SARCLAD

TECHNOLOGY FOR THE METALS INDUSTRY

Rollscan Buyer's Guide

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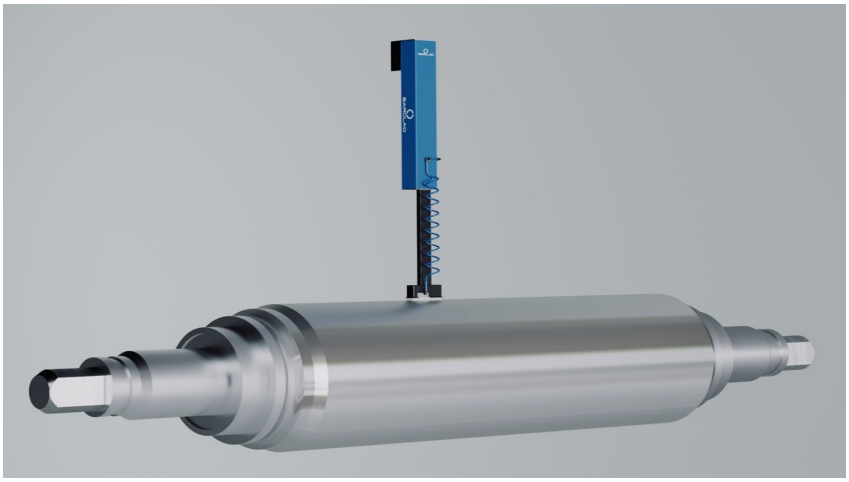
What is a Rollscan?

Rollscan is Sarclad's roll inspection system brand. Launched in the 1980's it was the first brand introduced to detect cracks in work or back up rolls used by steel mills to produce strip steel. Using eddy current technology, defects can be detected on the surface of the roll that can be removed by grinding to ensure optimum roll surface at all times.

Defects in the core of the roll can also be detected with ultrasonic technology. This is especially important from a safety perspective to avoid roll breaks and potentially roll explosions. Rollscan is the market leader in North America and globally recognised with over 600 units sold worldwide.



Who Needs Roll Inspection?

Any mill that wants to optimise its roll fleet from a productivity, quality and safety perspective should have one on each grinder that they have in operation. This includes hot and cold rolled steel mills and aluminium rolling mills.

Roll manufacturers also scan their brand-new rolls to ensure their rolls are defect free before being delivered to steel mills, often under guarantee.

What type of rolls can be scanned?

In a system designed for easy application in a roll grinding environment. The system is applied to all common roll materials used in the mill.

- High Chromium Irons
- Alloy Indefinite Chill
- High Speed Steel
- Forged Steel

Why Should I Purchase a Rollscan?

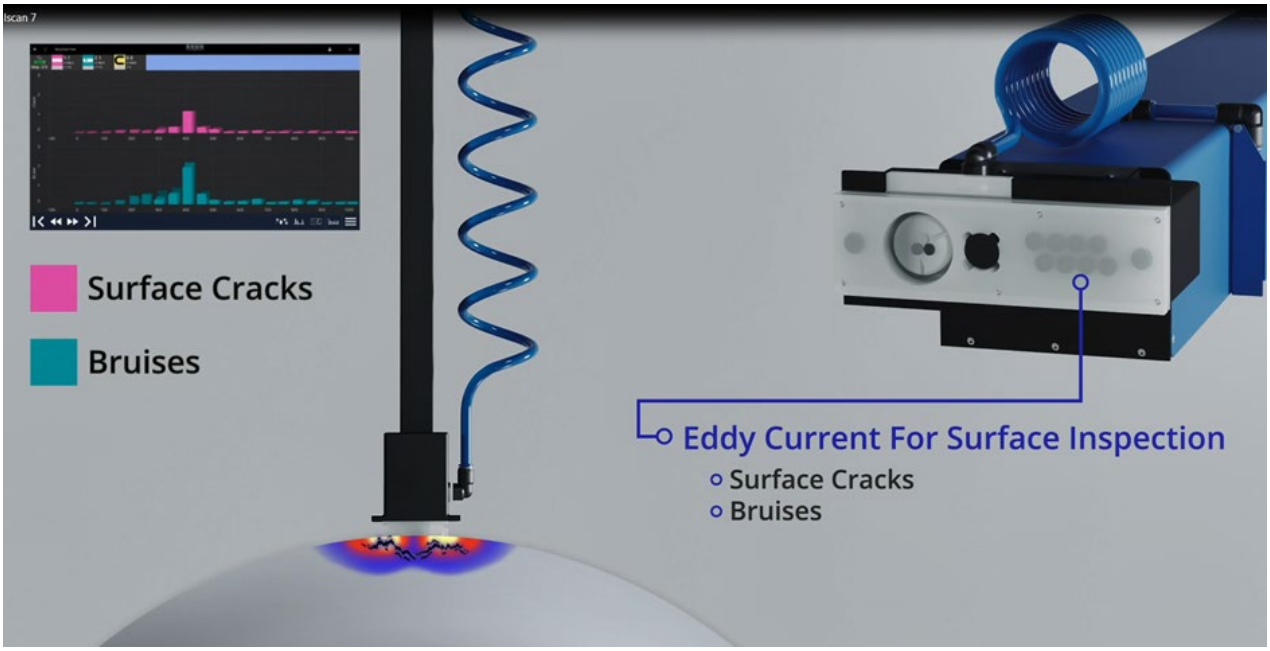
Roll Safety & Quality	Full roll coverage capability with three technologies available on one probe head.
Time Saver	Compact, user friendly operation with sensitive area inspection Width> competition: (EC 32mm surface; 20mm sub surface)
Money Saver	Intelligence for your grinding operation. Avoid unnecessary wear life depletion on your rolls. Low maintenance and proven shelf life
Fast Payback	Return on investment typically <1 year through optimised wear life (please ask for or return-on-investment calculator)
Integrate With Your Grinder	Range of integration solutions available (CNC, Profinet, Profibus)
Regional Sarclad Service & Support	United Kingdom, United States, India and China
Roll Fleet Management Aid	Minimise your quarantined rolls rack with Sarclad Defect Finder
Sarclad Capabilities	Over 600 sales globally showcases proven durability in operation and excellent after sales support

