Anti-theft Initiatives employed in Cables

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AGENDA

1. Introduction

2. Technologies Considered

3. Current Offerings

4. Experimental Cables

5. Standards

6. Closing - The Future
1. INTRODUCTION

• Cable theft is an extremely serious crime with devastating effects on Society, Industry and Business at large

• Often causes irreparable damage to Utility infrastructure and results in the disruption of both Essential services and Emergency services and additional loss in revenues due to business’s not being able to operate normally.

• It is reported that cable theft conservatively costs the South African Economy about R5bn a year including both direct and indirect costs (Some Sources report much more). [http://www.combinedpi.co.za]
1. INTRODUCTION

- While changes are being made to existing laws to become more severe in terms of penalties and sentencing of offenders who damage infrastructure, it would seem that cable theft remains undeterred.

- Aberdare Cables is vested in the fight against cable theft and has over the last few years dedicated significant amount of research and development effort towards identifying, testing and employing several anti-theft initiatives in cables.

- This presentation will aim to create awareness of the different anti-theft technologies considered, currently available and other future technologies currently being evaluated.
1. INTRODUCTION

What are the means available to the Cable manufacturers to deter cable and conductor theft?

- Making available equipment to physically restrain cables and conductors.
- **Unique identification marks** in or on cables and conductors (ownership traceability).
- Designing cable types which makes use of alternative “unattractive” conductor materials.
- **Visual means** to identify anti-theft cables at a glance.
- **RFID** techniques
2. TECHNOLOGIES CONSIDERED

A. CCA & CCS (Bi Metals)

* Copper cladding is metallurgically bonded

- Basic material (i.e. CCA & CCS Rod) is not produced locally, but drawing and stranding could be done in RSA
2. TECHNOLOGIES CONSIDERED

A. 1 - CCS (Bi Metal)

- Corrosion resistance / Mechanical robustness
- Very limited scrap value
- High electrical ampacity
- CCS IACS (30% – 55% [ 40%])
- Rated for fusing temperature of CCS = 1084 Deg. C
  [ Steel alone : (1425 – 1540 Deg. C)]
- Further deterrent to theft is to treat the surface so as to discolour not to resemble copper.
2. TECHNOLOGIES CONSIDERED

A. 1 - CCS (Bi Metal)

• Stated potential Applications: Telephone drop wire, Coaxial cable, Tracer wire, Railway cable, Automotive cable, Consumer electronics

• Size: 0.1mm-5mm

• Temper: Hard drawn /Annealed

• Strength: Low carbon, High strength, Extra high strength.

• Standard: ASTM B227
2. TECHNOLOGIES CONSIDERED

A. 2 - CCA (Bi Metal)

• 10% and 15% by volume CCA

• 62.9% - 64.4% min IACS [ AI = 61% IACS]

• CCA presents a potential alternative to copper conductors for use in LV and MV cables for anti-theft purposes.

• The conductor could present a corrosion risk, if the ends are left unprotected in outdoor installations.

• Very limited Scrap value.

• Could drawn to fine sizes, can be used for small conductor sizes - high fatigue resistance in the annealed state.
2. TECHNOLOGIES CONSIDERED

A. 2 - CCA (Bi Metal)

- Stated potential Applications: Coaxial cable, cable, Railway cable, Automotive cable, Consumer electronics, Low voltage power cable
- Sizes: 0.1mm-5mm
- Temper: Hard drawn /Annealed
- Strength: Normal strength, High strength
- Standard: ASTM B566
2. TECHNOLOGIES CONSIDERED

B. Contamination of conductors

- To hinder recycling

- Conductors are treated during stranding with a substance which makes it extremely difficult to recover the copper in an automated process.

- This system does not have an element of traceability and reduces the value of copper scrap for both the manufacturer and the owner.
2. TECHNOLOGIES CONSIDERED

C. Conductor Marking
(Sequentially Marked Copper Tapes)

• Stranded Conductors are uniquely marked by insertion of a sequentially engraved copper tape into the conductor construction.

• High cost of additional copper offset by a change in construction.

• Cu Tapes are not readily available – Req. development.

• Cu tapes may be removed, but are not foreign and not as noticeable as the polyester tapes.

• Cu Tapes more fire resistant than Polyester tapes
2. TECHNOLOGIES CONSIDERED

C. Conductor Marking
(Sequentially Marked Copper Tapes)
2. TECHNOLOGIES CONSIDERED

D. Conductor Marking (Microdots)

- Stranded Conductors are uniquely marked by incorporating Nickel based microdots with unique customer specific markings into the conductor strand.

- Dots and marked products are customer specific and requires a high level of control from the strand manufacturing process, impacting on mass production.

- Concern over cross contamination and questioning of ownership could impact on the conviction of thieves. Microdot thread may solve this problem.

- The dots are small and requires a handheld microscope to identify the markings. (UV ink is used as an aid)
2. TECHNOLOGIES CONSIDERED

D. Conductor Marking (Microdots)
3. TECHNOLOGIES OFFERED

A. Physical Methods

• Prevents removal of buried cable in new installations by means of clamping.
3. TECHNOLOGIES OFFERED

B. Marking of Overhead Conductors (ESKOM Specific)

Marking Rollers

Marked Wire

Eskom Wire Marking Requirement
3. TECHNOLOGIES OFFERED

C. Alternative Conductor Materials (Copper Clad Steel)

• Application for Earthing/Bonding Purposes

• Mature technology in solid and stranded configurations
3. TECHNOLOGIES OFFERED

D. Cable Marking (Polyester Tapes)

- Cable is marked by a sequentially coded Polyester tape, which is applied under the armour

- Applicable to LV and MV Cables

- This marking assists customers in asset tracking and is linked to the manufacturer’s records.
3. TECHNOLOGIES OFFERED

D. Conductor Marking (Polyester Tapes)

- Stranded Conductors are uniquely marked by insertion of a sequentially marked tape into the conductor construction.

