



BEHIND THE LINES

Guarding & Machine Safety

IAN HANSEN
ROTOCONSULT



2015 ARM Annual Meeting

www.ianhansenconsult.com

2015 ARM Annual Meeting

SUMMARY OF PRESENTATION

- Industry Association resources
- Machine Safe Guarding
- Risk Assessment vs Risk Reduction

*Important, but not
the focus today*

- Fixed Guards
- Interlocked Guarding
- Presence sensing guarding
- Perimeter zone guarding
- Examples of guarding around different machine designs
- Upgrade options available
- Example of old carousel upgrade.
- Oven escape
- Training

*Examples of
Risk Reduction*

WHO IS IAN HANSEN?



Over 30 years experience in the plastics industry.

- 15 years in colour compounding and grinding of powders
- 15 years in rotational moulding operations.

Ian has previously served as President of ARMA (ARM Australasia)

Also served on the board of ARMO (Affiliation of Rotational Moulding Organisations)

12 years involved in the manufacture of water and chemical tanks, as well as custom moulding, using a variety of equipment; from rock & roll open flame machines to biaxial hot air ovens.

Presented to rotomoulding audiences around the world on Quality and Tank Standards.

Written technical articles for Rotoworld.

Currently works as an independent consultant to the global rotomoulding industry.

Industry association resources

Participate in industry safety programs

Enter annual ARM Safety Recognition Awards

As association members you have access to a large technical library covering a variety of information related to rotomoulding.

Use this resource!

ARMA – Machine Guarding Guide (2013)

MAGAZINE FOR THE ROTATIONAL, MouldING & PLASTICS INDUSTRIES
RotoWorld.

ARM NEWS
AUGUST
ARMA
ARMA-CE
SEPTEMBER
NORRICH ARMA
2013

Association of Rotational Moulders Australasia Inc. (ARMA)

Case Study: Carousel Perimeter Safe Guarding

by Ian Harcourt, Roto-Consult



2015 ARM Annual

Machine safe guarding

Severed fingers, crushed limbs, blindness...

The list of potential machine related injuries is as long as it is horrifying

There can be as many type of hazards from moving machine parts as there are types of rotational moulding machines

Machine guarding is essential to protect people from needless and often preventable injuries

Managers and supervisors are responsible to have undertaken a logical and organised approach to risk assessment and risk reduction for all machines and equipment used in the workplace.

Do you have a Risk Assessment Plan?



Risk Assessment vs Risk Reduction



Risk Assessment

The process by which the intended use of the machine, the tasks, the hazards and the level of risk are assessed.

Risk Reduction

The application of protective measures to reduce risk to a tolerable level.



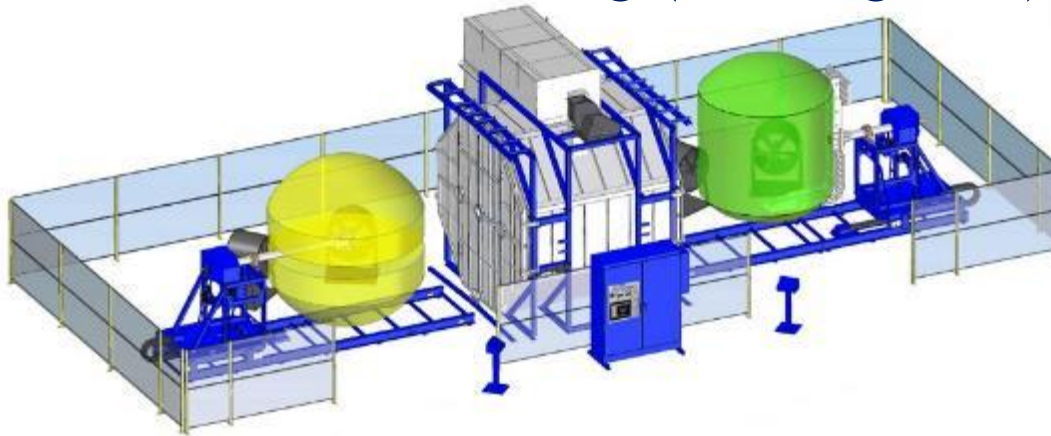
Warnings and training
are least effective
because people will
always make mistakes!