How Does It Work?

Sarclad offers three different defect detecting technologies on one probe head to offer the most comprehensive coverage on the market:

1. Roll surface Inspection
2. Ultrasonic Compression wave detection
3. Ultrasonic Surface / Creep wave detection

1. Roll surface Inspection



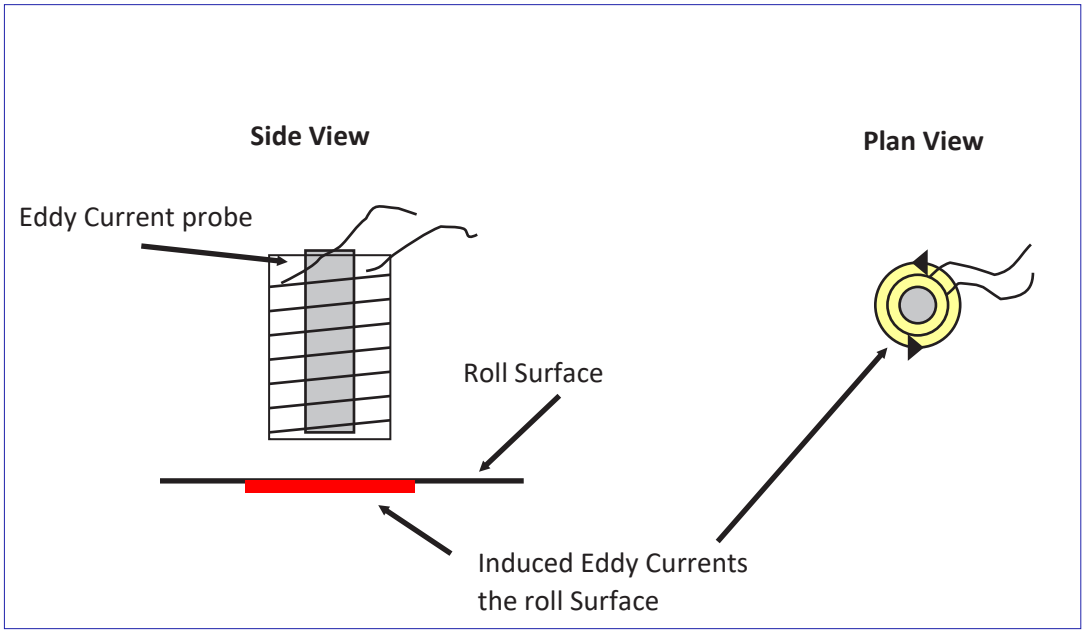
The Rollscan eddy current system for surface inspection is routinely used to detect common causes of roll damage.

Eddy current inspection is a non-contacting method that reveals any metallurgical anomalies.

- Detects and quantifies surface cracks.
- Detects and quantifies pinch bruises, tail end marks and local changes in hardness.

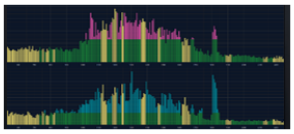
How Surface Inspection Works

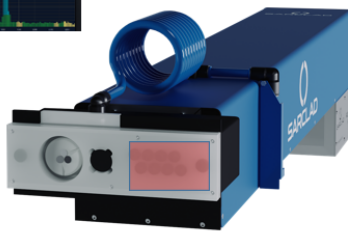
An eight-probe eddy current system is used for higher roll scanning rates. This simple diagram below shows the basic principle of eddy current inspection. A coil through which alternating current is flowing will induce eddy currents in metals placed close to it. A flat surface brought close to the coil will have eddy currents induced in it. The currents will flow as shown in the plan view.



