Conifex Planer System Introduction

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Principal
UBSafe Inc.

CONIFEX PLANER

INDUSTRY PILOT PROJECT

UBSafe inc.

Project Team

1. WSBC, BC Forest Safety Council, MAG
2. Client – Conifex
   - Procedure development
3. UBSafe Inc.
   - Turn-Key responsibility (General Contractor)
   - Assessment
   - Engineering
   - Project Management
   - Verification / Validation
   - Startup and training

Project Outcomes

1. Provision of three safeguarding approaches to suit industry (simple to complex)
2. Significant enhancement in safety for production, maintenance and minor servicing activities
3. Reduction of per occurrence planer entry time from 80 seconds to 20 seconds
4. Overall downtime reduction 50%
5. Legislative compliance (system is verified and validated)

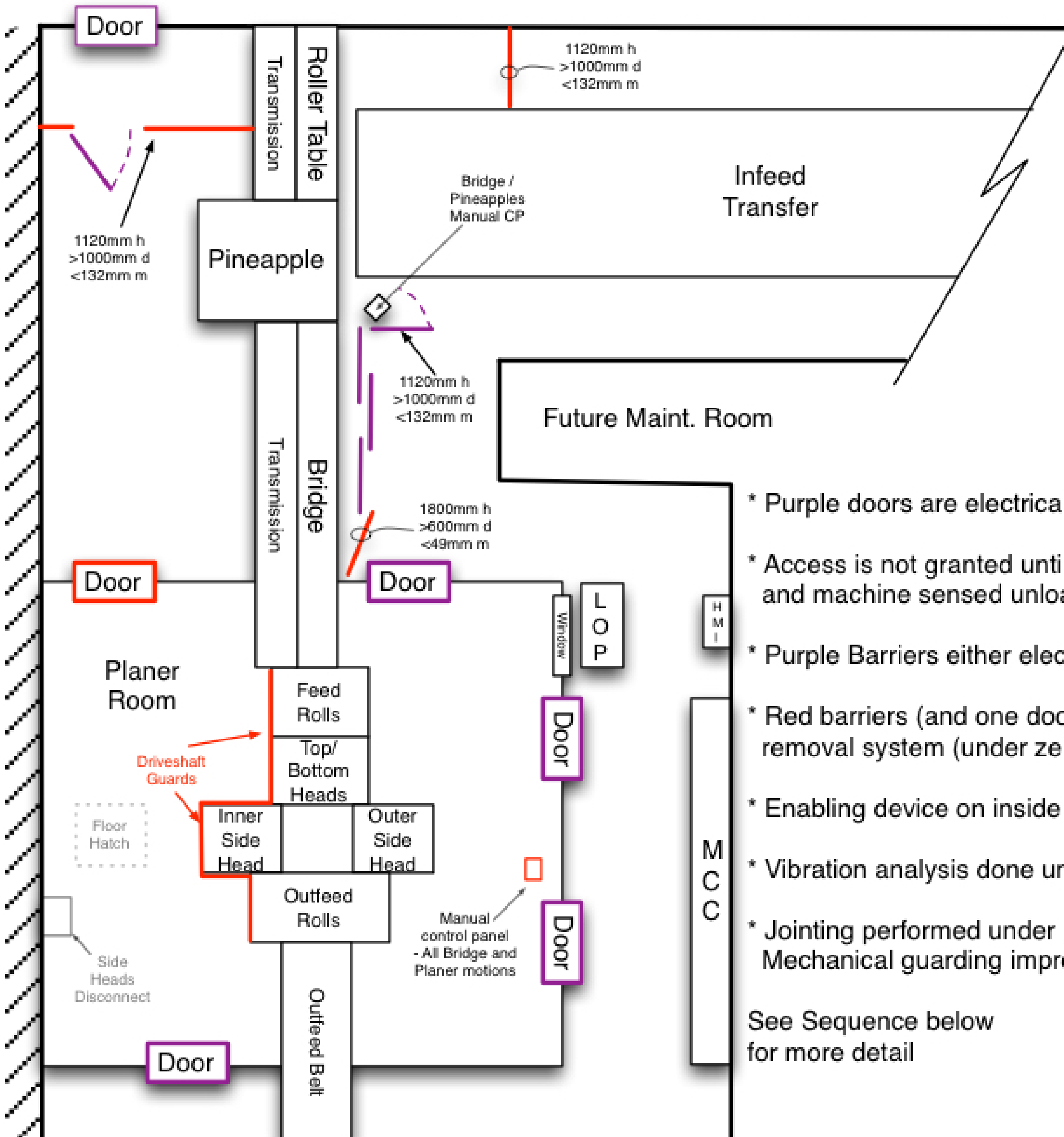
Assessment

1. Task based risk assessment and safeguarding report (roadmap)
2. Included CSA and ISO terminology (risk index levels and performance levels)
3. All tasks, associated hazards and solutions detailed including residual hazard levels
4. Team included safety, management, operations, maintenance, supervisors

Specification and prelim approval

1. Functional / safety specification developed and approved
   - Safety functions
   - Detail design information
   - System structure

2. Preliminary approval process with WSBC difficult
   - History of lockout used as a safeguard
   - Approvals and variances active across multiple industries



* Purple doors are electrically guard-locked (inner feed side exception).

* Access is not granted until zero speed detected and machine sensed unloaded.

* Purple Barriers either electrically guard-locked or interlocked.

* Red barriers (and one door) are fixed guards with maintenance removal system (under zero energy lockout).

* Enabling device on inside for manual motions at new control panel.

* Vibration analysis done under reg. 10.12 and permit to work system.

* Jointing performed under reg. 10.12 and permit to work system. Mechanical guarding improvements at side heads.