Specific Moving Part Guarding



Zone Perimeter Guarding (fence guard)



1 Fixed Guard

Normally used where access to the machine during operation or maintenance, when the machine is stopped or isolated, is less frequent (ie once per shift)

Provides a barrier – a permanent part of the machine, preferable to all other types of guards.

This guard type is not suitable where access to those areas is necessary for regular cleaning and maintenance.



1 Fixed Guard

User built guards may not conform well to the configuration and function of the machine.

There is a risk that user built guards may be poorly designed or built.

Not used as built



1 Fixed Guard

Open Flame Rock & Roll mould frames typically have running rings ('L' or 'C' section) which use idle or drive wheels to support the front section of large moulds, which creates a classic pinch point

The risk of operators getting their hands or loose clothing caught are minimised with guards



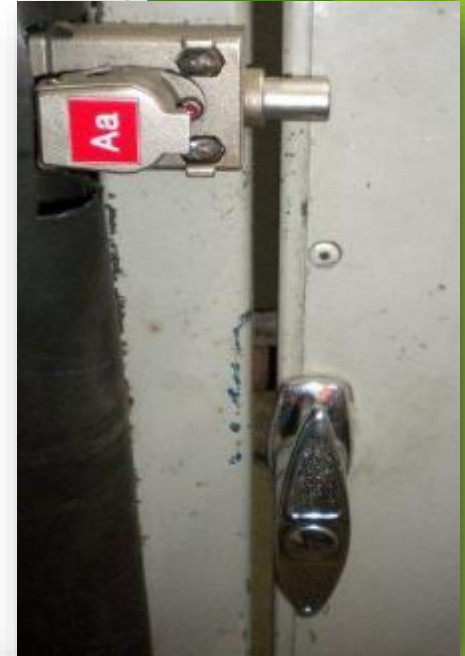
2 Interlocked Guard

When this type of guard is opened or removed, the tripping mechanism and/or power automatically shuts off, and the machine cannot be started until the guard is back in place.

Used when a process requires operator to open or close a guard frequently

Interfaced with control system to prevent accidental access

Connected to power control



3 Presence sensing system, trip devices

When this type of guard is opened or removed, the tripping mechanism and/or power automatically shuts off, and the machine cannot be started until the guard is back in place.

Often used where regular access to the area of the machine requiring guarding is necessary (e.g. unloading & reloading moulds).

