposed drive belts and pulleys for the bridge roll case. The power transmission components still require local guarding.

	CS02 safety system operation panel at main planer entrance (zone 2).
	This is the manual control panel on the inside of the planer room. The panel is used when jointing mode (mode 3) is entered whereby the millwright must select and acknowledge the mode change, remove the jointing key from the CS02 panel, and insert the key into one of the jointing key switches shown here. This then allows the top or bottom head (one or the other) to be jointed. The yellow and black 'safeball' is an ABB enabling device that is used in mode 4 (setup/sizing) to jog the bridge roll case and feed rolls to bring a board into the planer.



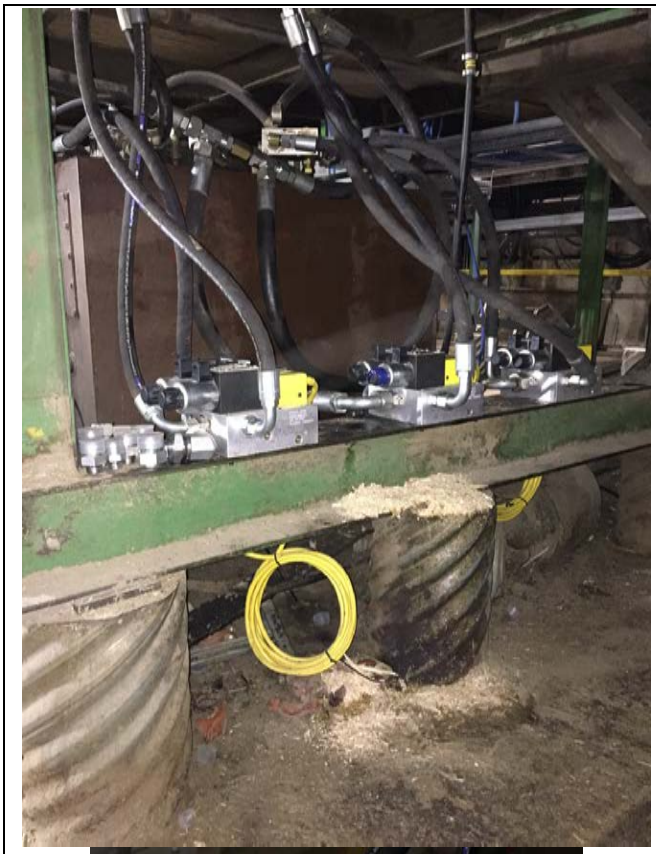
This is the bottom planer head and the Pilz 'back EMF' style safety rated zero speed switch used to detect head motion. Once properly tuned the devices detected the slightest head motion resulting in the system remaining locked until zero speed is achieved.

The Pilz safety relay resides in the safety cabinet.



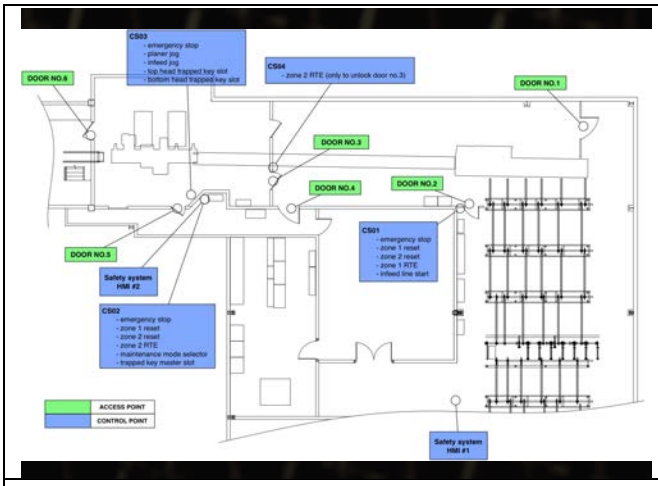
This is a photo of one of the two infeed hold down shoe pneumatic cylinders. Attached to the cylinder lower port is a safety rated, Ross Controls pneumatic load holding valve. This valve is controlled and monitored by the safety system to 'block' the cylinder from being able to extend downward.

The process control signal is also disabled by the safety PLC. The gravity hazard can only be presented by multiple catastrophic system failure, in particular mechanical failure of both of the shoe cylinders (one on each side).