See Sequence below
for more detail

Safety System Major Components

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

Other system components

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


SCP01

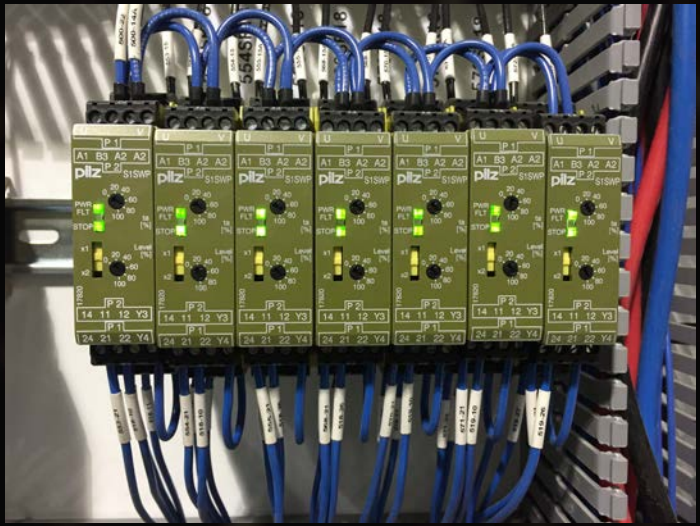

Safety enabled
PLANER INFEED TABLE
PLANER FEED ROLLS
ALLPOINTS


STOP
LOCK OUT BEFORE ENTRY


Allen-Bradley

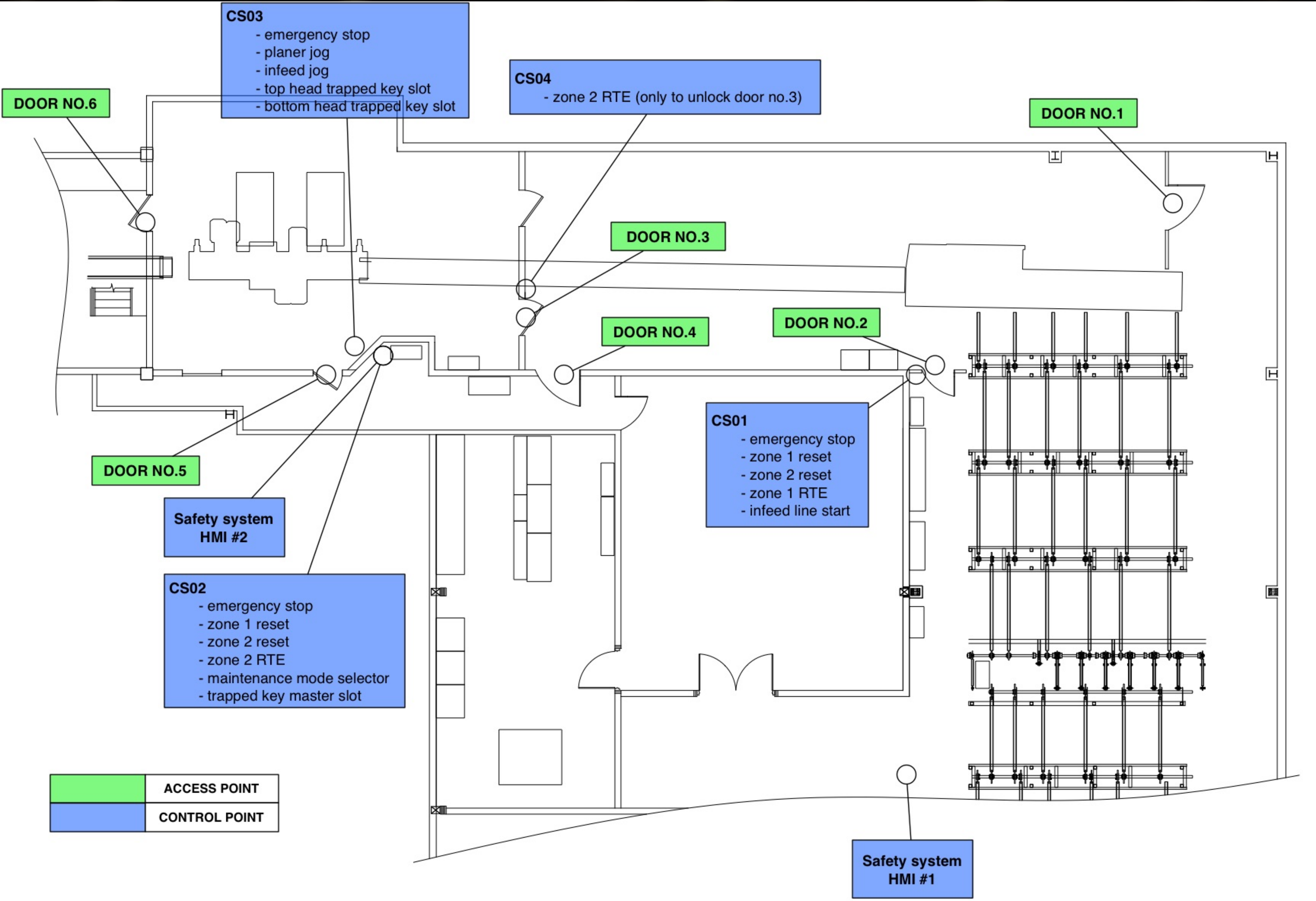

SAFETY FAULTS
ISOLATION DEVICES
MAINTENANCE MODE DISPLAY
RESET CONDITIONS
CS02
MAINTENANCE ENABLE
PILZ
1 2 3 4
STOP
SELECT TASK PRIOR TO PRESSING RTE
ZONE 2 REQUEST TO ENTER
1 = AUTO
2 = VIBRATION
3 = JOINTING
4 = SIZING / SETUP
ZONE 2 REQUEST TO ENTER
RESET ZONE 1
TOP / BOTTOM HEAD JOINT KEY
RESET ZONE 2

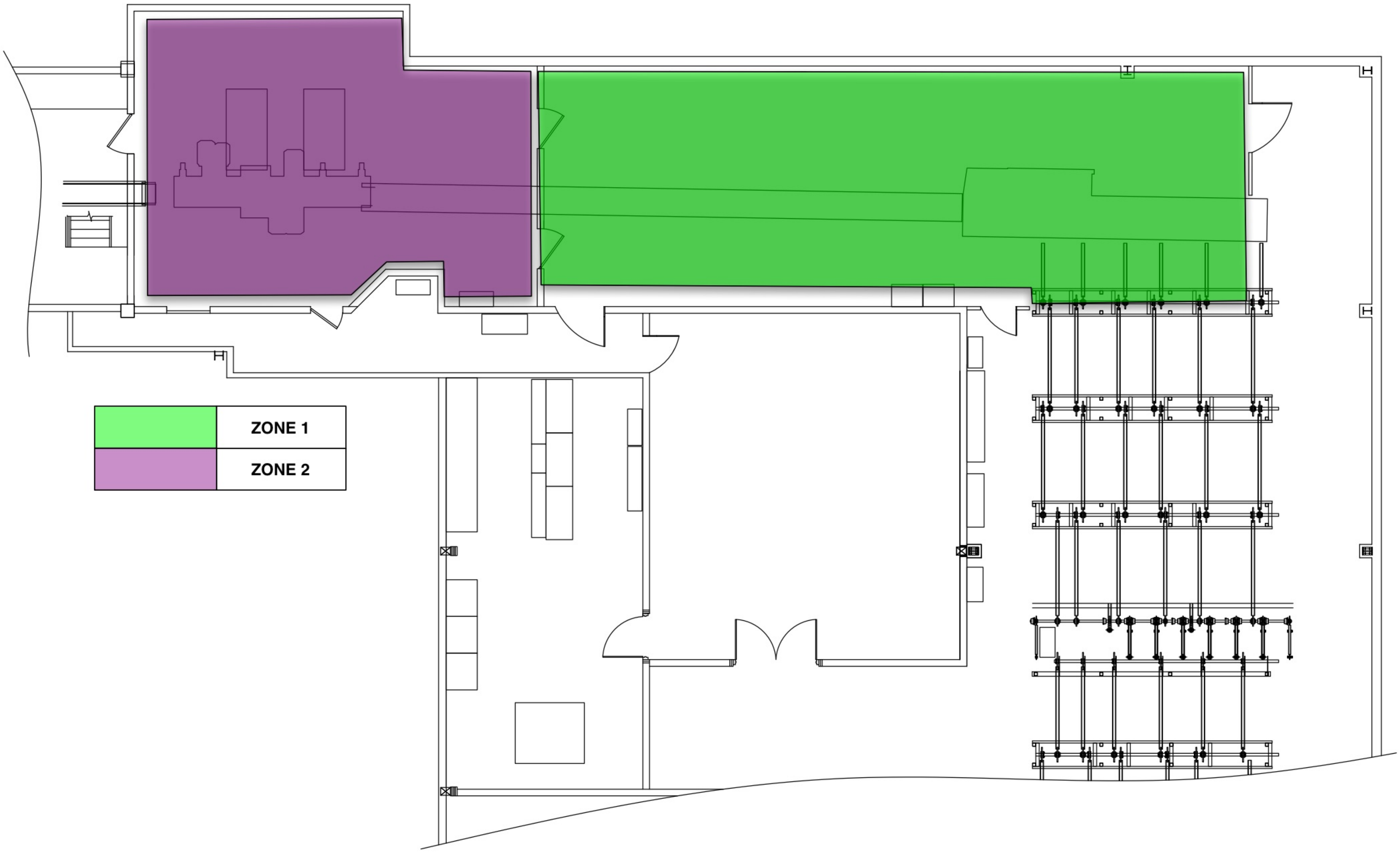

CS03
ERGENCY


pilz
S1SWP
A1 B3 A2 A2
PWR
FLT
STOP
Level
14 11 12 Y3
24 21 22 Y4


LANER FEEDTABLE
5C1-A-335


SIDENER


CS03
- emergency stop
- planer jog
- infeed jog
- top head trapped key slot
- bottom head trapped key slot
CS04
- zone 2 RTE (only to unlock door no.3)
DOOR NO.6
DOOR NO.1
DOOR NO.3
DOOR NO.4
DOOR NO.2
CS01
- emergency stop
- zone 1 reset
- zone 2 reset
- zone 1 RTE
- infeed line start
DOOR NO.5
Safety system HMI #2
CS02
- emergency stop
- zone 1 reset
- zone 2 reset
- zone 2 RTE
- maintenance mode selector
- trapped key master slot
ACCESS POINT
CONTROL POINT
Safety system HMI #1