When the eddy current probe passes over a surface breaking crack or bruise on the roll surface the induced eddy currents are disrupted. This disruption is then recorded, quantified, interpreted, and displayed by the Sarclad Rollscan system.

Eddy Current Detection Output





1. Coverage
Rollscan provides the operator with an indication of coverage, based on the speeds set by the operator for a given pass (shown as a percentage of full coverage).
Orange window indicates below the coverage threshold value
Green window indicates above the coverage threshold value.

2. Crack Detection
The maximum crack depth detected (mm) is shown along with the position on the roll using;
1. X (longitudinal) and
2. Y (circumferential) coordinates.

Note the colour coding (pink) is used on the crack data plot to indicate defects above the threshold value.

3. Bruise Detection
The maximum bruise size detected (0-3 intensity) is shown along with the position on the roll using;
1. X (longitudinal) and
2. Y (circumferential) coordinates.

Note the colour coding (blue) is used on the bruise data plot to indicate defects above the threshold value.

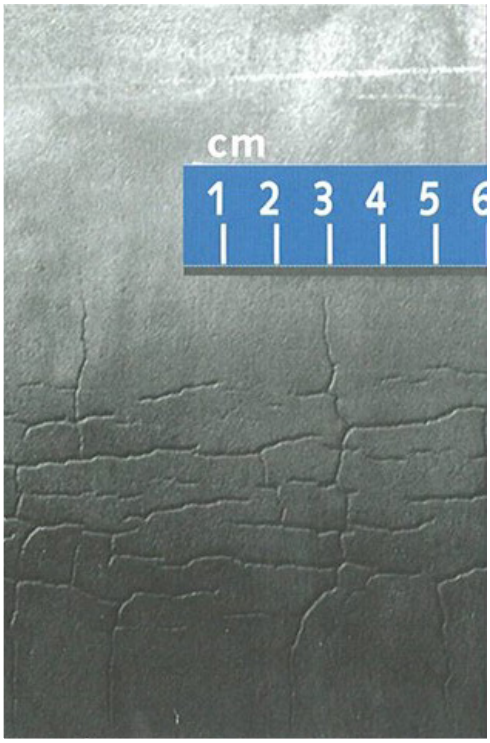
NB. The threshold is set by the Roll Shop Manager based on experience, knowing the typical background reflection levels received from rolls of a given material and from results obtained by manual scan.

4. Magnetism Detection
The maximum magnetism value detected is shown along with the position on the roll using;
1. X (longitudinal) and
2. Y (circumferential) coordinates.

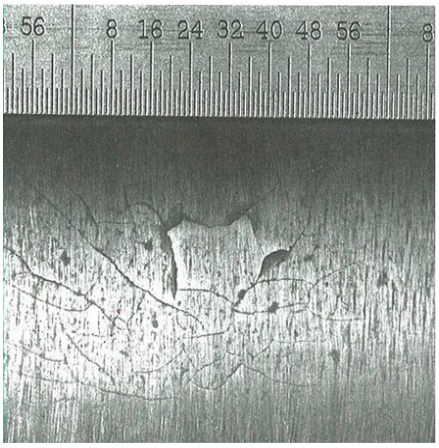
Note the colour coding (yellow) is used on the graph to indicate defects above the threshold value.