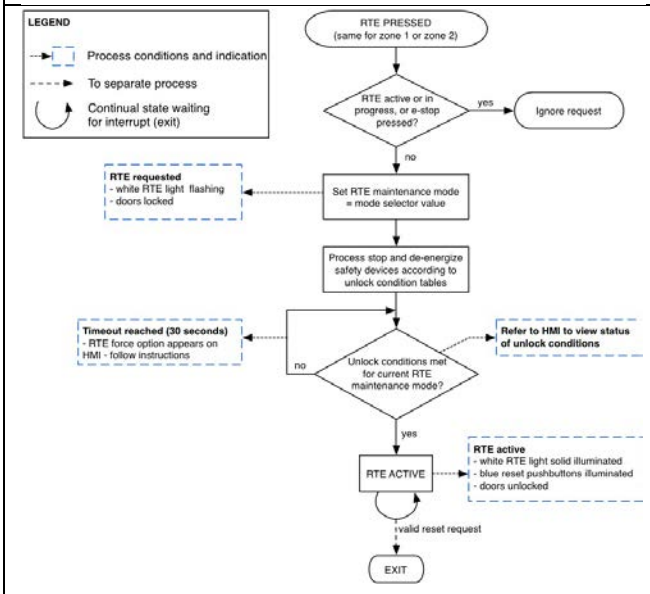
In the basement are three hydraulic pumps. Each unit has a Sidner Engineering safety rated block / bleed hydraulic valve which is controlled and monitored by the safety system.

The valve blocks source pressure and drains system pressure back to tank.



This HMI screen gives an overview of the safety system and door status.

Safety system zones and status.

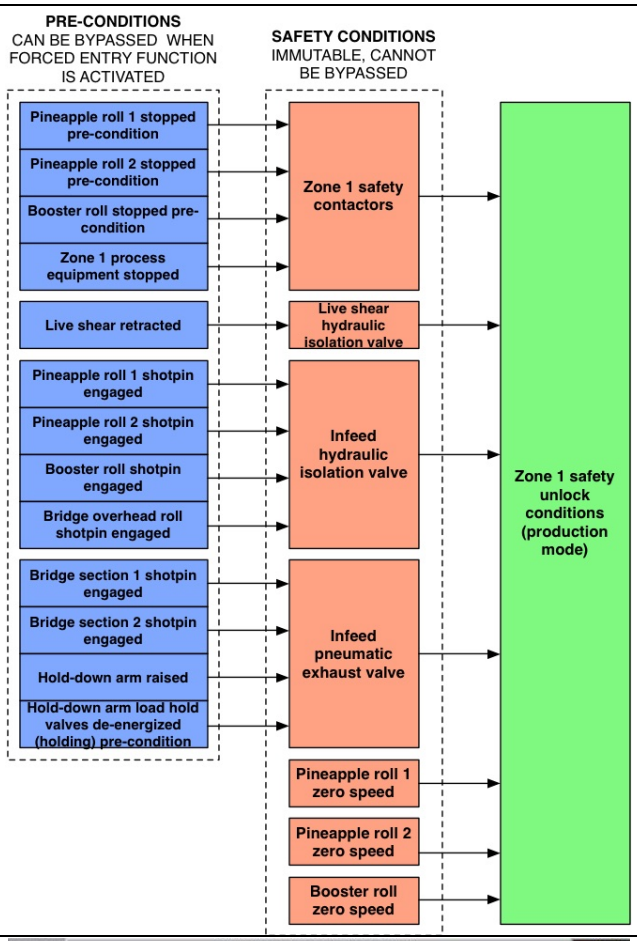


<u>Entering the system</u>

A white pilot light on each zone RTE push button indicates RTE status as follows:

- Slow flash (1Hz): A request to enter has been initiated and the system is performing a controlled stop and waiting for unlock conditions to be met.
- Fast flash (10Hz): The request to enter has reached the timeout value. The force RTE function is activated on the HMI.
- Solid: All safe states have been satisfied and the doors are unlocked.
- Off: Doors are closed and locked and no request to enter has been started.

For production mode, the RTE is zone specific. Zone 1 RTE pushbuttons only control / indicate status for zone 1 and similar is applicable for zone 2.



This information screen gives an overview of the conditions that must be met to enter Zone 1.

This is one of the main overview screens which shows the status of the unlock conditions, safety system mode, request to enter status, etc.

