Machinery Guarding Training Pack for Quarries.

The Covid-19 pandemic has prevented the delivery of Quarry Safety Campaign workshops to ICF members as normally happens when the HSA run initiatives for the quarrying Industry.

To continue to support improvement in safety standards in the Quarry Sector, the Authority has decided to provide campaign guidance material within this information document that may help in achieving compliance.

Please consider the contents, distribute & explain to your staff, and take any actions as appropriate.

The Authority has prepared a Machinery Guarding Inspection Proforma that identifies the key areas that inspectors would review during any inspection. The Machinery Guarding Inspection Proforma is included in this information document. The Authority has also developed a generic checklist for conveyors that quarry operators could further develop and adapt for use at their quarries to carry our conveyor safety checks. The generic checklist may contain a number of items that may not be included on each conveyor, which is why it may be necessary for the quarry operator to adapt the checklist to reflect each conveyor at the quarry. The conveyor checklist does not specify a time period within which a checklist should be completed. This should be based upon the individual conveyor or location, on how many hours the conveyor is in use, the level of maintenance work that is required and the age and general condition of the conveyor.

Operating machinery that is inadequately guarded can result in fatal or severe injuries if a person becomes entangled or trapped. Similarly, maintenance work can be equally as dangerous if suitable isolation is not in place while guarding is removed or where work at height or in confined spaces is not adequately managed.

The generic conveyor checklist is overleaf and the Machinery Guarding Inspection Proforma which will be used by Inspectors is on the following page. The remainder of the document provides guidance on machinery and conveyor safety that may assist in addressing items in the Machinery Guarding Inspection Proforma.

Conveyor Checklist

Conveyor Name _____**/No** _____

Date of Inspection _____

Inspected by _____

	Yes	No	N/A
Are Guards Coloured so that they Stand Out			
Are Tail End/Return End Pulleys Adequately Guarded			
Are Head /Delivery Pulleys Adequately Guarded			
Are Snub Pulleys Adequately Guarded			
Are Drive Pulleys Adequately Guarded			
Are Take-Up/Tension Pulleys Adequately Guarded			
Are Bend/Deflection Pulleys Adequately Guarded			
Are Return Idler Rollers That Are Accessible And Have Downward Pressure Adequately Guarded/Enclosed So That There Is No Trapping Or Crushing Risk			
Are Conveyor Belt Scrapers Adequately Guarded			
Are Nip Points Around The Feed Hopper Adequately Guarded			
Are Nip Points Around The Skirt Plate Adequately Guarded			
Are Nip Points Around The Chute Adequately Guarded			
Are Proximity (Fixed) Guards Securely Fastened And Require A Tool To Remove			
If Weekly Or More Frequent Access Required To Areas Behind A Fixed Guard, If So			
• Is There An Interlock System In Use With Proximity (Fixed) Guards			
• Is A Captive Key System In Place For Isolation			
• Is There A Single Key For Each Captive Key System (No Duplicates)			
Are Tension Rollers Fully Enclosed And The Guard Extend At Least 600 Millimetres Past The Nip Points At The Top			
Are Tension Units Fully Enclosed Or At A Height Where They Do Not Present A Danger At The Base			
Are There Procedures For Isolating The Conveyor And Any Associated Equipment (I.E. Conveyors Feeding In Or Out From That Conveyor)			
Do The Procedures Require Physical Isolation I.E. Personal Locks Or Captive Keys			
Are Isolation Points Clearly Marked			
Can Individual Drive Motors Be Isolated			
Is A Pullwire Stop Available Over The Length Of The Conveyor			
Does The Pullwire Stop The Conveyor When Pulled In Either Direction			
Does The Lock Out Box Latch To The Off Position When The Pullwire Is Pulled			
If Emergency Stops Are Provided Are They Clean And Easily Accessible			
Have Emergency Stops And Pullwires Been Tested To Ensure Safe Operation			
Are Walkways Free From Spillage			
Are Walkways Structurally Safe And Safe For Travelling Upon			

Inspectors Machinery Guarding Inspection Proforma

The inspector's machinery guarding inspection proforma identifies the key areas that the Inspector will be seeking compliance with during any inspection.

