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• Steel Cord Belt Non-destructive Testing • Remotely Accessed Belt Scanning

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☑ **Our Ref.**: TN-16/712
Date : 6/2010 : Revised 7/2012, 1/2014

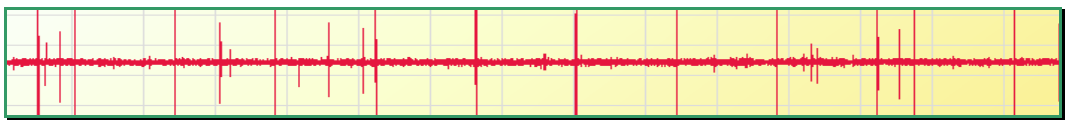
Technical Note : TN-16

Locating Non-visible Damaged Cables in Steel Cord Belts

☑ **Issued To : Website** **Version date Date : July 2012**
Date 1-3-2014

General supporting document for belt scan clients issued by :
Conveyor Technologies Pty. Ltd.

Visual Studio Professional



1.0 INTRODUCTION

Technical Note TN-16 describes general methods for locating and verifying broken cables in steel cord belts, in situations where NDT belt scan data indicates damaged cables and the damage is not visible on inspection.

Belt scans detect various types of magnetic field disturbances caused by :

a) Broken steel cables inside the rubber belt.

b) Displaced cables relative to the flat cable plane (often at double-cure zones – manufacturing defects).

c) Displaced cables relative to the flat cable plane (at embedded rip-loop panels induced by manufacture).

d) Spurious magnetic pockets caused by welding leads on the belt or by magnetized tools placed on the belt.

Points b) and c) are both related to fabrication of the belt. Often, displaced cables undergo high-low tension cycling during bending and reverse bending on pulleys. Due to the high modulus of steel cables, strain cycling will eventually result in cable fraying and fatigue, leading to fully broken cables (or a number of broken cables/site).

Pont d) is an artifact of testing when spurious signals are generated by fields in cables that are not associated to broken cables.

Signal analysis is used to discriminate between real damage signals and spurious signals. As shown by **Figure 1** ;

1. Real broken cable signals are symmetrical and have a signal length duration of about 12 in. (0.3 m).

2. Welding noise and spurious magnetic pockets are not symmetrical and usually of large amplitude.

In many cases, broken cables and magnetic pockets will show visible evidence of rubber cover damage. In this situation, a simple plastic compass (oil filled) is a useful tool for locating events. If the event site is not visible but contains broken cables, the area will "feel" soft to a deflection push test from a wooden object (do not use steel objects for the push test).

As a rule, all NDT signals of amplitudes indicating 5+ broken cables are always reported, irrespective of their origin. If spurious data exists in a belt, it can be magnetically cleaned (conditioning) to remove spurious fields, as shown in **Figure 2**.

Figure 2 shows a before and after belt scan that showed cable break-like signals that were not visible on inspection, but the signals were removed by the conditioning process. The removal indicates the signals were spurious.

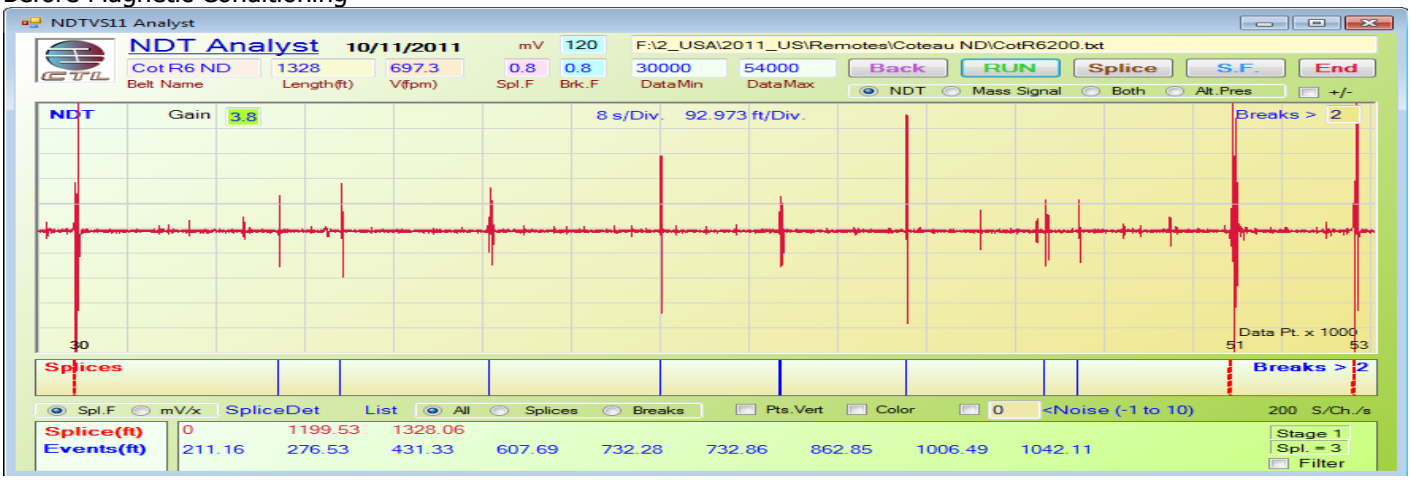
The alternative method for physically locating damage sites is described in Section 2.0 – Method.