(green)	ZONE 1
(purple)	ZONE 2

Entering System

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

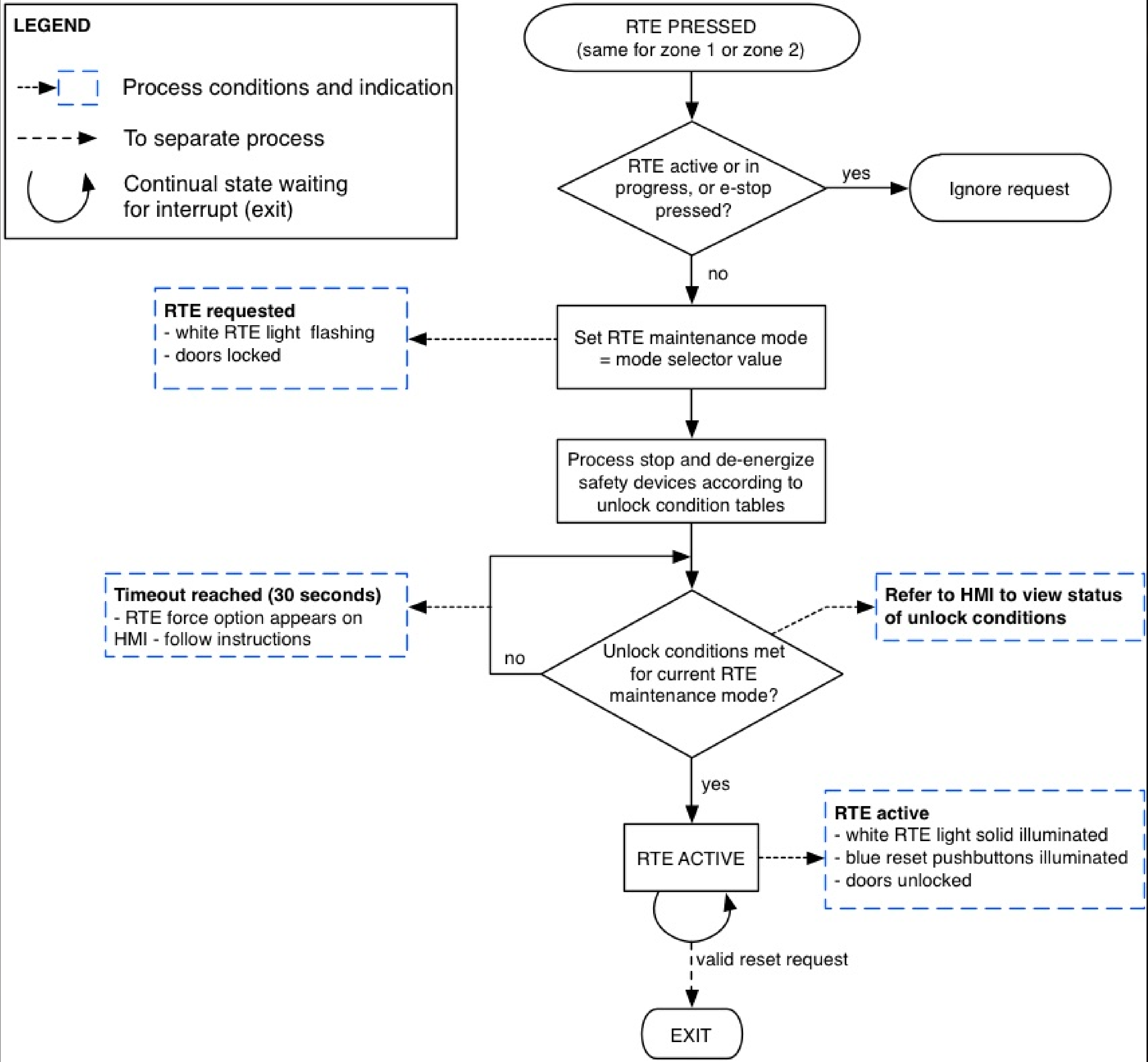
Slow flash (1Hz): A request to enter has been initiated and the system is performing a controlled stop and waiting for unlock conditions to be met.

Fast flash (10Hz): The request to enter has reached the timeout value. The force RTE function is activated on the HMI.

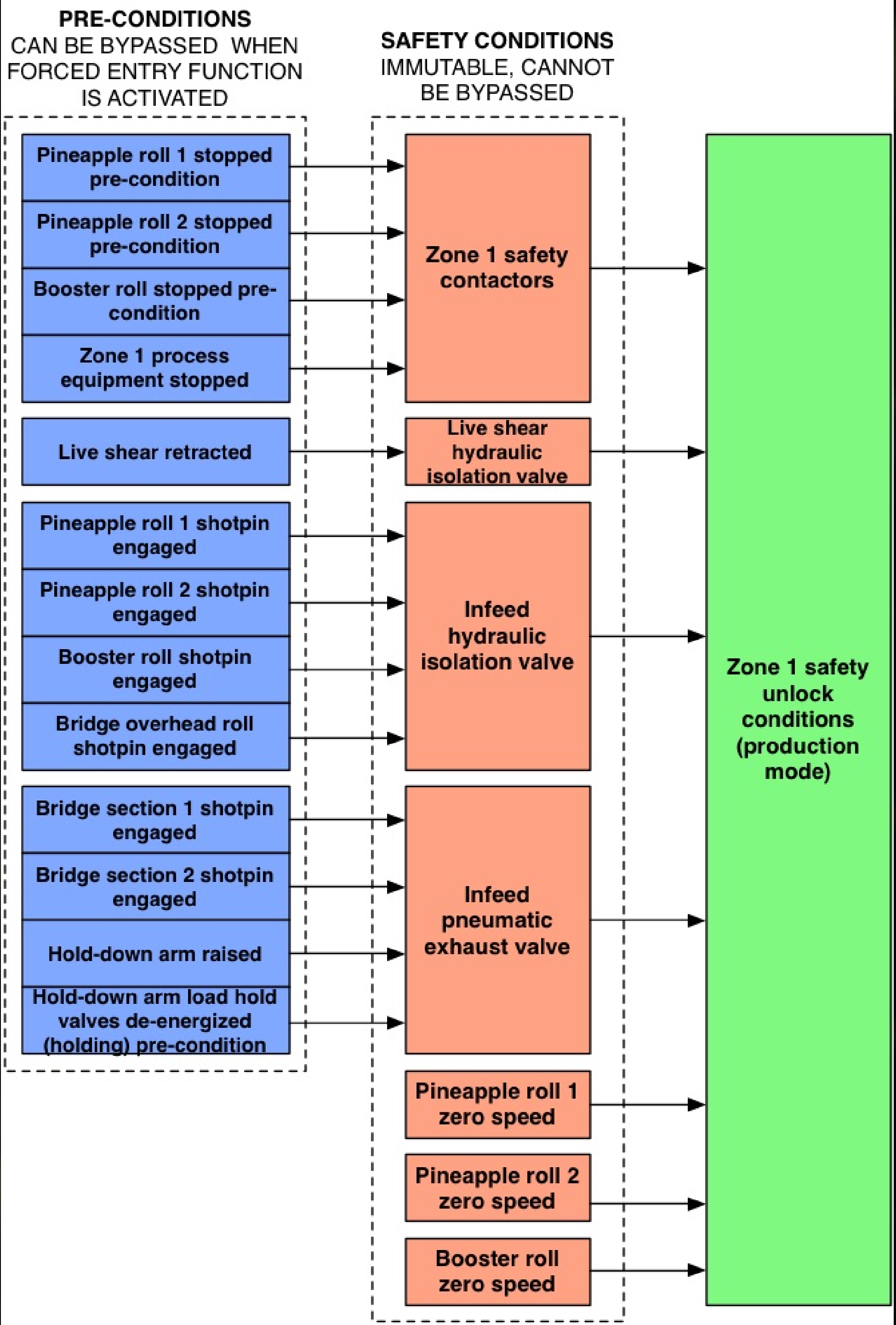
Solid: All safe states have been satisfied and the doors are unlocked.

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.