No	Question	Yes	No	N/A
1	Are Return And Delivery Drums Of Conveyors Adequately Guarded			
2	Are Drive Drums And Drive Belts Adequately Guarded			
3	Are Tension Units Adequately Guarded			
4	Is Proximity Guarding In Good Condition			
5	Does Proximity Guarding Require A Tool To Remove it			
6	Where Access Is Required In Proximity Guarding Is An Interlock In Place/Padlock And Procedures			
7	Are Skirts/Transfer Point Rollers Adequately Guarded			
8	Can Conveyors And Other Equipment Be Isolated And Locked Off			
9	Are Isolation Procedures Known/Used/Followed			
10	Are Exposed Idler Rollers That Are A Nip Point Adequately Guarded			
11	Are Pullwires Operating Correctly (In Either Direction)			
12	Do Lock Out Boxes Latch When Pullwire is Operated			
13	Are Emergency Stops Accessible, Suitable And Operational			
14	Are All Sprockets/Chains/Drives Guarded			
15	Are Walkways On Conveyors/Crushers In A Safe Condition			
16	Are Walkways On Conveyors Free From Spillage			
17	Are There Records Of Conveyor And Pullwire Inspections			
18	Are PTO Shafts Adequately Guarded			

Conveyor Terminology

Nip points are any dangerous point occurring on the in-running side at the line of contact between the conveyor belt and rotating pulley and in certain cases between the conveyor belt and an idler roller or a fixed part of the conveyor.

Tail end/Return pulleys are usually found close to the point where material is loaded onto the conveyor belt and is the terminal pulley at the tail of a conveyor as shown below.

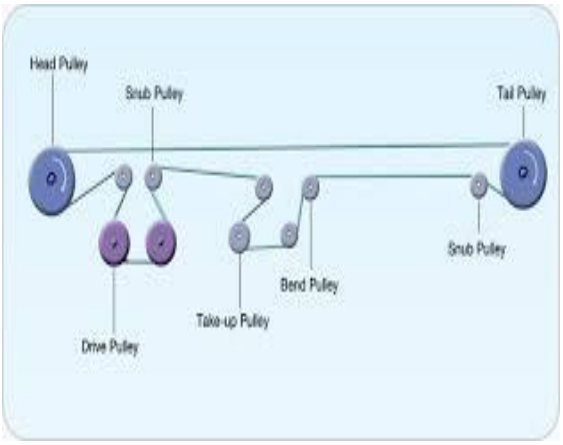
Head/Delivery pulleys are found at the point where the material transported by the conveyor is transferred from the conveyor as shown below and is the terminal pulley at the head of a conveyor.

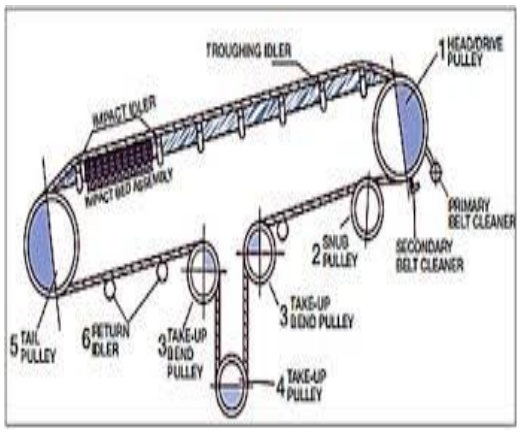
Snub pulleys are normally positioned on the outside of the conveyor belt, and are used to develop the necessary arc of contact (angle of wrap) of the belt on the drive pulley and could be on any of the locations below.

A drive pulley is one or more pulleys that drives the belt and is usually powered by one or more electric motors; the head/delivery pulley may also be the drive pulley.