Interfaced with control system to prevent accidental access

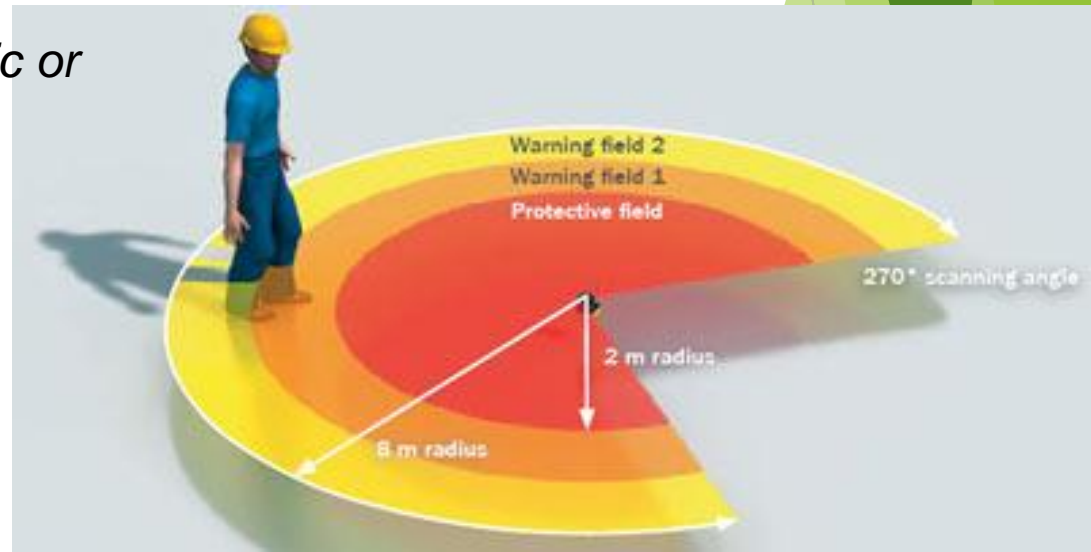


Mechanical barrier trip device

- *electrical, mechanical, hydraulic or pneumatic*

Photoelectric trip device

- *Light beam*



Safe Guarding by distance : Perimeter Guarding

Maintain a safe distance from the danger area to the worker



A perimeter guard is a fence which completely surrounds a machine. It is regarded as a form of engineering control if a portion of the machine is incorporated as part of the fence, *otherwise* it is a form of isolation in the hierarchy of control.



Rock & Roll Open Flame



Isolation is a popular control option



Rock & Roll - Single Station Oven



Fixed Guard rails



Single station - Oven

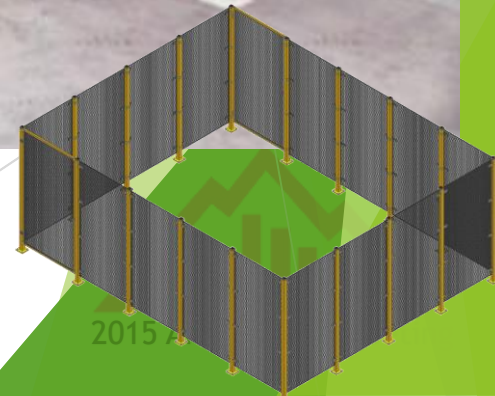
Fixed Guard rails
Safety Fence
Light Curtain