LEGEND
Process conditions and indication
To separate process
Continual state waiting for interrupt (exit)
RTE PRESSED (same for zone 1 or zone 2)
RTE active or in progress, or e-stop pressed?
yes
Ignore request
no
Set RTE maintenance mode = mode selector value
RTE requested
- white RTE light flashing
- doors locked
Process stop and de-energize safety devices according to unlock condition tables
Timeout reached (30 seconds)
- RTE force option appears on HMI - follow instructions
Refer to HMI to view status of unlock conditions
no
Unlock conditions met for current RTE maintenance mode?
yes
RTE ACTIVE
RTE active
- white RTE light solid illuminated
- blue reset pushbuttons illuminated
- doors unlocked
valid reset request
EXIT


PRE-CONDITIONS
CAN BE BYPASSED WHEN FORCED ENTRY FUNCTION IS ACTIVATED
SAFETY CONDITIONS
IMMUTABLE, CANNOT BE BYPASSED
Pineapple roll 1 stopped pre-condition
Pineapple roll 2 stopped pre-condition
Booster roll stopped pre-condition
Zone 1 process equipment stopped
Live shear retracted
Pineapple roll 1 shotpin engaged
Pineapple roll 2 shotpin engaged
Booster roll shotpin engaged
Bridge overhead roll shotpin engaged
Bridge section 1 shotpin engaged
Bridge section 2 shotpin engaged
Hold-down arm raised
Hold-down arm load hold valves de-energized (holding) pre-condition
Zone 1 safety contactors
Live shear hydraulic isolation valve
Infeed hydraulic isolation valve
Infeed pneumatic exhaust valve
Pineapple roll 1 zero speed
Pineapple roll 2 zero speed
Booster roll zero speed
Zone 1 safety unlock conditions (production mode)


PRE-CONDITIONS
CAN BE BYPASSED WHEN FORCED ENTRY FUNCTION IS ACTIVATED
SAFETY CONDITIONS
IMMUTABLE, CANNOT BE BYPASSED
Planer top head stopped pre-condition
Planer bottom head stopped pre-condition
Planer inside head stopped pre-condition
Planer bottom head stopped pre-condition
Zone 2 process equipment stopped
Infeed roll 1 shotpin engaged
Infeed roll 2 shotpin engaged
Outfeed roll shotpin engaged
Planer outside head retracted
Planer top head load hold valves de-energized (holding) pre-condition
Zone 2 safety contactors
Setworks hydraulic isolation valve
Planer top head zero speed
Planer bottom head zero speed
Planer inside head zero speed
Planer outside head zero speed
Planer top head load hold valves engaged
Zone 1 safety unlock conditions
Zone 2 safety unlock conditions (production mode)

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Conifex Planer Safety System - REQUEST TO ENTER

UBSafe

ZONE 1 RTE STATUS

- RTE NOT REQUESTED
- RTE REQUESTED, IN PROGRESS
- RTE ACTIVE, DOORS UNLOCKED

ZONE 2 RTE STATUS

- RTE NOT REQUESTED
- RTE REQUESTED, IN PROGRESS
- RTE ACTIVE, DOORS UNLOCKED

CURRENT MODE

- MODE 1 - PRODUCTION
- MODE 2 - VIBRATION
- MODE 3 - JOINTING
- MODE 4 - SIZING/SETUP
- MODE 5 - SAFETY DISABLED

CONDITION STATUS INDICATION	STATE INDICATION
CONDITION NOT APPLICABLE TO CURRENT MODE	CONDITION TRUE
CONDITION APPLICABLE TO CURRENT MODE	CONDITION NOT TRUE
	CONDITION NOT TRUE & RTE ACTIVE

ZONE 1 UNLOCK CONDITIONS

CONDITION	SAFE STATE
ZONE 1 SAFETY CONTACTORS	OFF
PINEAPPLE ROLL 1	ZERO SPEED
PINEAPPLE ROLL 2	ZERO SPEED
BOOSTER ROLL	ZERO SPEED
LIVE SHEAR HYDRAULIC ISOLATION VALVE	OFF
LIVE SHEAR POSITION	RETRACTED
INFEED HYDRAULIC ISOLATION VALVE	OFF
PINEAPPLE ROLL 1 SHOT PIN	EXTENDED
PINEAPPLE ROLL 2 SHOT PIN	EXTENDED
BOOSTER ROLL SHOT PIN	EXTENDED
BRIDGE OVERHEAD ROLL SHOT PIN	EXTENDED
INFEED PNEUMATIC EXHAUST VALVE	OFF
INFEED HOLDDOWN LOAD HOLD VALVES	OFF
BRIDGE HOLD DOWN 1 SHOT PIN	EXTENDED
BRIDGE HOLD DOWN 2 SHOT PIN	EXTENDED
ZONE 1 PROCESS EQUIPMENT	STOPPED

ZONE 2 UNLOCK CONDITIONS

CONDITION	SAFE STATE
ZONE 2 SAFETY CONTACTORS	OFF
PLANER TOP HEAD	ZERO SPEED
PLANER BOTTOM HEAD	ZERO SPEED
PLANER INSIDE HEAD	ZERO SPEED
PLANER OUTSIDE HEAD	ZERO SPEED
SETWORKS HYDRAULIC ISOLATION VALVE	OFF
TOP HEAD LOAD HOLD VALVE 1	OFF
TOP HEAD LOAD HOLD VALVE 2	OFF
INFEED ROLL 1 SHOT PIN	EXTENDED
INFEED ROLL 2 SHOT PIN	EXTENDED
OUTFEED ROLL SHOTPIN	EXTENDED
PLANER OUTSIDE HEAD	RETRACTED
ZONE 2 PROCESS EQUIPMENT	STOPPED

REQUEST TO ENTER ZONE 1

RESET ZONE 1

ZONE 1 RTE TIMED OUT

FORCE ENTRY

REQUEST TO ENTER ZONE 2

RESET ZONE 2

ZONE 2 RTE TIMED OUT

FORCE ENTRY

MAINTENANCE MODE ACKNOWLEDGE

HOME | RESET CONDITIONS | REQUEST TO ENTER | SHOT PINS | I/O, FAULTS, DIAGNOSTICS | ISOLATION DEVICES | MAINTENANCE MODE DISPLAY

Entering when conditions not met

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.

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Conifex Planer Safety System - REQUEST TO ENTER

UBSafe

ZONE 1 RTE STATUS

RTE NOT REQUESTED
RTE REQUESTED, IN PROGRESS
RTE ACTIVE, DOORS UNLOCKED

ZONE 2 RTE STATUS

RTE NOT REQUESTED
RTE REQUESTED, IN PROGRESS
RTE ACTIVE, DOORS UNLOCKED

CURRENT MODE

MODE 1 - PRODUCTION
MODE 2 - VIBRATION
MODE 3 - JOINTING
MODE 4 - SIZING/SETUP
MODE 5 - SAFETY DISABLED

CONDITION STATUS INDICATION	STATE INDICATION
CONDITION NOT APPLICABLE TO CURRENT MODE	CONDITION TRUE
	CONDITION NOT TRUE
CONDITION APPLICABLE TO CURRENT MODE	CONDITION NOT TRUE & RTE ACTIVE

ZONE 1 UNLOCK CONDITIONS

CONDITION	SAFE STATE
ZONE 1 SAFETY CONTACTORS	OFF
PINEAPPLE ROLL 1	ZERO SPEED
PINEAPPLE ROLL 2	ZERO SPEED
BOOSTER ROLL	ZERO SPEED
LIVE SHEAR HYDRAULIC ISOLATION VALVE	OFF
LIVE SHEAR POSITION	RETRACTED
INFEED HYDRAULIC ISOLATION VALVE	OFF
PINEAPPLE ROLL 1 SHOT PIN	EXTENDED
PINEAPPLE ROLL 2 SHOT PIN	EXTENDED
BOOSTER ROLL SHOT PIN	EXTENDED
BRIDGE OVERHEAD ROLL SHOT PIN	EXTENDED
INFEED PNEUMATIC EXHAUST VALVE	OFF
INFEED HOLDDOWN LOAD HOLD VALVES	OFF
BRIDGE HOLD DOWN 1 SHOT PIN	EXTENDED
BRIDGE HOLD DOWN 2 SHOT PIN	EXTENDED
ZONE 1 PROCESS EQUIPMENT	STOPPED

ZONE 2 UNLOCK CONDITIONS

CONDITION	SAFE STATE
ZONE 2 SAFETY CONTACTORS	OFF
PLANER TOP HEAD	ZERO SPEED
PLANER BOTTOM HEAD	ZERO SPEED
PLANER INSIDE HEAD	ZERO SPEED
PLANER OUTSIDE HEAD	ZERO SPEED
SETWORKS HYDRAULIC ISOLATION VALVE	OFF
TOP HEAD LOAD HOLD VALVE 1	OFF
TOP HEAD LOAD HOLD VALVE 2	OFF
INFEED ROLL 1 SHOT PIN	EXTENDED
INFEED ROLL 2 SHOT PIN	EXTENDED
OUTFEED ROLL SHOTPIN	EXTENDED
PLANER OUTSIDE HEAD	RETRACTED
ZONE 2 PROCESS EQUIPMENT	STOPPED

REQUEST TO ENTER ZONE 1

RESET ZONE 1

ZONE 1 RTE TIMED OUT

FORCE ENTRY

REQUEST TO ENTER ZONE 2

RESET ZONE 2

ZONE 2 RTE TIMED OUT

FORCE ENTRY

MAINTENANCE MODE ACKNOWLEDGE

HOME

RESET CONDITIONS | REQUEST TO ENTER | SHOT PINS | I/O, FAULTS, DIAGNOSTICS | ISOLATION DEVICES | MAINTENANCE MODE DISPLAY

CLOSE

! WARNING !