Take-up/Tension pulleys are designed to increase the tension of the conveyor, they can be horizontal or vertical and are usually installed on inclined or heavily loaded conveyors, they are a moving pulley used in the take-up/tension device for taking up slack and applying tension to the conveyor belt as shown below.

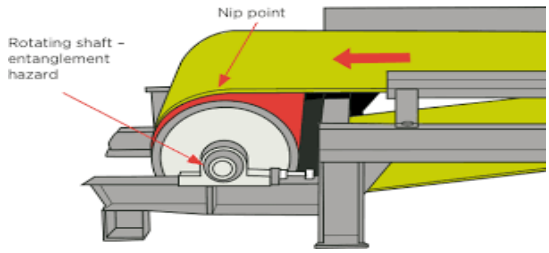
Bend/deflection pulleys are pulleys used to change the direction of the conveyor belt as shown below and have significant force placed upon them by the conveyor belt.



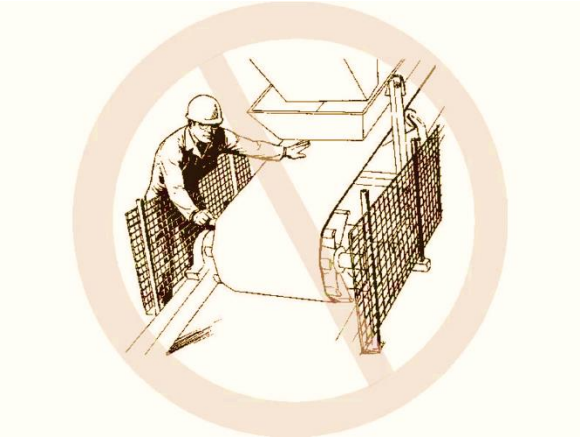


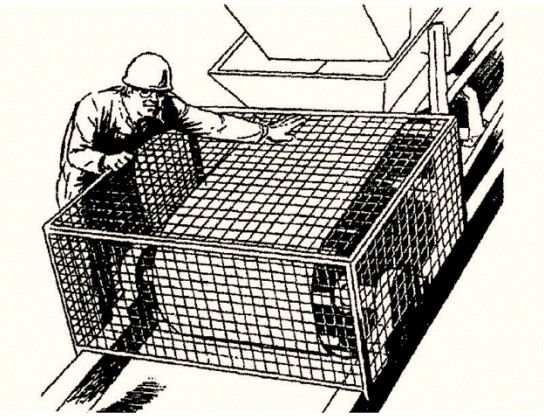
Direction of Conveyed material

Head drum guarding should prevent access to head drums and all associated nip points. The distance from the guard end to the centre shaft of the head drum should be a minimum of 1000mm. Where troughing idlers are positioned close to the head drum and place the belt under tension, the guard should be extended.



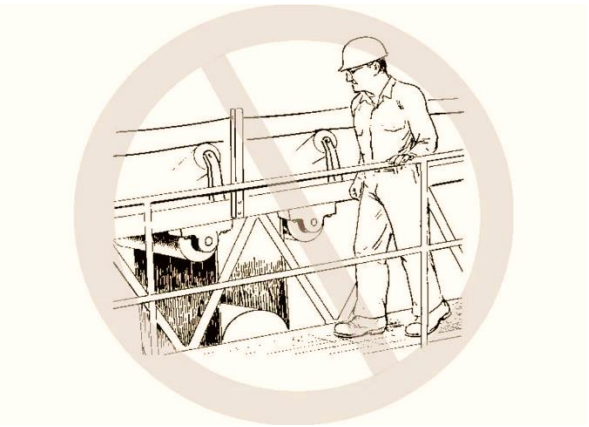
Tail/return drum guarding should enclose all rotating shafts and nip points and extend at least 600 millimetres from the entanglement hazards. They must require a tool to remove them and must be replaced following any maintenance work or clean up before the conveyor is restarted.