Double Shuttle Oven



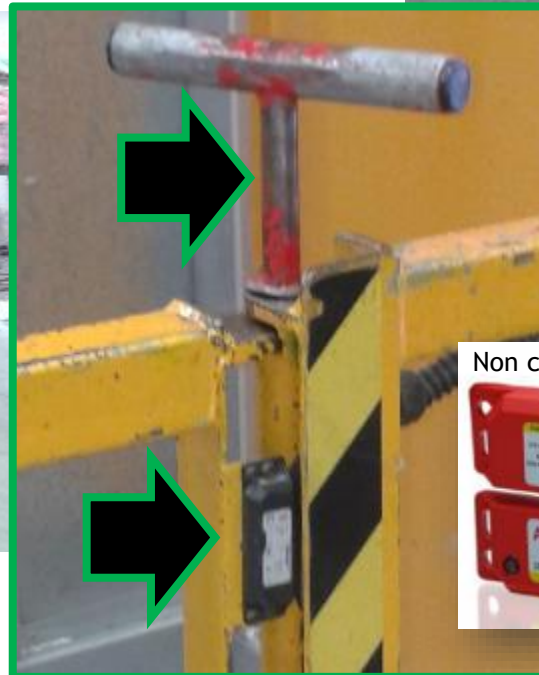
Isolation control



Shuttle Oven



Movable guards



Non contact safety switch



Triple Shuttle Oven



RotoWorld®



*Isolation
guarding, more
common place
option for new
machines*



Carousel Oven



Centre Carriage guarding



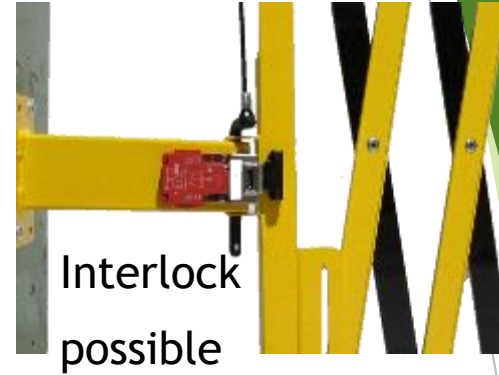
Perimeter guarding

Light Curtains



Bollard Chain fence

Expandable fence



Colour coded safety zones



Note the floor colour difference

Fall Prevention Guard rails



ROTOMACHINERY
POLYMER
STP GROUP

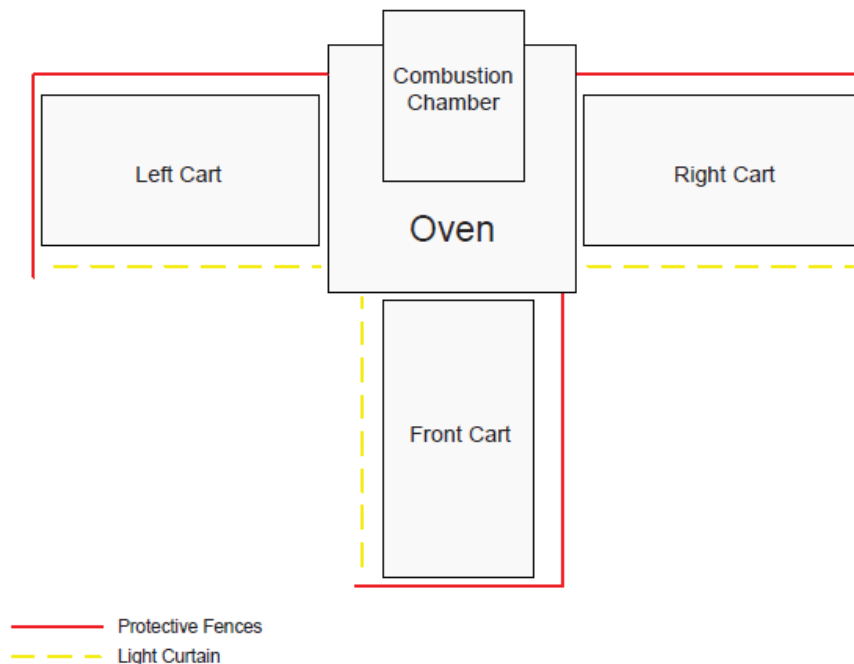


Maintenance



Buy safe guards with new machine

1.8. Light Curtain



Supplier Machine Manuals will usually reference safety:

The light curtain is used to secure the cooling zone of each side to avoid injuries due to cart movement or axis rotation.

If the sight between the light curtains emitter and receiver is obstructed, all movement in the breached area will be forbidden.

A distinct sound signal from the cart buzzer will warn the operator that the secure zone has been breached. If the cart needs to come out of the oven while in automatic cycle, the axis will remain in rotation, the oven burner will be put in low fire and the automatic cycle will be put in hold until the area has been cleared, the light curtain reset and the cycle resume by pressing the start button.

The zone must be enclosed using protective fences to forbid an access to the cart from the sides not protected by the light curtain.

The Figure shows an example of the fences layout.

Buy safe guards with new machine



or retrofit to existing machine

Upgrade with new safety solution



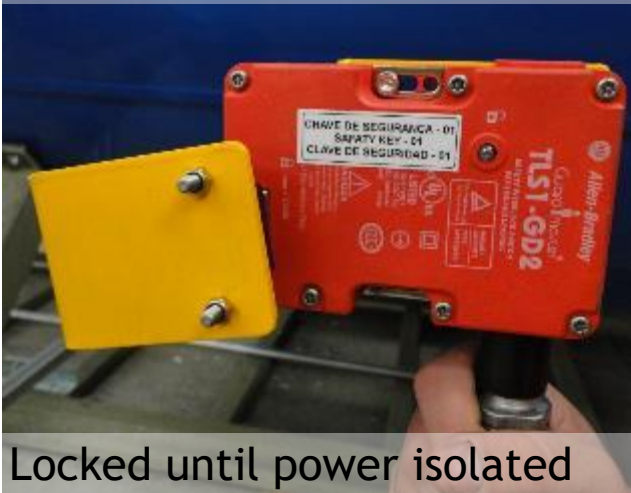
Positive tongue operated interlock switch



Safety Relay



Safety Contactor



Locked until power isolated

TLS-GD2 is ideal for machines which do not stop immediately, or where premature interruption of the machine could cause damage to tooling and components or cause an additional hazard.