FORCING ENTRY INTO THE INFEED OR PLANER AREAS WILL DISENGAGE THE SAFETY ISOLATION DEVICES, BUT THERE MAY BE RESIDUAL HAZARDS DEPENDING ON THE POSITION OF ALL THE EQUIPMENT.

VIEW ALL UNLOCK CONDITIONS THAT ARE NOT BEING MET AND ENSURE THAT THE APPROPRIATE PRECAUTIONS ARE TAKEN.

ACKNOWLEDGE AND FORCE ENTRY

Example 1

There are some instances where despite being issued a stop command, the pineapple rolls and/or spiral rollcase do not come to a complete stop, and turn at a crawl speed.

Because the logic is waiting for the preconditions of zero speed status from the safety relays and the process PLC, the safety contactors will not open.

During forced entry, the safety contactors will ignore the equipment stopped pre conditions, and force off the safety contactors (note that the zero speed safety conditions are never ignored).

At this point, the motors will coast to a stop, the safety system will detect zero speed safety conditions, and the doors will unlock.

Safety System Reset

Blue reset push buttons

The blue reset push button pilot lights 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.

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Conifex Planer Safety System - SAFETY RESET CONDITIONS

UBSafe

CONDITION SATISFIED
CONDITION NOT SATISFIED

ZONE 1 RESET CONDITIONS	ZONE 2 RESET CONDITIONS
MODE SELECTOR IN MODE "1"	MODE SELECTOR IN MODE "1"
EMERGENCY STOPS ENABLED	EMERGENCY STOPS ENABLED
TRAPPED KEY AT HOME POSITION AND ENABLED	TRAPPED KEY AT HOME POSITION AND ENABLED
GUARDLOCK #1 HANDLE CLOSED	GUARDLOCK #1 HANDLE CLOSED
GUARDLOCK #2 HANDLE CLOSED	GUARDLOCK #2 HANDLE CLOSED
GUARDLOCK #3 HANDLE CLOSED	GUARDLOCK #3 HANDLE CLOSED
GUARDLOCK #4 HANDLE CLOSED	GUARDLOCK #4 HANDLE CLOSED
GUARDLOCK #5 HANDLE CLOSED	GUARDLOCK #5 HANDLE CLOSED
GUARDLOCK #6 HANDLE CLOSED	GUARDLOCK #6 HANDLE CLOSED
PINEAPPLE ROLL 1 STOPPED	TOP HEAD STOPPED
PINEAPPLE ROLL 2 STOPPED	BOTTOM HEAD STOPPED
BOOSTER ROLL STOPPED	INSIDE HEAD STOPPED
ZONE 1 PROCESS STOPPED	OUTSIDE HEAD STOPPED
ZONE 2 RESET AND ENABLED	ZONE 2 PROCESS STOPPED
ZONE 1 - NO SAFETY FAULTS	ZONE 2 - NO SAFETY FAULTS

HOME | RESET CONDITIONS | REQUEST TO ENTER | SHOT PINS | I/O, FAULTS, DIAGNOSTICS | ISOLATION DEVICES | MAINTENANCE MODE DISPLAY

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Conifex Planer Safety System - REQUEST TO ENTER

UBSafe

ZONE 1 RTE STATUS

- RTE NOT REQUESTED
- RTE REQUESTED, IN PROGRESS
- RTE ACTIVE, DOORS UNLOCKED

ZONE 2 RTE STATUS

- RTE NOT REQUESTED
- RTE REQUESTED, IN PROGRESS
- RTE ACTIVE, DOORS UNLOCKED

CURRENT MODE

- MODE 1 - PRODUCTION
- MODE 2 - VIBRATION
- MODE 3 - JOINTING
- MODE 4 - SIZING/SETUP
- MODE 5 - SAFETY DISABLED

CONDITION STATUS INDICATION	STATE INDICATION
CONDITION NOT APPLICABLE TO CURRENT MODE	CONDITION TRUE
	CONDITION NOT TRUE
CONDITION APPLICABLE TO CURRENT MODE	CONDITION NOT TRUE & RTE ACTIVE

ZONE 1 UNLOCK CONDITIONS

CONDITION	SAFE STATE
ZONE 1 SAFETY CONTACTORS	OFF
PINEAPPLE ROLL 1	ZERO SPEED
PINEAPPLE ROLL 2	ZERO SPEED
BOOSTER ROLL	ZERO SPEED
LIVE SHEAR HYDRAULIC ISOLATION VALVE	OFF
LIVE SHEAR POSITION	RETRACTED
INFEED HYDRAULIC ISOLATION VALVE	OFF
PINEAPPLE ROLL 1 SHOT PIN	EXTENDED
PINEAPPLE ROLL 2 SHOT PIN	EXTENDED
BOOSTER ROLL SHOT PIN	EXTENDED
BRIDGE OVERHEAD ROLL SHOT PIN	EXTENDED
INFEED PNEUMATIC EXHAUST VALVE	OFF
INFEED HOLDDOWN LOAD HOLD VALVES	OFF
BRIDGE HOLD DOWN 1 SHOT PIN	EXTENDED
BRIDGE HOLD DOWN 2 SHOT PIN	EXTENDED
ZONE 1 PROCESS EQUIPMENT	STOPPED

ZONE 2 UNLOCK CONDITIONS

CONDITION	SAFE STATE
ZONE 2 SAFETY CONTACTORS	OFF
PLANER TOP HEAD	ZERO SPEED
PLANER BOTTOM HEAD	ZERO SPEED
PLANER INSIDE HEAD	ZERO SPEED
PLANER OUTSIDE HEAD	ZERO SPEED
SETWORKS HYDRAULIC ISOLATION VALVE	OFF
TOP HEAD LOAD HOLD VALVE 1	OFF
TOP HEAD LOAD HOLD VALVE 2	OFF
INFEED ROLL 1 SHOT PIN	EXTENDED
INFEED ROLL 2 SHOT PIN	EXTENDED
OUTFEED ROLL SHOTPIN	EXTENDED
PLANER OUTSIDE HEAD	RETRACTED
ZONE 2 PROCESS EQUIPMENT	STOPPED

REQUEST TO ENTER ZONE 1

RESET ZONE 1

ZONE 1 RTE TIMED OUT

FORCE ENTRY

REQUEST TO ENTER ZONE 2

RESET ZONE 2

ZONE 2 RTE TIMED OUT

FORCE ENTRY

MAINTENANCE MODE ACKNOWLEDGE

HOME | RESET CONDITIONS | REQUEST TO ENTER | SHOT PINS | I/O, FAULTS, DIAGNOSTICS | ISOLATION DEVICES | MAINTENANCE MODE DISPLAY

Emergency Conditions

Emergency Stop

- Category 1 stop
- 15 second delay regardless of equipment state
- Fire and extraneous conditions