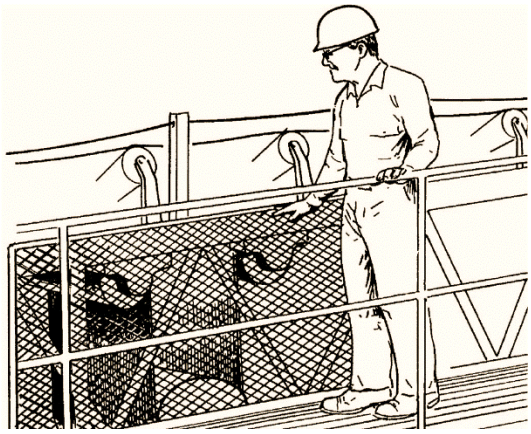




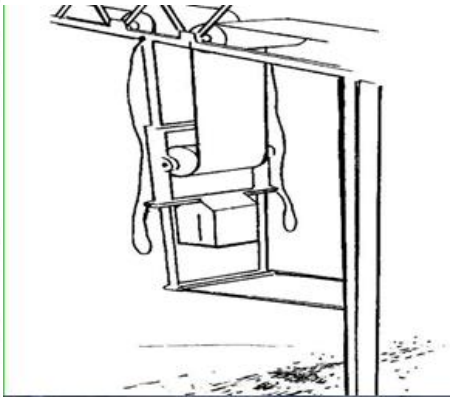
Drive belts transmit the power from the electric motor to the drive, they rotate at high speeds and should be fully enclosed and must require a tool to remove them and the guard should always be replaced following maintenance.

Vertical tension Units must be guarded at the top and the bottom of the tensioner. At the top the guard must extend at least 600 millimetres beyond the nip point.





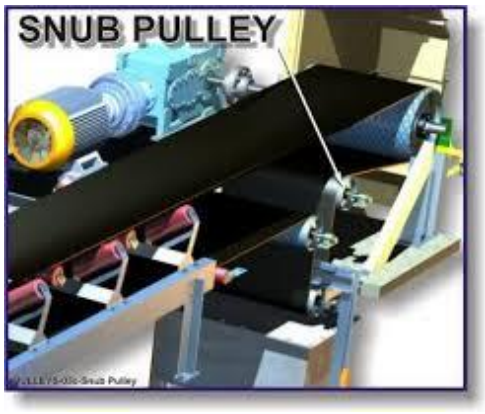
The area at the base of the tension unit must prevent access to any nip points or rollers and be of adequate height to prevent anyone reaching into the unit as shown on the illustration on the left below.



Conveyor vertical take up device takes up slack and applies tension to the conveyor belt, particularly at start up or during heavy loading. Normally a vertical weight moves up and down to apply the tension.

Conveyor gravity take-up units should be enclosed with mesh panels that prevent access to moving parts within the tower including the risk of the gravity take-up weight falling to ground level in the event of the belt breaking. The panels should be at least two metres high so that a person cannot reach into the roller. All panels should be secured such that they require a tool for removal.

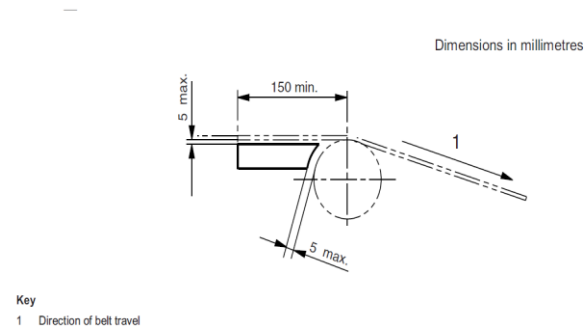
Snub pulleys have significant force acting upon them as they change the direction of the conveyor and should be fully enclosed by a guard that extends at least 600 millimetres beyond the nip point.