- The tapes are relatively easy to apply, but some restrictions need to be overcome i.e. on 7 wire conductor constructions.
3. TECHNOLOGIES OFFERED

E. Conductor & Cable Marking (Sequential Tapes & Database)

• The common feature of these currently offered systems is the sequential nature of the marking code.

• Aberdare’s current offer is for a sequentially marked polyester tape which is applied on the cable and in each of the conductors, depending on size.

The offered range of marked cable includes:

• MV XLPE and PILE all sizes
• LV cable 50mm2 and larger, 18 wires or more.
• LV cable 16 mm2 to 35 mm2 (Cable Marking only and excluding Airdac)
• LV ABC
3. TECHNOLOGIES OFFERED

E. Conductor & Cable Marking  
(Sequential Tapes & Database storage)

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3. TECHNOLOGIES OFFERED

E. Conductor & Cable Marking (Sequential Tapes & Database Query)

“083 920 1044”
3. TECHNOLOGIES OFFERED

F. Inventory Management System (AberTrack™)

- Combat Theft
- Cable Yard Management Optimisation
- Cut Operational Costs
4. EXPERIMENTAL CABLES

A. Combination of metals

- Use of tinned copper and galvanised steel wire or other combinations in one conductor.

- Conductor has the appearance of Aluminium and acts as a theft deterrent.

- Mixed metals has a reduced scrap value and lower incentive to thieves.

- Not intended for bare earth applications

- Example of Mixed metal Cable – CNE SAFERDAC……
4. EXPERIMENTAL CABLES

A. Combination of metals

[Technical data sheet image]

- Tinned Cu wire
4. EXPERIMENTAL CABLES

B. 1 - Copper Clad Aluminium (10%)

- 2.5 mm² x 27 and 15 core LV Cables for traffic signal application
4. EXPERIMENTAL CABLES

B. 2 - Copper Clad Aluminium (10%)

- 50 mm2 x 4 core LV Cables for power distribution
4. EXPERIMENTAL CABLES

C. Conductor Marking of small sizes

• A technique is being perfected for the marking of small 7 wire conductors
4. EXPERIMENTAL CABLES

D. Conductor Marking
(Direct Laser Marking)

• Stranded Conductors are uniquely marked by engraving using a laser to sequentially mark the conductor surface.

• Suitable high power lasers for marking “On The Fly” have not been a reality in the past and required development.

• The system has a high start-up cost, but has a low on-going cost.

• Laser marking is possible, but visibility of the mark has to be addressed.
4. EXPERIMENTAL CABLES

D. Conductor Marking (Direct Laser Marking)
4. EXPERIMENTAL CABLES

E. Conductor Marking (Inkjet Marking)
4. EXPERIMENTAL CABLES

F. Class 5 Flexible conductor marking

• The first elastomeric trailing cables for mining have been manufactured with marked class 5 copper conductors
4. EXPERIMENTAL CABLES

G. Sheath Strengthening of Rubber trailing cables

• The addition of a tough hard to cut mid-sheath high tensile steel wire layer.

• Visual distinction is required to warn
• would-be thieves
5. STANDARDS

A. NRS 102: Theft Deterrent Earthing Materials

• This standard deals with conductors and connectors and references international standards:

- ASTM B228-04, Standard specification for concentric lay stranded CCS conductors.

- ASTM B910, Standard specification for annealed CCS wire.

• Copper Clad Steel definition:

Bimetallic conductor that is manufactured by a mechanical bonding process that produces a metallurgical bond between a solid oxygen-free copper layer and a steel core.
5. STANDARDS

B. WG - SANS 1741: Unique conductor and cable marking systems.

- A SABS workgroup has met during 2015 and 2016 and is making good progress towards a CD document.

- The document deals with cable marking guideline aspects such as marking techniques (direct marking, batch marking, sequential marking and combination marking), marking location and limitations, data and database requirements.
5. STANDARDS

C. WG - SANS 1411-1: Materials of insulated electric cables and flexible cords - Conductors

• A SABS workgroup has met a number of times during 2015 and it is likely that the CD document may be completed during the course of 2016.

• The WG is considering the inclusion of additional conductor material types specifically intended for specialised anti-theft cable types:
  • CCS & CCA
  • Al Alloy
  • Mix of metals
  • Steel
5. STANDARDS

D. WG - SANS 1507: Electric cables with extruded solid dielectric insulation for fixed installations (300/500 V to 1900/3 300 V)

• A SABS WG has been proposed to consider the inclusion of specific anti-theft cable types making use of additional conductors considered under the SANS 1411-1 WG.

• Proposed inclusions would typically include:

  - Mixed metal service connection cable
  - CCA traffic signal cables
  - CCA and Mixed metal street lighting and distribution cables
  - Aluminium alloy centre pivot cables
6. CLOSING – THE FUTURE

The following aspects are expected to see further development into the future:

• Direct conductor marking technology

• More widespread use of alternative conductor types

• Formation of a common conductor marking database query system

• Monitoring of fibre optic elements built into power cables

• Development of flexible Al Alloy or CCA class 5 conductors for trailing cables
Thank You!