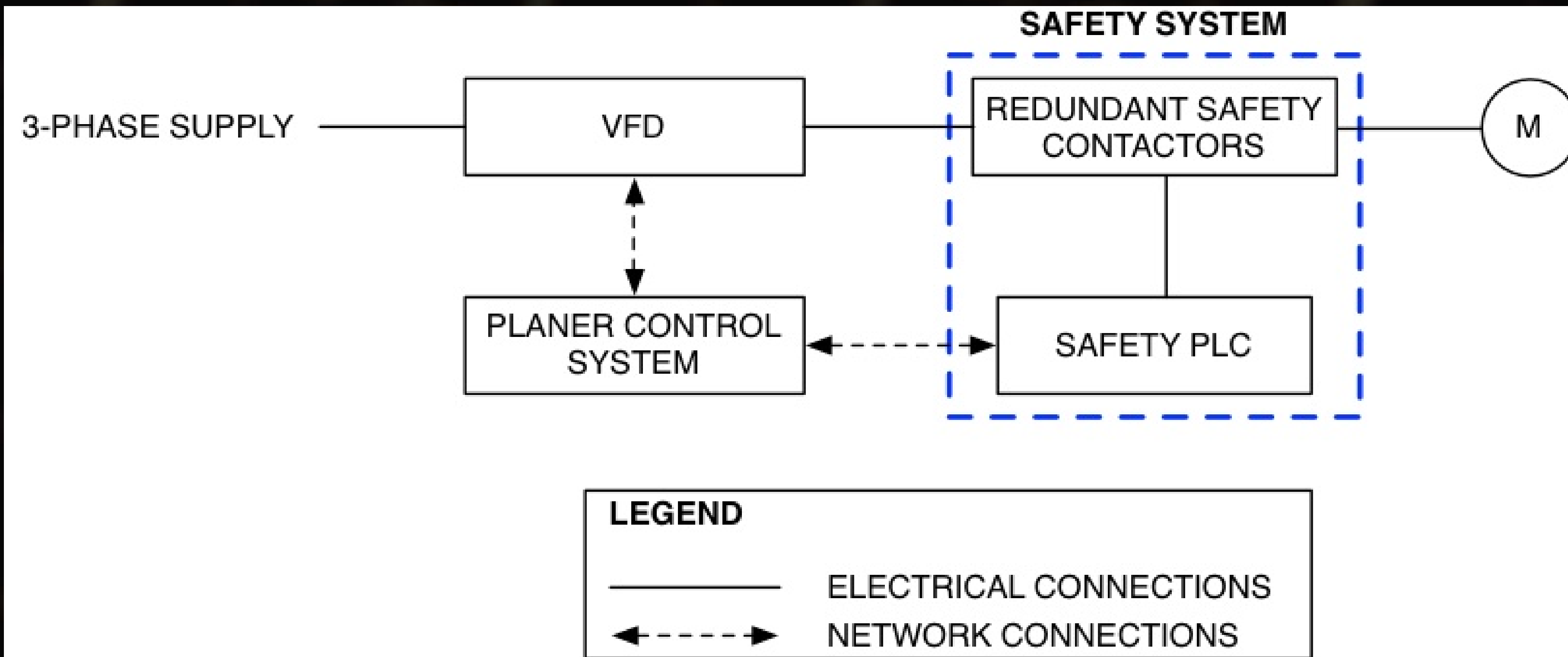
Escape and emergency stop from inside

- Rockwell guardlocking device incorporates rear handle
- Causes fault within guardlocking device that must be manually reset as well as faulting safety system

Maintenance and Technical

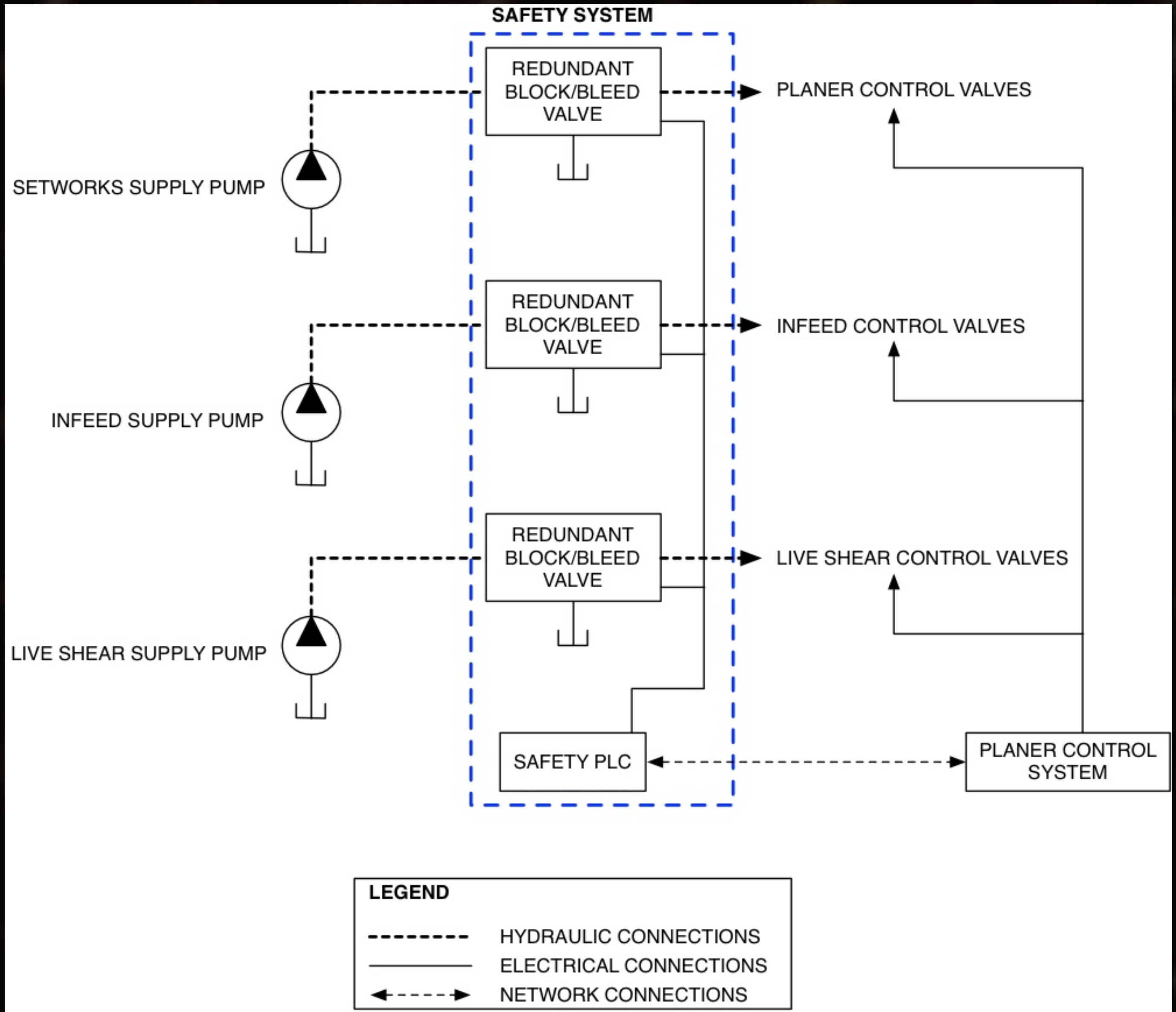
- Maintenance and user manuals provided
- Training sessions with maintenance, operations and engineering

Electrical



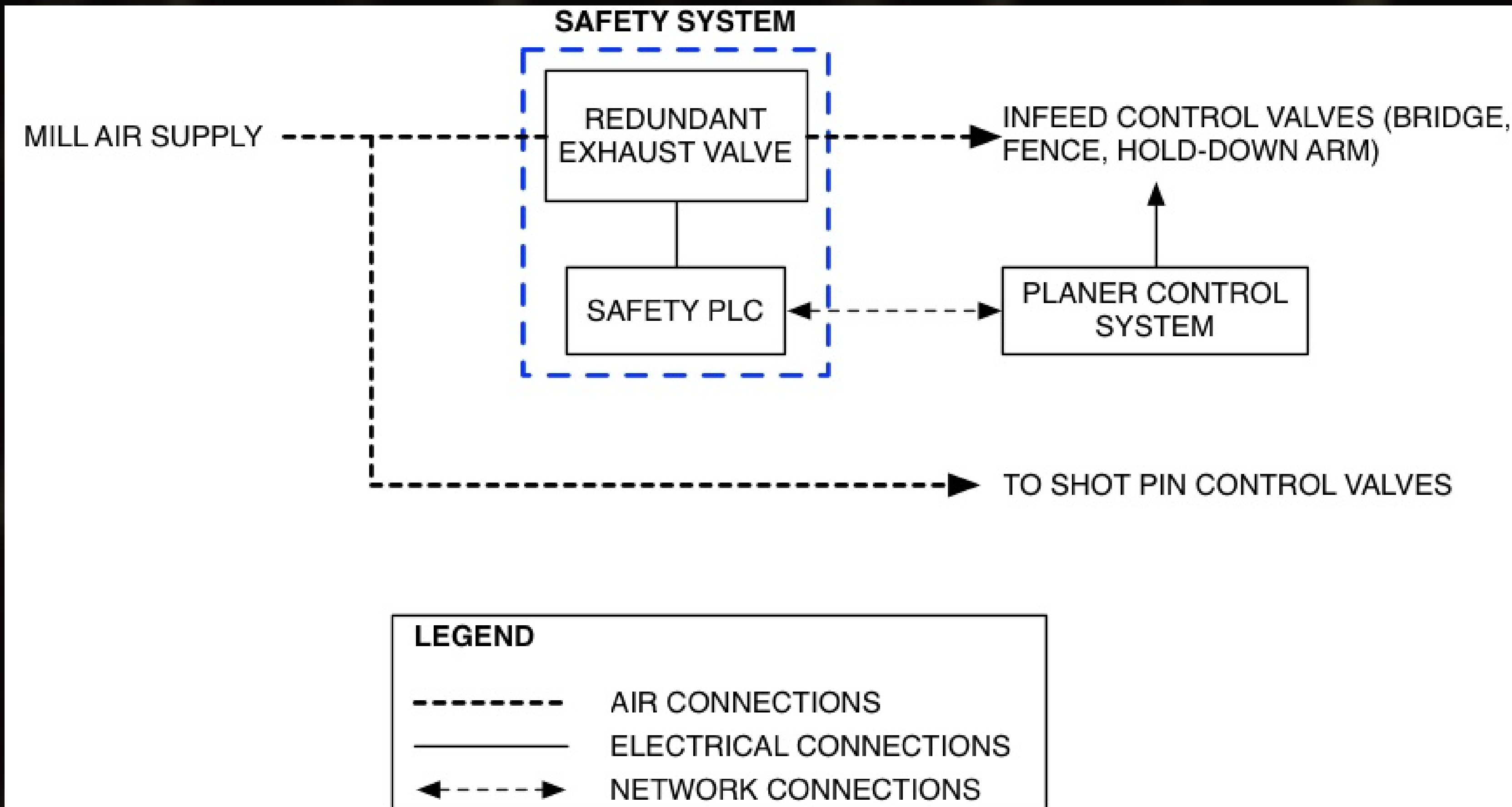
SAFETY SYSTEM
3-PHASE SUPPLY
VFD
REDUNDANT SAFETY CONTACTORS
M
PLANER CONTROL SYSTEM
SAFETY PLC
LEGEND
ELECTRICAL CONNECTIONS
NETWORK CONNECTIONS