Typical Surface Cracks

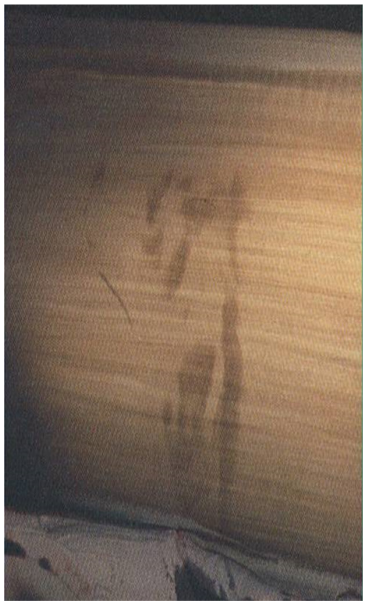
Hot Mill Fire Cracks

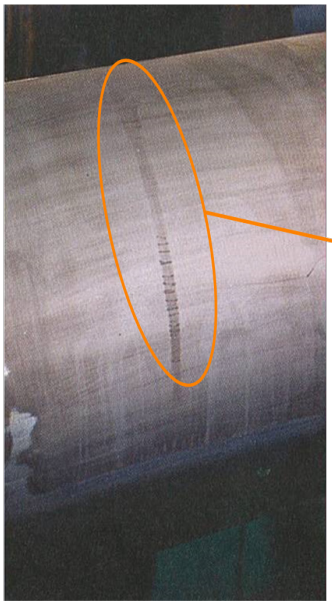


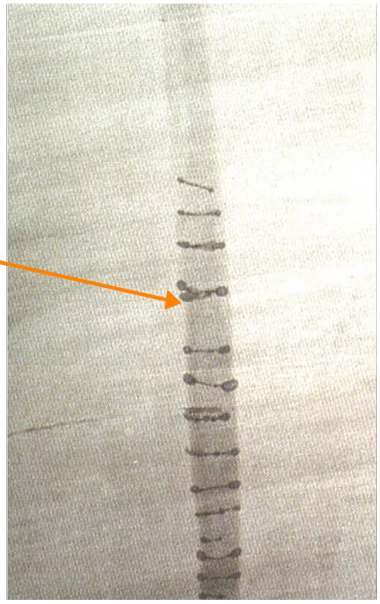
Cold Mill Surface Cracks



Typical Surface Bruising (and Cracking) Displayed After Etching







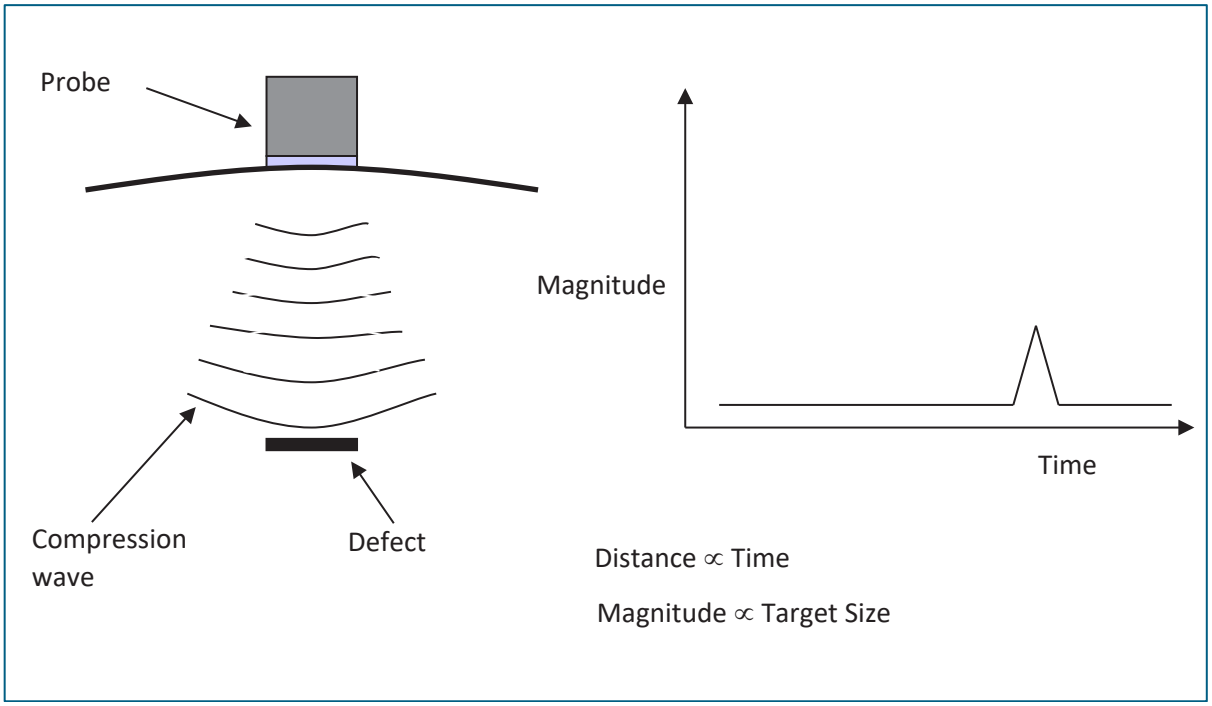
2. Ultrasonic Sub Surface Roll Inspection

Compression Wave

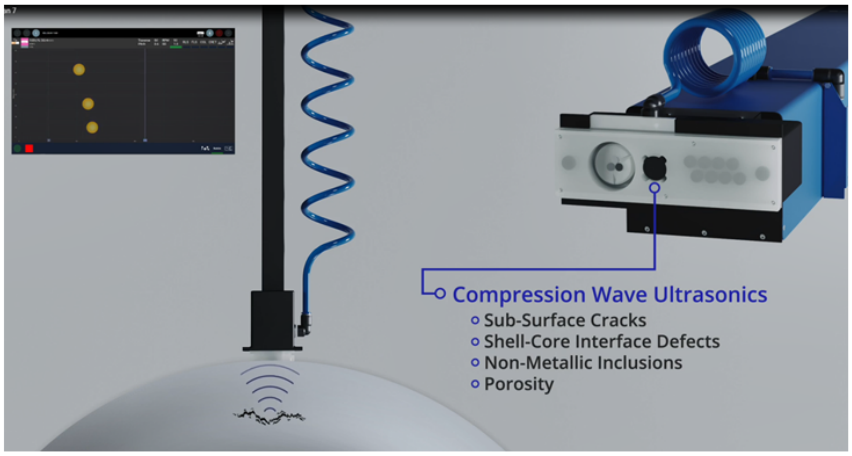
The Sarclad Rollscan Sub-Surface inspection system uses ultrasonic compression wave technology to detect sub-surface defects such as shell core defects, non- metallic inclusions, porosity, down to a depth of 100mm.