Machine supplier can sometimes update software program to enable new safety features, so you can shut down more specific parts of machine.

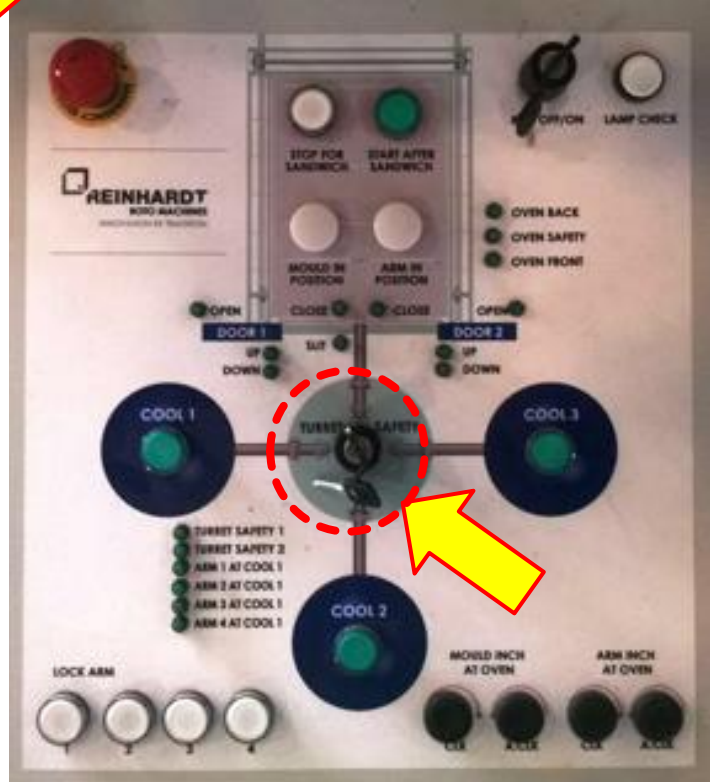
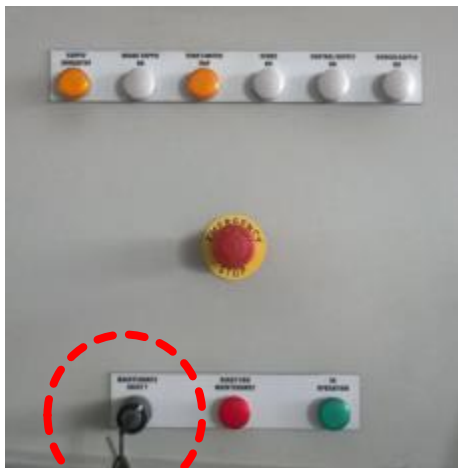
“I don't need to upgrade my machine safety to the latest technology standards”



Rheinart 3 Arm Carousel Machine

Does the lack of safety fence around the centre carriage turntable (turret) create unnecessary risk?

Standards can change...



*Turret safety: Center completely isolated
Operator must lock and remove key when
entering turret*

Upgrade of old McNeil carousel



*Power on - key trapped. Once the key is turned and removed the power source is **isolated** and the key can then be taken elsewhere*



Machine suppliers can sometimes update software programs to enable new safety features, so you can shut down part of machine, instead of total power cut.

Gate open, with key in lock, operator has manual control

Upgrade of old McNeil carousel



Key out of locks, no manual or automatic movement of carriage or rotation possible.
Gate open, key in lock, power isolated to carriage in Oven, Pre-cool and Cool stations.
Key out of main control panel - oven entry door locked, oven exit door able to open.
Podium has manual control over Primary and Secondary rotation to service the moulds.