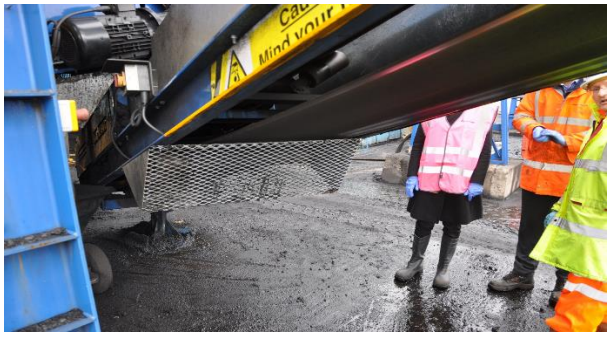


A scraper is a cleaning device fixed or flexibly mounted on the return (empty) side of the belt across the width of a belt or pulley of a conveyor, for removing material and require guarding if they are accessible and are a nip point.

Return idler rollers support the return (empty) side of the belt and require guarding if they are accessible and have downward pressure placed upon them by the conveyor.

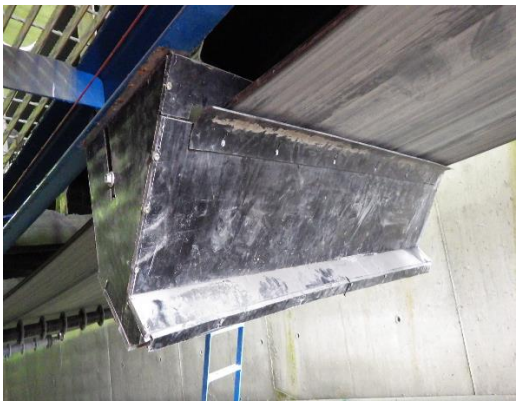
A return idler nip point guard is a fixed guard inserted at a return nip point designed to physically safeguard the nip point by preventing access to the roller. However, nip guards are often not correctly fitted or set to the correct dimensions to provide adequate protection so that a person is not at risk of becoming trapped or crushed in the roller. In addition to this, the required 5 millimetre maximum distance to the conveyor belt is difficult to maintain during start-up of the conveyor or when it is loaded or if insufficient tension is applied to the conveyor. Even when fitted in accordance with the diagram below and where the belt can yield (leave the idlers) to produce a clearance of at least 50 millimetres at the nip point it may not prevent the risk of trapping or crushing.





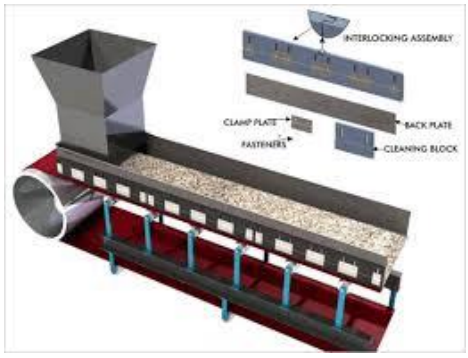
It is highly recommended that where any return idler roller is accessible and there is downward pressure on that roller that it should be enclosed or fitted with a guard that will prevent the trapping or crushing risk either in addition to or as a replacement for a nip guard.

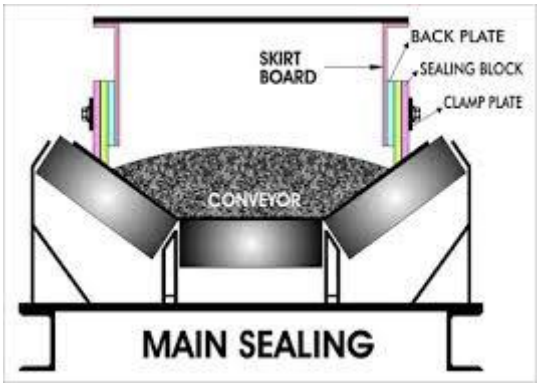
Examples of suitable idler roller guarding are shown below



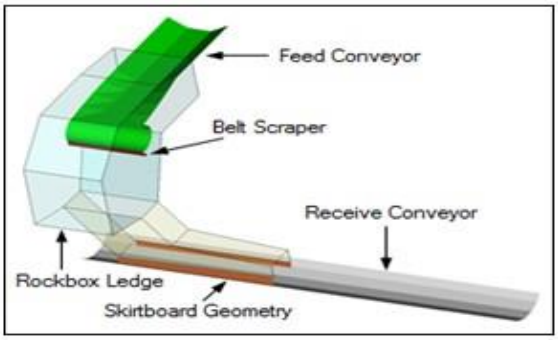
The feed hopper is the collecting device at the delivery point of the conveyor for receiving material.