When looking at ultrasonics there are two components, transmission and reception. The ultrasonic probe transmits a sound wave and when a defect is present receives a reflection of that sound wave (an echo) which is then quantified compared to the original, recorded and displayed by the Sarclad Rollscan system.

The principle of ultrasound defect detection is shown in the diagram below.

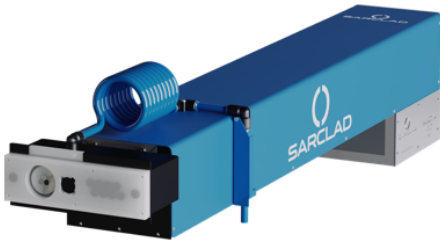


Compression Wave Technology for Depth Detection to 100mm+



Sub surface inspection capability : 20mm
Roll surface speed : 1m/s

Item	Typical Use	Frequency MHz	Resolution / Min Defect (mm)	Typical Depth Range (mm)
Sub Surface	Cold Mill	5.0 Twin Crystal	1.0	2.5 - 60
Sub Surface	Hot Mill	2.25 Twin Crystal	2.0	4 – 100+



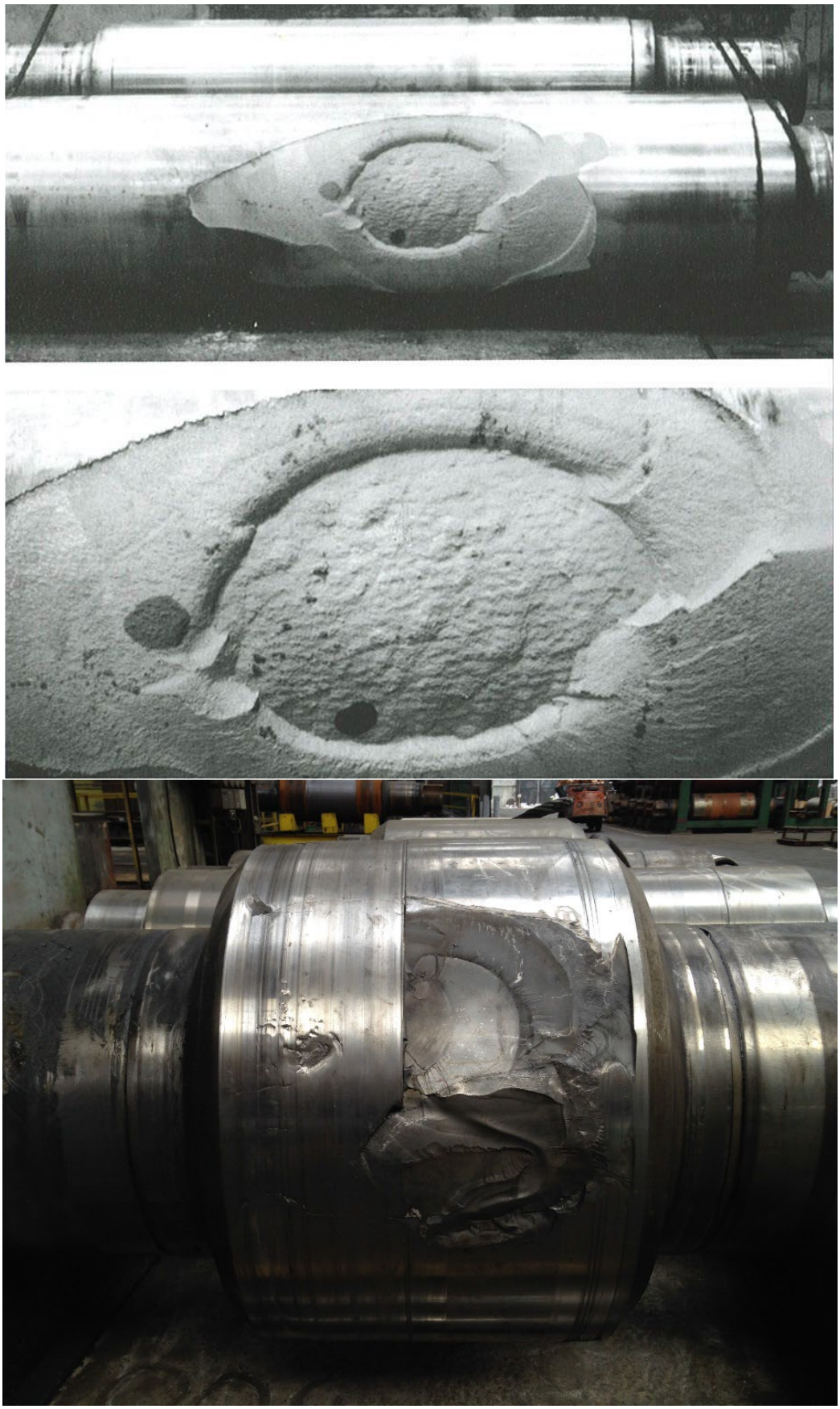
The Rollscan system uses a high frequency vertical ultrasonic probe to detect internal defects to ensure that the roll can be removed from surface prior to catastrophic roll failure.
The Subsurface flaws detected are typically;