Due to certain sequencing and process conditions, abnormal circumstances could occur whereby the unlock conditions will not be met during a normal request to enter sequence (i.e. bridge could not fully raise due to jam up of boards).

To deal with this, indication of the RTE requirements are displayed on the HMI and a forced entry function has been incorporated into the
safety system.

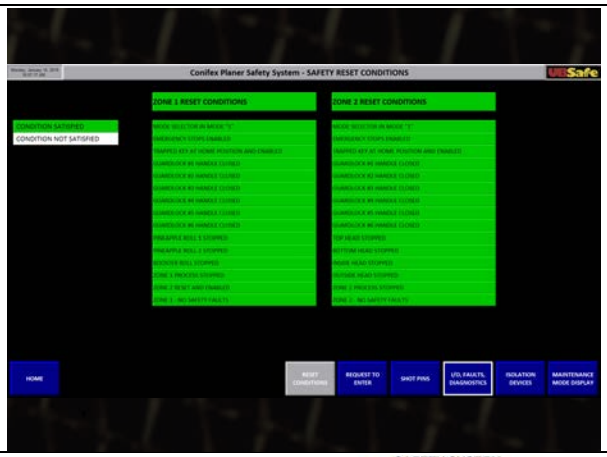
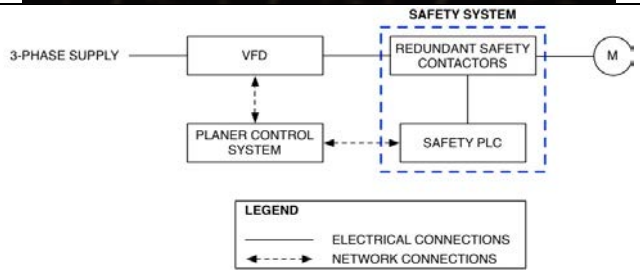
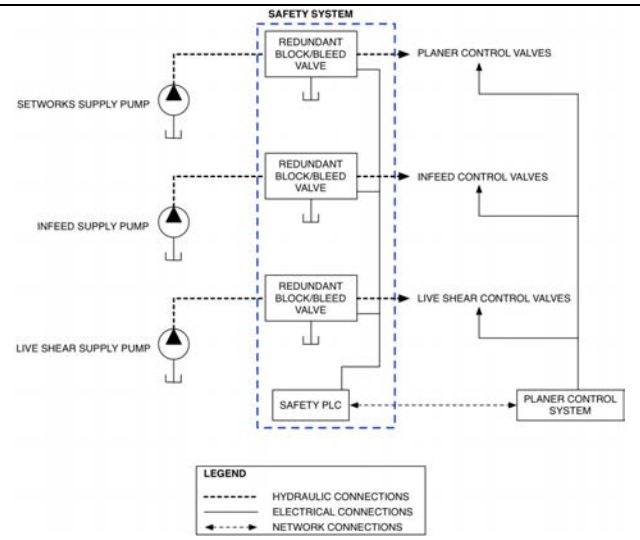
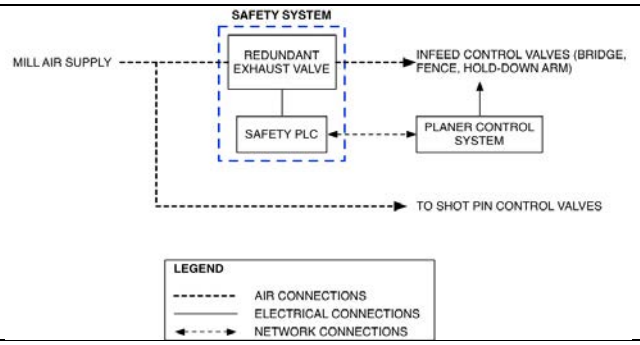
	Overview of the safety system conditions needed to reset and rearm the system. The blue reset push button pilot lights also indicate the safety system status as follows: • Solid: One or more of the reset conditions are not satisfied. Refer to the HMI to see which conditions are not being met. • Flashing: All reset conditions are satisfied, and the zone can be reset using the reset pushbuttons. • Off: The doors are closed and locked and safety is enabled. Planer runs normally using existing controls.
	Basic diagram illustrating the electrical portion of the safety control system.
	Basic diagram illustrating the hydraulic portion of the safety control system.
	Basic diagram illustrating the pneumatic portion of the safety control system.