NOTE : A plastic "camping-type" compass (oil filled, is available at Walmart for a few dollars). The compass is used to locate events and magnetic pockets in the belt as an on-site test. Once located, the physical "push" test mentioned above can be used to confirm damage if it is real. As stated above, real damage feels soft in a push test.

a) Belt scan signals for actual broken cables (0.8 ft. signal) b) Spurious magnetic pockets (3 ft. long signal).

Figure 1. NDT signals for spurious and real broken cable signals.

Before Magnetic Conditioning



After Conditioning Real Real

Figure 2. Pre-conditioning and Post conditioning to remove spurious signals.

2.0 ON-SITE DAMAGE LOCATION - METHOD

Tools

Obtain a simple paraffin oil-filled plastic compass. The compass will visually indicated deviations of cable fields at or near a magnetic disturbance such as caused by broken cables, pockets and defects in manufacture (Walmart camping).

Method

1. Stop the belt in a convenient inspection location, at the site where the belt scan indicates the event of interest.
2. Place the compass on the belt surface, flat or parallel with the earth's surface (a tilted compass will not have a needle free to rotate). In other words, gravity needs to act perpendicular to the plane of the compass needle.
3. Begin traversing the belt cover in sweeps with about 6 in. (150 mm) separation paths (see Figure 3).
4. When a field is encountered, the compass needle will rotate towards the field lines. You can plot the center of the field (breaks) by moving the compass in a circle until the needle always points inwards to the circle center. The circle diameter will depend on the number of broken cables and their break distribution.

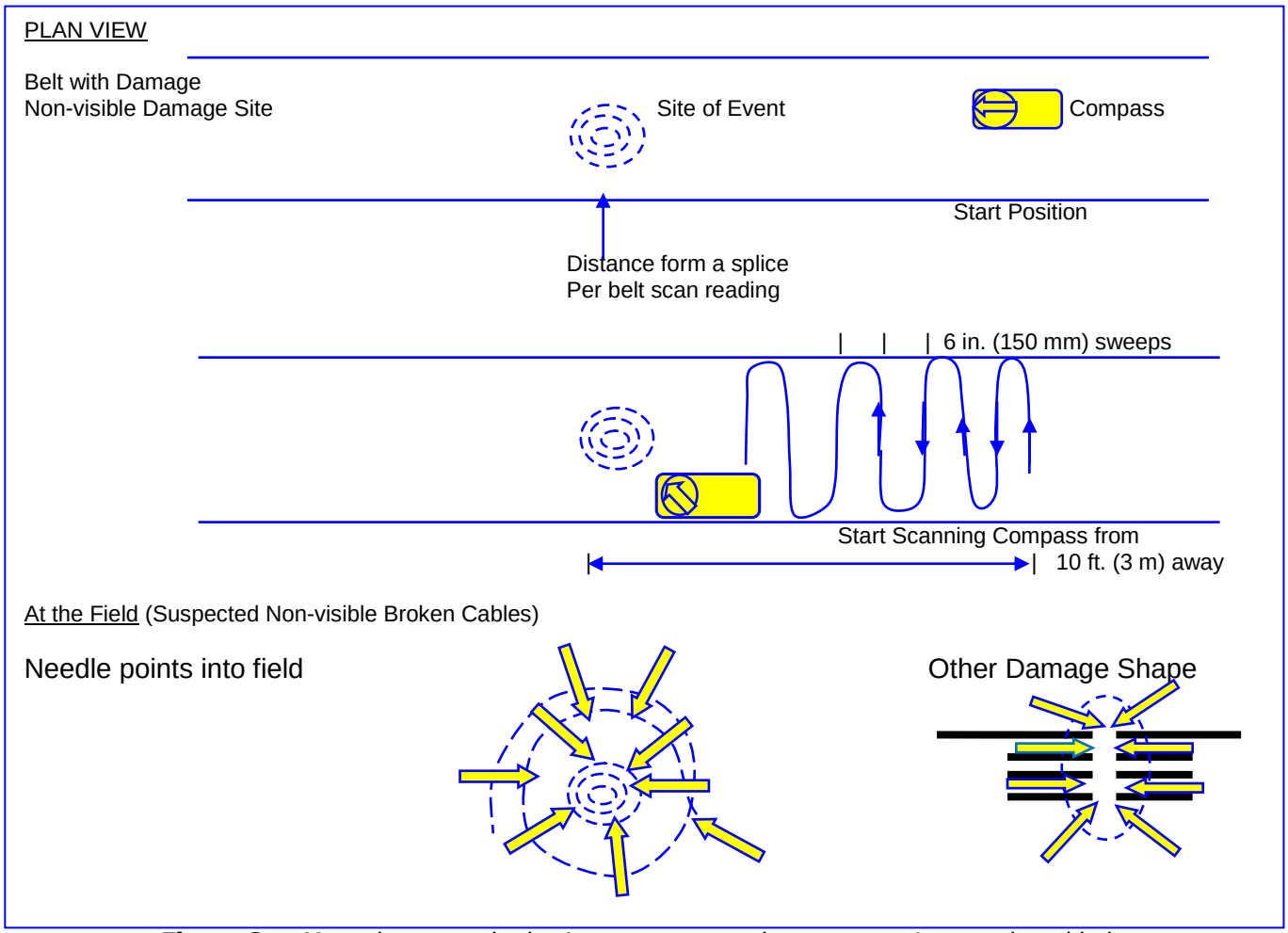


Figure 3. Manual scan method using a compass to locate events in a steel cord belt.