The skirt plate is an extension to the feed hopper or an independent plate along part or the length of the conveyor for centralising and/or retaining material on the belt.





A chute is a straight or curved, open topped or enclosed, smooth trough through which materials are directed and fall under gravity onto another conveyor, crusher, sizer, screener or stockpile.



Fixed distance guarding, sometimes called proximity guarding does not enclose the nip points and provides protection by preventing physical access to operating equipment by virtue of its dimensions and its distance from the danger zone.

Fixed distance guards must as a minimum require a tool to gain entry i.e. bolted sections that require a spanner or other tool to remove them, padlocks are not an acceptable alternative to bolting or other fixings as a key is not a tool.

If regular access (weekly or more frequent) is required then a hinged access point that is electrically interlocked should be provided to enable access and ensure isolation. Preferably, this should be a trapped key system that requires a unique key to be removed that will isolate power to the equipment which can be then used to allow access.

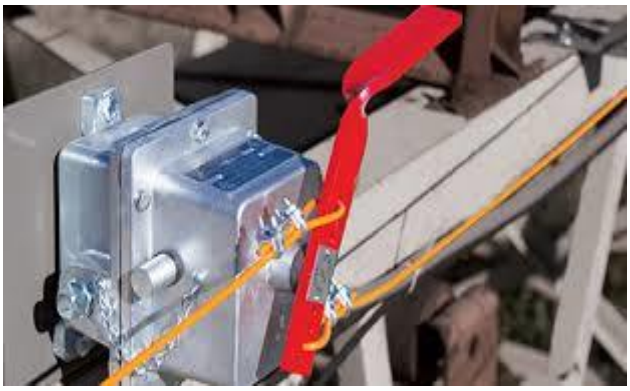
Modern captive key locking systems require the power to a piece of equipment to be isolated before allowing the key to be removed. The key should only be available if removing it from the electrical supply panel switches off the equipment and it cannot be energised without replacing the key. The key can then be used to open a gate or allow access to a paddle mixer/block maker or be retained by the person carrying out maintenance on the equipment.

There should only be one key, duplicate keys can defeat the protection. Some older systems such as those originally used on block making machines were designed to permit dual key use but are no longer recommended.




Pullcords are designed to stop the conveyor in the event of an emergency. All conveyors over 5 metres in length should be fitted with pullcords.

Pullcords must be mounted using a position switch at either end or a position switch at one end and a tension spring at the other end. Pullcords must not be firmly anchored at either end as this will limit the effectiveness of the pullcord to work in both directions. They should be tested on a regular basis. A written record of the test and any repairs or adjustments required must be carried out immediately.

Emergency stop buttons are designed to stop the conveyor in the event of an emergency. Emergency stop buttons must be red, prominently marked and easily identified with a mushroom head latch in type or lock in type with manual reset; they should be tested on a regular basis.

A written record of the test and any repairs or adjustments required must be carried out immediately.



Crusher flywheels, sprockets and drive belts should be fully guarded or enclosed.


PTO Shafts on bowsers and tractors must be adequately guarded with a complete PTO Guard as take off points are a serious entanglement risk. There must also be a “U gurad” in place on the tractor and an “O guard” on the machinery it is driving. The chain should be attached to the U Guard to prevent rotation and damage to the PTO Guard.



Walkways on inclined conveyors should be kept in good condition, fitted with handrails, be free from spillage and be structurally sound so that there is no danger of a person falling or the walkway collapsing when in use. Side boarding should prevent any spillage falling from the conveyor walkway onto persons below.