Table 14: Maintenance mode energy isolation matrix

Equipment		Zone	Production (mode 1)	Vibration (mode 2)	Jointing (mode 3)	Set up (mode 4)	Disable (mode 5)
Electrical (safety contactors)	Feedtable spiral rollcase	1	OFF	OFF	OFF	ENABLE [2]	ON
	Pineapple roll #1	1	OFF	OFF	OFF	ENABLE [2]	ON
	Pineapple Roll #2	1	OFF	OFF	OFF	ENABLE [2]	ON
	Booster roll	1	OFF	OFF	OFF	ENABLE [2]	ON
	Planer feedtable	1	OFF	OFF	OFF	ENABLE [2]	ON
	Metering transfer	1	OFF	OFF	OFF	ENABLE [2]	ON
	Infeed bridge section #1 rollcase	1	OFF	OFF	OFF	ENABLE [2]	ON
	Infeed bridge section #2 rollcase	1	OFF	OFF	OFF	ENABLE [2]	ON
	Infeed bridge overhead roll #1	1	OFF	OFF	OFF	ENABLE [2]	ON
	Infeed bridge overhead roll #2	1	OFF	OFF	OFF	ENABLE [2]	ON
	Planer top feedroll #1	2	OFF	OFF	OFF	ENABLE [2]	ON
	Planer bottom feedroll #1	2	OFF	OFF	OFF	ENABLE [2]	ON
	Planer top feedroll #2	2	OFF	OFF	OFF	ENABLE [2]	ON
	Planer bottom feedroll #2	2	OFF	OFF	OFF	ENABLE [2]	ON
	Planer outfeed top feedroll	2	OFF	OFF	OFF	ENABLE [2]	ON
	Planer outfeed bottom feedroll	2	OFF	OFF	OFF	ENABLE [2]	ON
	Planer outside head	2	OFF	ON	OFF	ON	ON
	Planer inside head	2	OFF	ON	OFF	ON	ON
	Planer top head	2	OFF	ON	ENABLE [1]	ON	ON
	Planer bottom head	2	OFF	ON	ENABLE [1]	ON	ON
	Planer outfeed belt #1 [3]	2	ON				
	Planer jog	2	OFF	OFF	OFF	ENABLE [2]	ON
	Infeed jog	2	OFF	OFF	OFF	ENABLE [2]	ON
Hydraulic & pneumatic	Infeed table live shear	1	OFF	OFF	OFF	OFF	ON
	Infeed bridge and bridge fence	1	OFF	OFF	OFF	ON	ON
	Infeed hold-down load hold valves	1	OFF	OFF	OFF	ON	ON
	Infeed DTS	2	OFF	OFF	OFF	ON	ON
	Setworks system	2	OFF	OFF	ENABLE [1]	ON	ON
	Top head load hold valves	2	OFF	OFF	ENABLE [1]	ON	ON

Maintenance Modes

1. Mode 1 – Production
2. Mode 2 – Vibration
3. Mode 3 – Jointing
4. Mode 4 – Setup / Sizing
5. Mode 5 – Bypass / God mode

Entry into different modes controlled thru RFID key fob that are distributed by management-controlled system.

The HMI screen details which energies are live in which mode. Live energies to be controlled by requirements of Regulation 10.12, energized work.

2.2 Safety system component validation

The following components and associated safety ratings are used in the safety system design.