- Areas of porosity
- Non-metallic inclusions
- Internal cracks
- Interface / Bond Separation

System performance specification is given in Table 1. The following images are examples of typical roll failures due to sub surface defects:

Cold Mill Roll Fatigue Spalls

Hot Mill Cast Roll Core / Shell Interface Spall



Which version do I need?

If only the surface off the roll needs to be inspected for cracks and bruises then the Eddy current rollscan should be selected.

If surface plus inspection into the core of the roll is required, then a rollscan with eddy current plus compression wave ultrasonics should be selected. If inspection just below the surface is required, then a rollscan with eddy current, compression wave and creep wave technology should be selected.

How long does it take to scan?

This depends upon the size of the roll and the technologies involved. Please provide roll dimensions and we will be happy to provide you with a calculation. Eddy current inspection can occur whilst the grinding operation is in operation, providing data to ensure that an informed decision is taken as to how much or little is needed to be ground from the roll. Ultrasonic inspection takes place after grinding.

How long do rollscans last?

Providing they are well maintained, rollscans have an excellent longevity track record and can typically be expected to operate for a 10 year period plus.

Why should I upgrade?

The latest Mark VII rollscan comes with the front- end processor built in, digital technology and enhanced probe head and grinder integration options.

What aftersales support is available?

Sarclad offers unsurpassed aftersales support from its local offices in the UK, US, India and China. This includes local engineers for servicing and delivery of required parts.

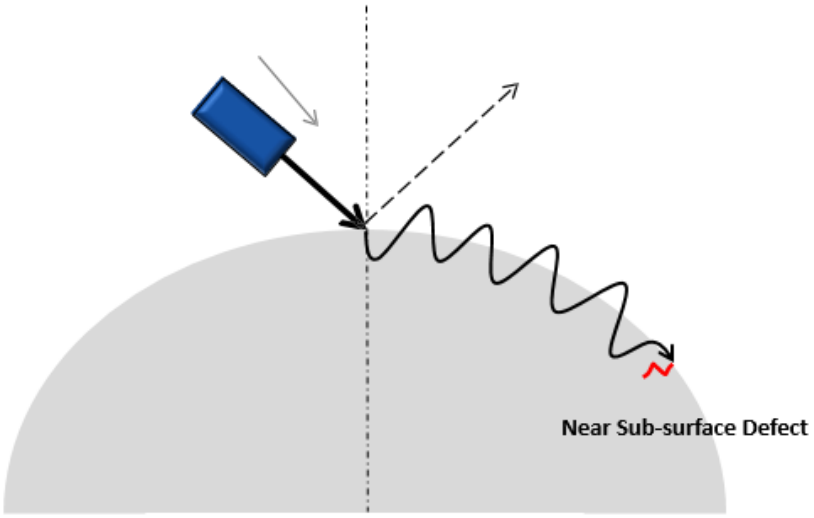
Who can I contact?