Hydraulic



SAFETY SYSTEM
REDUNDANT BLOCK/BLEED VALVE
PLANER CONTROL VALVES
SETWORKS SUPPLY PUMP
REDUNDANT BLOCK/BLEED VALVE
INFEED CONTROL VALVES
INFEED SUPPLY PUMP
REDUNDANT BLOCK/BLEED VALVE
LIVE SHEAR CONTROL VALVES
LIVE SHEAR SUPPLY PUMP
SAFETY PLC
PLANER CONTROL SYSTEM
LEGEND
HYDRAULIC CONNECTIONS
ELECTRICAL CONNECTIONS
NETWORK CONNECTIONS

Pnuematic


SAFETY SYSTEM
MILL AIR SUPPLY
REDUNDANT EXHAUST VALVE
INFEED CONTROL VALVES (BRIDGE, FENCE, HOLD-DOWN ARM)
SAFETY PLC
PLANER CONTROL SYSTEM
TO SHOT PIN CONTROL VALVES
LEGEND
AIR CONNECTIONS
ELECTRICAL CONNECTIONS
NETWORK CONNECTIONS

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. Energized Work Reg 10.12.

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

CLOSE

! WARNING !

YOU ARE ENTERING THE PLANER AREA IN MODE #

REFER TO THE TABLE TO THE RIGHT TO SEE WHICH EQUIPMENT IS ACTIVE AND TAKE THE APPROPRIATE PRECAUTIONS.

WORKING ON ENERGIZED EQUIPMENT MUST FOLLOW THE REQUIREMENTS OF BC OHS PART 10

ACKNOWLEDGE AND SET MODE #

	Equipment	Mode 2 Vibration	Mode 3 Jointing	Mode 4 Setup & sizing
Electrial (safety contactors)	Planer Feedtable Spiral Rollcase	OFF	OFF	ENABLE [2]
	Planer Infeed Pineapple Roll #1	OFF	OFF	ENABLE [2]
	Planer Infeed Pineapple Roll #2	OFF	OFF	ENABLE [2]
	Planer Infeed Booster Roll	OFF	OFF	ENABLE [2]
	Planer feedtable	OFF	OFF	ENABLE [2]
	Metering transfer	OFF	OFF	ENABLE [2]
	Planer Infeed Bridge Section #1 Rollcase	OFF	OFF	ENABLE [2]
	Planer Infeed Bridge Section #2 Rollcase	OFF	OFF	ENABLE [2]
	Planer Infeed Bridge Overhead Roll #1	OFF	OFF	ENABLE [2]
	Planer Infeed Bridge Overhead Roll #2	OFF	OFF	ENABLE [2]
	Planer Infeed Top Feedroll #1	OFF	OFF	ENABLE [2]
	Planer Infeed Bottom Feedroll #1	OFF	OFF	ENABLE [2]
	Planer Infeed Top Feedroll #2	OFF	OFF	ENABLE [2]
	Planer Infeed Bottom Feedroll #2	OFF	OFF	ENABLE [2]
	Planer Outfeed Top Feedroll #1	OFF	OFF	ENABLE [2]
	Planer Outfeed Bottom Feedroll #1	OFF	OFF	ENABLE [2]
	Planer Outside Side Head	ON	OFF	ON
	Planer Inside Side Head	ON	OFF	ON
	Planer Top Head	ON	ENABLE [1]	ON
	Planer Bottom Head	ON	ENABLE [1]	ON
	Planer jog	OFF	OFF	ENABLE [2]
	Infeed jog	OFF	OFF	ENABLE [2]
Hydraulic & pneumatic	Planer infeed table live shear	OFF	OFF	OFF
	Infeed bridge and bridge fence	OFF	OFF	ON
	Infeed hold-down load hold valves	OFF	OFF	ON
	Infeed & Planer DTS	OFF	OFF	ON
	Setworks system	OFF	ENABLE [1]	ON
	Top head load hold valves	OFF	ENABLE [1]	ON

Notes

[1] Trapped key system enables equipment shown.

[2] Handheld enable device (“Safeball”) enables equipment shown above.

Legend

OFF	Energy isolated by safety system
ENABLE	Energy controlled by safety system through an enabling device
ON	Energized under care and control of the maintenance worker (constant ON)

Verification / Validation

Design verification performed and safety system modelled in Sistema to > PLd. System validation performed and report generated.

- Required for approval process and compliance
- Functional testing, failure modes, fault injection – isolation matrix

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

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.

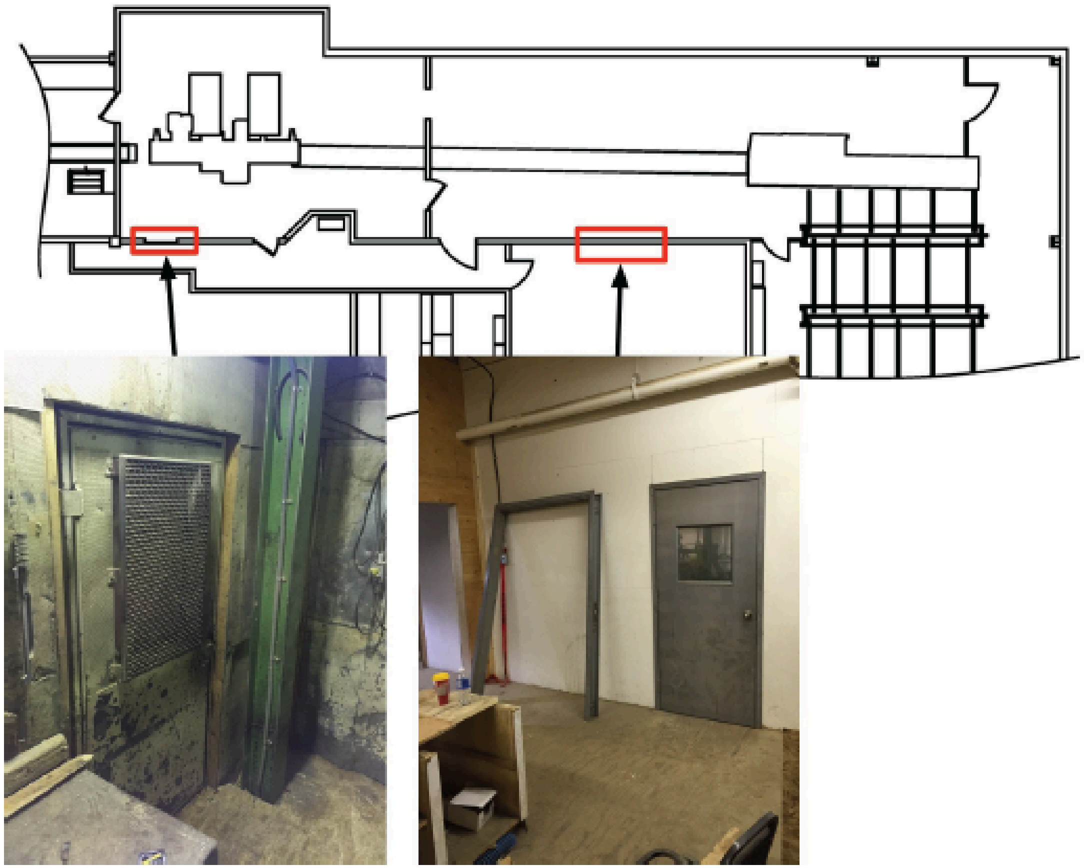
3.2.2 Safety function 2B: Prevent unlocking until safe state is detected

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.