Component	Make	Model	Safety-related ratings [1]	Certifying body
Guard lock	Allen Bradley	442G Multifunctional access box	Cat.4, PLe, PFHd 2.47E-08	N/A – DoC [2]
E-stop pushbutton	Allen Bradley	800T – X02 SERIES D	Compliance to EN 60947-5-1 B10d – 2.50E+06	N/A – DoC [2]
E-stop pushbutton for hazardous location	Allen Bradley	800H – AP2A	Compliance to EN 60947-5-1 B10d – 1.82E+06	N/A – DoC [2]
Handheld enabling device	ABB	Safeball JSTD1–B	B10d – 2.00E+6	N/A – DoC [2]
Trapped key	Schmersal	SHGV/ESS21S2	Positive break contact per IEC 60947-5-1 B10d – 2.00E+6	N/A – DoC [2]
Safety controller	Allen Bradley	1769-L30ERMS	Cat.4, PLe, PFHd – 1.50E-09	TUV
Safety output card	Allen Bradley	1734-OB8S	Cat.4 PLe. PFHd 5.14E-10	TUV
Safety input card	Allen Bradley	1734-IB8S	Cat.4 PLe. PFHd 5.10E-10	TUV
Safety control relay	Allen Bradley	700S-CF530EJBC	Mechanically linked B10d – 2.00E+06	SUVA
Safety contactor	Allen Bradley	100S-C09EJ322BC	Mirror contacts (IEC 60947-4-1) Mechanically linked Contacts (IEC 60947-5-1)	SUVA
Safety contactor	Allen Bradley	100S-C12EJ23BC	Mirror contacts (IEC 60947-4-1) Mechanically linked contacts (IEC 60947-5-1)	SUVA
Safety contactor	Allen Bradley	100S-C16EJ23BC	Mirror contacts (IEC 60947-4-1) Mechanically linked contacts (IEC 60947-5-1)	SUVA

A verification / validation was performed whereby the safety functions are mathematically calculated to meet or exceed the level of risk faced. Design verification was performed utilizing Sistema software.

Validation of the system was performed by a combination of functional testing and fault injection to test system functionality and failure modes in abnormal conditions such as short circuits and ground faults.

3.2.1 Safety function 2A: Prevent equipment start while door is unlocked

Triggering event	N/A – monitoring function only
Stop category	N/A
Reaction	Once lock signal from guard locks is received, can reset safety circuit and energize isolation devices.
Safe state	Lock signal positively detected by safety PLC and waiting for equipment restart command. Refer to design specification document "CON7-01 Planer design specification document R1.pdf" and addendum "CON7-01_guardlock_design_changes_R1.pdf" for details on safe state and energy isolation.
Circuit performance required	Control reliable as per CSA Z432-04.
Circuit performance achieved	Control reliable as per CSA Z432-04 or a Category-4 structure as per CSA Z432-16.

3.2.2 Safety function 2B: Prevent unlocking until safe state is detected

Triggering event	Request to enter activated for entry in to Zone 1.
Stop category	1
Reaction	The actuators in zone 1 are commanded to stop and the tensioning equipment raises and/or retracts. When the system detects safe state (zero speed, isolation devices de-energized and the restraint systems in place), doors will unlock.
Safe state	All actuators at rest, hydraulic/pneumatic/electrical energy isolated from the system using the respective redundant isolation devices. Gravity hazards controlled by shot pin system. Refer to design specification document "CON7-01 Planer design specification document R1.pdf" and addendum "CON7-01_guardlock_design_changes_R1.pdf" for details on safe state and energy isolation.
Circuit performance required	Control reliable as per CSA Z432-04.
Circuit performance achieved	Control reliable as per CSA Z432-04 or a Category-3 structure as per CSA Z432-16.

5.0 THE APPROVAL PROCESS AND DOCUMENTATION

The approval process required a number of steps as detailed in guideline 10.10 (2) “CSID as an SIS”.

A key component to the approval process is definition of the tasks that the CSID is used for and the procedures for us. Some of the Conifex procedures are shown below;

SAFE WORK PROCEDURE

CONIFEX

Safe Work Procedure (SWP) for:	Clearing Jam-ups in the Planer room (Zone #2)
Department / Area:	Planer
Date Created:	Dec.11/18
Revision Date:	Jan.8/19

Normal Production: Clearing Planer jam-ups using the Safe Guard System. (Level 1 Access)
WARNING: ***All other or maintenance tasks must follow lock-out procedures.***

HAZARD(S):	CONTROL(S):
• Caught in/between / Rotation Hazards -There is always a hazard of unintended machine motion or rotation hazards. • Pinch Points / Severe crush hazard The system could get a false reading because of a jammed component. • Hot surfaces – Friction between and lumber and the equipment.	• The safeguard system – Training on the use of the safety system and understanding of this safe work procedure steps. • PPE – All required site personal protective equipment. • Hazard assessment before starting the task – Always be aware of any defective equipment; report it to your Supervisor immediately.