sales@sarclad.com

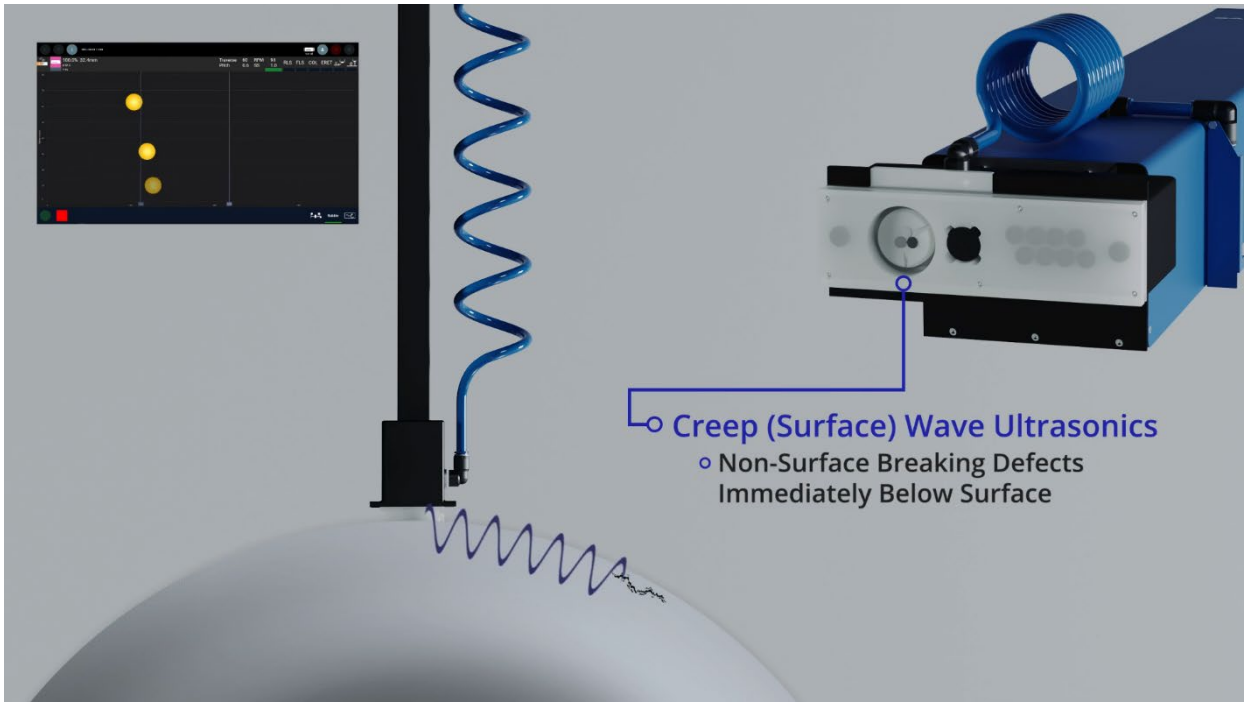
3. Creep (Surface) Wave Ultrasonics

Surface wave ultrasonic inspection detects both cracks on the surface and just below the surface of the roll. These near surface cracks will not be detected by eddy current systems but are too close to the surface for standard ultrasonic detection.

Surface wave works by angling the ultrasonic beam obliquely at the roll surface. Once this angle of incidence is above a critical point, the beam no longer penetrates towards the roll centre but instead travels around the roll circumference allowing detection of defects immediately below the surface.



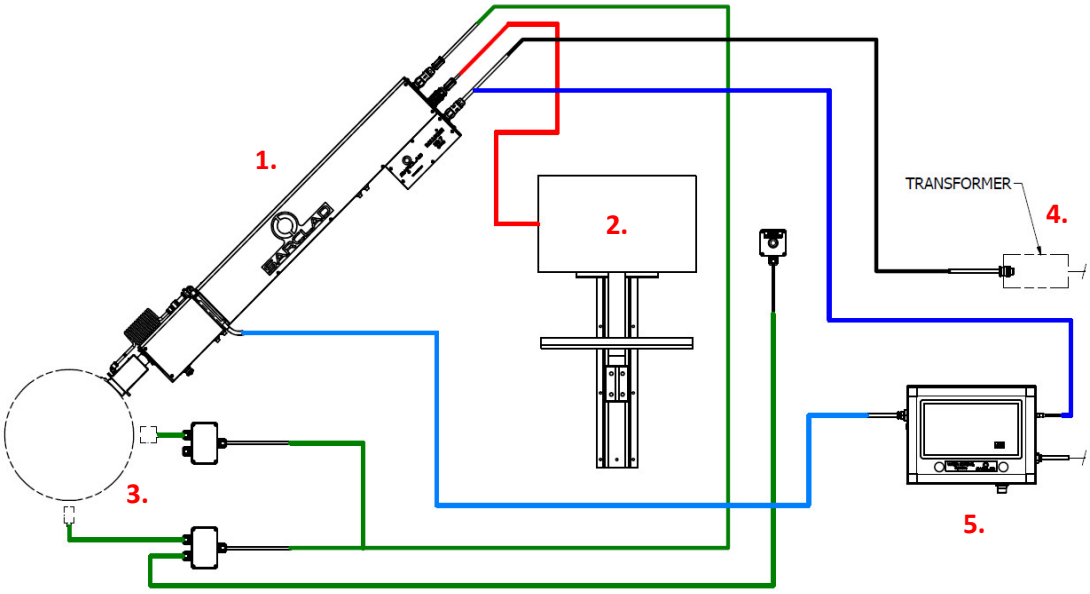
The surface wave system incorporates the same features as the standard ultrasonic system.