4.0 RESIDUAL HAZARDS

In the context of this section, the residual hazards are actually deficiencies but Conifex have purposely elected to apply lower level controls (safe work procedures) to these high-risk hazards for functional reasons. This is the sole responsibility of Conifex, its management and directors.

4.1 Unmonitored doors



There are 2 unmonitored doors, one located in zone 2 and one in zone 1, which are locked from the outside, but can be opened from inside the hazardous area, and may be left open allowing unrestricted access to the hazardous areas.

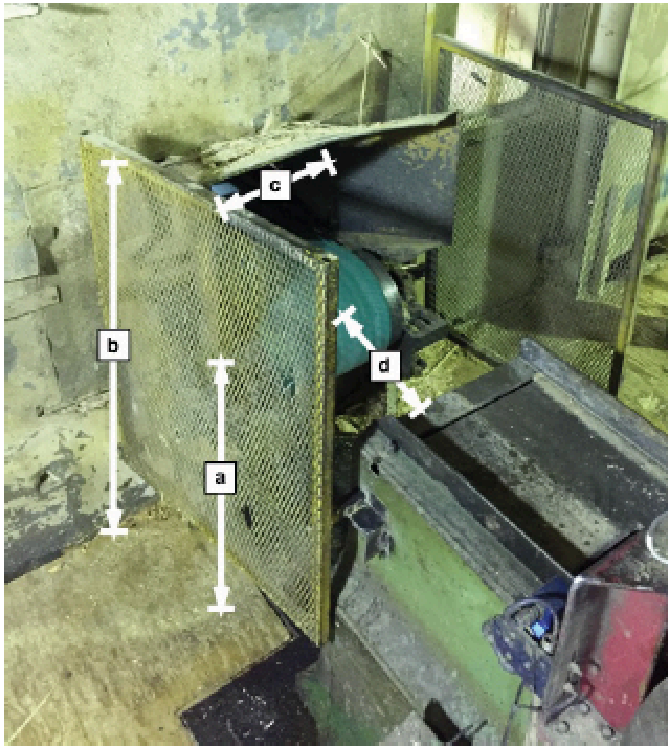
Conifex must keep these doors closed and locked, with the keys kept under supervisory control. Alternatively, modify the doors to meet the definition of a fixed guard as per CSA Z432-16 clause 9.2, namely that they are secured in such a way that requires tools to displace (note that a key is not a 'tool' as per the definitions of the standard).

5.0 SAFEGUARDING DEFICIENCIES

5.1 Mechanical (fixed) guarding

The following fixed guarding deficiencies were noted during validation. Fixed guarding requirements are validated against CSA Z432-16, which requires conformance to CAN/CSA-ISO 13857.

5.1.1 Outfeed belt guarding deficiency



As per the original design, the outfeed belt was part of the energy control of a zone 2 request to enter. However during commissioning, Conifex deemed this impractical since it was required to push a jammed board through and out of the planer area when in production mode #1. Fixed guarding was installed around the outfeed belt, but the guarding is deficient and does not meet the reach over requirements of CAN/CSA-ISO 13857.

There are two solutions to deal with the outfeed belt hazards.

1. Extend existing guards upwards and outwards to prevent access to the hazards in accordance with CAN/CSA-ISO 13857 Table 1 or Table 2 [1].
2. Re-install the outfeed belt to the request to enter energy control and install a safety rated foot pedal or other hold-to-run control to allow motion of only the outfeed belt while inside the safeguarded area.

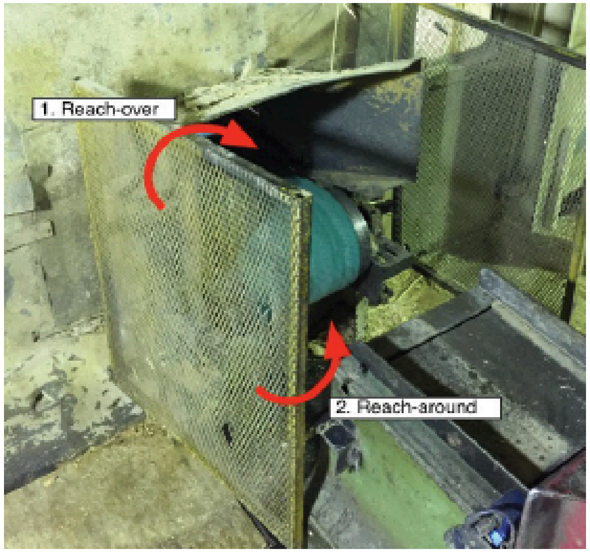
The existing guarding dimensions measured on site, are as follows (refer to illustration left):

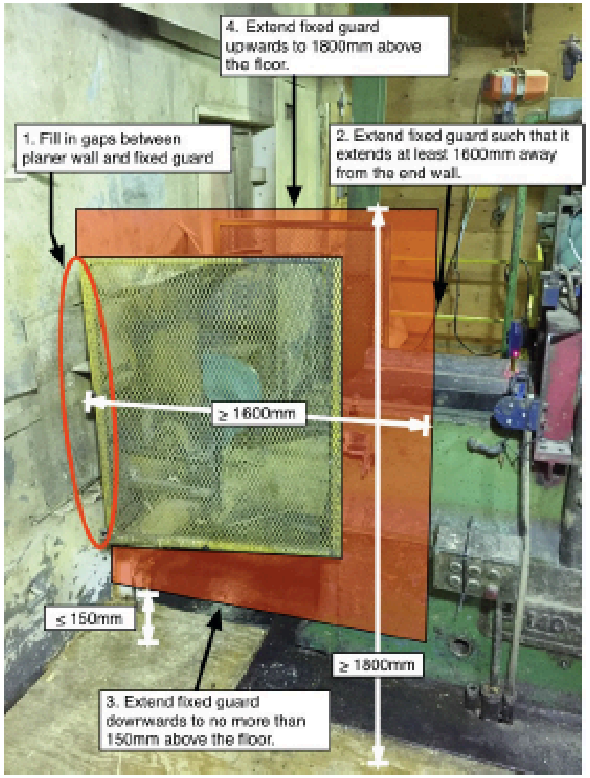
a. (height of hazard) 825mm
b. (height of guard) 1460mm
c. (horizontal distance 1 to hazard) 100mm
d. (horizontal distance 2 to hazard) 711mm

[continued on next page]

Notes

[1] Table 1 is used for low risk values, and Table 2 is used for high risk values.





Option 1 – Extend existing guarding

There are two reach hazards to be considered in this guard (see illustration top left).

1. The reach over distance when standing facing the guard.
2. The reach around distance when standing facing the guard.

The two hazards are treated separately in this discussion.

1. The reach-over distances are defined in CAN/CSA-ISO 13857 clause 4.2.2 "Reaching over protective structures".
2. For reach-around distances where movement is restricted at the shoulder, CAN/CSA-ISO 13857 clause 4.2.3 (reaching around) may be applied, although this requires that the reach-around distances constrain movement to the shoulder only. In this case it is possible to reach around the guarding at the waist, so the requirements of CAN/CSA-ISO 13857 Table 1 shall be applied, with the reference plane being the back wall (rotated 90° from vertical). Tables 1 and 2 can be found in the appendix.

Fill in gaps in the guarding between the planer wall and the guard, as shown bottom left (1). Increase the height of the existing guarding to 1800 mm from the floor (bottom left (4)), and extend the bottom of the guarding to within 150mm of the floor (bottom left (3)). Extend the guard horizontally away from the planer back wall to at least 1600mm from the planer back wall (bottom left (2)).

Notes

- Only one side is shown here, but this guarding must be applied to the other side as well.
- These measurements all assume the "low risk values" in CAN/CSA-ISO 13857 (reach over distances from Table 1). If Conifex deems the risk to be "high level", then the values in Table 2 shall be used. The only change would be that the horizontal distance from the wall would be increased from 1600mm to 1800mm.

[continued below]

6.0 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.

Safeguarding Plans, Evaluations, and Training

Design Consultation or Turnkey Solutions

Validation Reports

Preparation of CSID Approval package for WorkSafeBC review

CSA Z432, Z434, Z142 Technical Committee