SAFE WORK PROCEDURE STEPS:

Clearing Jam-ups in the Planer room (Zone #2)

When a jam-up occurs in the Planer you must follow these steps to clear it:

- **Step 1**: Press the 'Zone 2 REQUEST TO ENTER' (white) button on the Safe Guard Console, located on the side of the Planer feeder console. You can also use the request to enter on the HMI.
- **Step 2**: Verify the safety mode. i.e. Check conditions on HMI 'Request to enter screen' and pins are in place.
- **Step 3**: Apply your lock to zone 2 (door #1, 3, 5 or 6) door latch of the safety system.
- **Step 4**: Clear jammed in the planer using a pike pole, snyper tool or a planer strip. Be aware of gravity hazards – check that restraint pins are engaged. Significant jams may require lockout.
- **Step 5**: After jam has been cleared put away tools/devices back on wall.
- **Step 6**: Remove your lock from the door latch safety system and close the door.
- **Step 7**: Go back to the safe guard console and press the 'Zone 1 & 2 RESET BUTTON' (Blue) buttons. The HMI will indicate if all the safety devices are enabled and whether the planer can run.

ZONE 2 REQUEST TO ENTER	ZONE 2 DOOR 5 LATCH	USING TOOL	ZONE 2 RESET BOTTONS
			

SAFE WORK PROCEDURE

CONIFEX

Safe Work Procedure (SWP) for:	Clearing Planer Bridge (Zone 1 and 2) (Level 1 Access)
Department / Area:	Planer
Date Created:	Dec.11/18
Revision Date:	Jan.8/19

Normal Production: Level 1 Access - Clearing Planer Bridge jam-ups using the Safe Guard System.
WARNING: ***All other or maintenance tasks must follow lock-out procedures.***

HAZARD(S):	CONTROL(S):
• Caught in/between / Rotation Hazards -There is always a hazard of unintended machine motion or rotation hazards. • Pinch Points / Severe crush hazard The system could get a false reading because of a jammed component. • Hot surfaces – Friction between and lumber and the equipment.	• The safeguard system – Training on the use of the safety system and understanding of this safe work procedure steps. • PPE – All required site personal protective equipment. • Hazard assessment before starting the task – Always be aware of any defective equipment; report it to your Supervisor immediately.

SAFE WORK PROCEDURE STEPS:

Clearing Jam-up in the Planer Bridge (Zone #1 & #2)
When a jam-up occurs in the Planer Bridge you must follow these steps to clear it:

- **Step 1**: Press the 'Zone 1 REQUEST TO ENTER' (white) button on the Safe Guard Console, located by the Infeed.
- **Step 2**: Verify the safety mode. i.e. Check conditions on HMI 'Request to enter screen' and pins are in place.
- **Step 3**: Apply lock to zone 1 (door #2 or 4) door latch of the safety system.

⚠***Warning!*** *If you are going into zone 2, you MUST put your lock on a zone 2 door (1,3,5,6) since it is possible to reset zone 1 and then access the zone 1 hazards from the zone 2 areas*

- **Step 4**: Clear jammed in the Planer using a pike pole, snyper tool or a Planer strip. Be aware of gravity hazards – check that restraint pins are engaged. Significant jams may require lockout.
- **Step 5**: If you need to go into zone 2, press the 'Zone 2 REQUEST TO ENTER' button located on the downstream door to Planer. Follow the verification procedure above, then apply a personal lock to the zone 2 door.
- **Step 6**: After jam has been cleared put away tools/devices back on wall.

Note: *You can start the feedworks back up using the infeed line start (green) button on the safe guard console.*

ZONE 1
REQUEST TO ENTER

ZONE 1
DOOR 2 LATCH

APPLY LOCK HERE

USING TOOL

ZONE 1
RESET BOTTONS

SAFE WORK PROCEDURE

CONIFEX

Safe Work Procedure (SWP) for:	Clearing Planer Infeed Table & Pineapples (Zone 1)
Department / Area:	Planer
Date Created:	Dec.11/18
Revision Date:	Jan.8/19

Normal Production: Clearing Planer Infeed Table & Pineapple jam-ups using the Safe Guard System. (Level 1 Access)
WARNING: ***All other or maintenance tasks must follow lock-out procedures.***

HAZARD(S):	CONTROL(S):
• Caught in/between / Rotation Hazards -There is always a hazard of unintended machine motion or rotation hazards. • Pinch Points / Severe crush hazard The system could get a false reading because of a jammed component. • Hot surfaces – Friction between and lumber and the equipment.	• The safeguard system – Training on the use of the safety system and understanding of this safe work procedure steps. • PPE – All required site personal protective equipment. • Hazard assessment before starting the task – Always be aware of any defective equipment; report it to your Supervisor immediately.