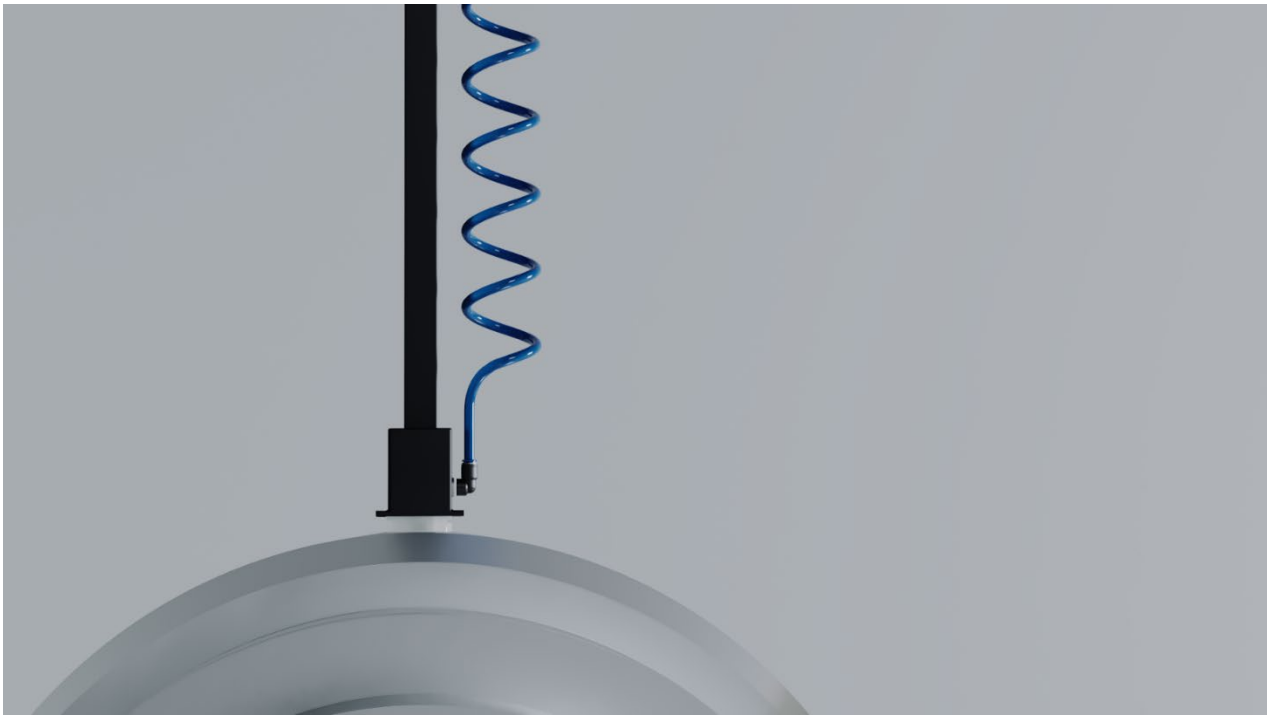


Typical Installation

System Components

The test head is usually installed on a roll grinder. It becomes an integrated part of the roll grinding process, allowing the operator to optimise the amount of grinding carried out.





Mark 7 Variant	Eddy Current Version A	Compression Wave Version B		Surface (Creep) Wave Version C	
Area of Detection	Roll surface defects	Up to100mm depth		Creep wave surface inspection	
Defects detected	Cracks & Bruises	Porosity, non-metallic inclusions, internal cracks, interface separation		Non surface breaking cracks	
Smallest detectable defect (surface)*	Shallow Crack >0.05mm Length >2.5mm Deeper Crack > 0.1mm Length > 1mm	Shallow Crack >0.05mm Length >2.5mm Deeper Crack > 0.1mm Length > 1mm		Shallow Crack >0.05mm Length >2.5mm Deeper Crack > 0.1mm Length > 1mm	
Smallest detectable defect (sub surface)		2.25MHz	2mm	2.25MHz	2mm
		5 MHz	1mm	5 MHz	1mm
Probe Head Dimensions (mm)	120 x 50 x 15	185 x 65 x 15		240 x 65 x 15 (typical)	
Filtering	Digital				
Inspection Sensor Range	32mm EC	+ 20mm sub surface 1.0 m/s		+7.5mm creep wave	
Inspection speed	2.5m/s				
Display Results	Histogram; Historic; Water Fall & Heat map + Bubble View (not for A)				
Operator Interface	Windows 10 and full touch / touch screen interface				
Frequency Available	1 MHz	2.25 or 5 MHz		10MHz	
Grinder Integration	Profinet, Profibus, customised solutions				
Support stand	Design and installation as required				
Coupling	Industrial water preferred-Grinding coolant possible with 50um filter				
Front end processor	Incorporated into test head				