Upgrade of old McNeil carousel



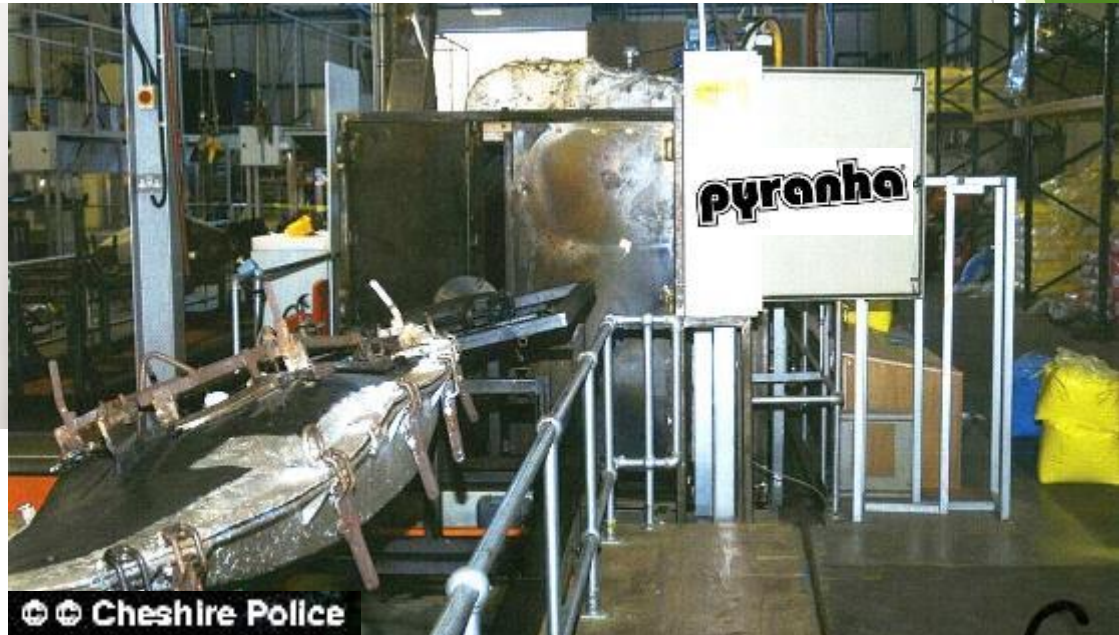
Light Curtain
highlight line

Yellow
Painted floor

Lock out / Tag out

Locking out has to do with the removal or prevention of hazardous energy (Securing a standard Personal Danger Lock (PDL) at the physical isolation point)

Tag out is a communication technique that warns others that the machine is under repair or maintenance. (Securing a standard Personal Safety Tag (PST) to the item of plant or equipment which displays a prominent warning and includes the name of the person who is working on the equipment)



Cheshire Police

There had been no escape hatch fitted to the oven prior to Alan Catterall's death
No line of sight from control panel inside the shuttle oven chamber

Death 2010 while cleaning ovens
Judgement 2015 - US\$0.5 million
fine/cost

Machines with automatic closing doors



If you have automatic moving carts and oven doors, you need to alert staff when movement is about to automatically occur.

Provide training on machine operation, including break down maintenance and cleaning maintenance.

What if procedures & training are not followed?



Do your operators have line of sight from their control panel (podium) inside the oven?

Do you have a means of oven escape if procedures and training not followed?



Exterior oven



Interior oven

User built shuttle oven Emergency Exit

You need it...



Training on machine guarding must be provided to operators, and should include :

- Information about potential hazards in the workplace
- The correct use of machines and their particular safe guards
- Personal Protective Equipment that may be required
- Methods for reporting unsafe conditions

Training

Knowledge
useful abilities
backbone of co
quired for a tr



3 TAKEAWAYS

1. Go back to your plant and check your existing safety guarding is working correctly
2. Review safety guarding equipment and procedures to ensure adequate for today
3. Consider if you can make improvements that may reduce risk of accident or injury tomorrow

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