SAFE WORK PROCEDURE STEPS:

Clearing Jam-up in the Planer Infeed Table & Pineapples (Zone #1)
When a jam-up occurs in the Planer Infeed Table & Pineapples you must follow these steps to clear it:

- **Step 1**: Press the 'Zone 1 REQUEST TO ENTER' (white) button on the Safe Guard Console, located by the Infeed.
- **Step 2**: Verify the safety mode. i.e. Check conditions on HMI 'Request to enter screen' and pins are in place.
- **Step 3**: Apply lock to zone 1 (door #2 or 4) door latch of the safety system.

⚠***Warning!*** *If you are going into zone 2, you MUST put your lock on a zone 2 door (1,3,5,6) since it is possible to reset zone 1 and then access the zone 1 hazards from the zone 2 areas*

- **Step 4**: Clear jammed in the Planer using a pike pole, Snyper tool or a Planer strip. (Figure #3) Be aware of gravity hazards – check that restraint pins are engaged. Significant jams may require lockout.
- **Step 5**: After jam has been cleared put away tools/devices back on wall.
- **Step 6**: Remove your Lock(s) from the door latch safety system and closed the door.
- **Step 7**: Go back to the Safe Guard Console and press the 'Zone 1 RESET BUTTON' (Blue) button. The HMI will indicate if all the safety devices are enabled and whether the planer can run.

Note: *You can start the feedworks back up using the infeed line start (green) button on the safe guard console.*

ZONE 1 REQUEST TO ENTER

ZONE 1 DOOR 2 LATCH

APPLY LOCK HERE

USING TOOL

ZONE 1 RESET BOTTONS

SAFE WORK PROCEDURE

Safe Work Procedure (SWP) for:	Jointing the Side Heads (Level 1 Access)
Department / Area:	Planer
Date Created:	Dec.11/18
Revision Date:	Jan.8/19

Maintenance: Jointing the side heads (inside & outside) using Lockout and the Safe Guard System.
WARNING: ***To Joint Side Heads must follow lock-out procedures.***

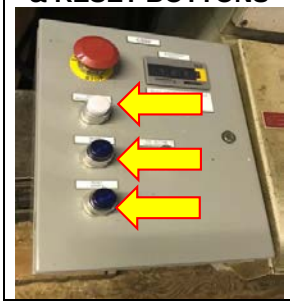
HAZARD(S):	CONTROL(S):
• Caught in/between / Rotation Hazards -There is always a hazard of unintended machine motion or rotation hazards. • Pinch Points / Severe crush hazard The system could get a false reading because of a jammed component. • Hot surfaces – Friction between and lumber and the equipment.	• Lockout the Inside Head (5A-A1-008) and Outside Head (5A-C4-009) • The safeguard system – Training on the use of the safety system and understanding of this safe work procedure steps. • PPE – All required site personal protective equipment. • Hazard assessment before starting the task – Always be aware of any defective equipment; report it to your Supervisor immediately.

SAFE WORK PROCEDURE STEPS:

Jointing the Side Heads (Full Lockout of planer heads is required)
When a Millwright is jointing the Top & Bottom Heads, these steps must be followed:

- **Step 1**: Press the 'Zone #2 REQUEST TO ENTER' (white) button on the Safe Guard Console located outside the planer room.
- **Step 2**: Wait for the door lock to disengage.
- **Step 3**: Apply lock to door #5 latch of the safety system.
- **Step 4**: Verify the safety mode. i.e. Check conditions on HMI 'Request to enter screen' and pins are in place.
- **Step 5:** ⚠ **Lockout the Side heads (Inside Head (5A-A1-008) and Outside Head (5A-C4-009) using the MCC disconnects and test your lockout.**
- **Step 6:** Setup the Wolftek side head grinder on the side heads and joint one at a time.
- **Step 7:** After jointing is complete, remove your locks and reset the safety system. The HMI will indicate if all the safety devices are enabled and whether the planer can run.

ZONE 2 REQUEST TO ENTER & RESET BOTTONS



ZONE 2 DOOR 5 LATCH

WOLFTEK- SIDE HEAD ROTARY JOINTER