WELCOME

Care and Maintenance of Ropes,
Sheaves plus attachments

Presented

By

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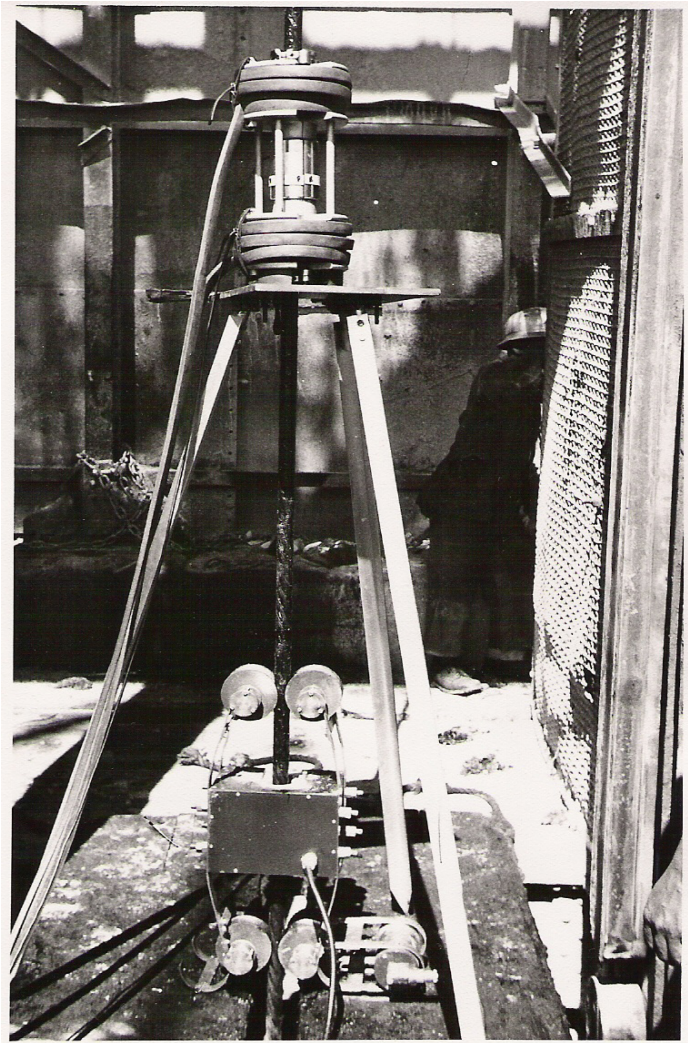
ANGLO - FIELD SERVICES

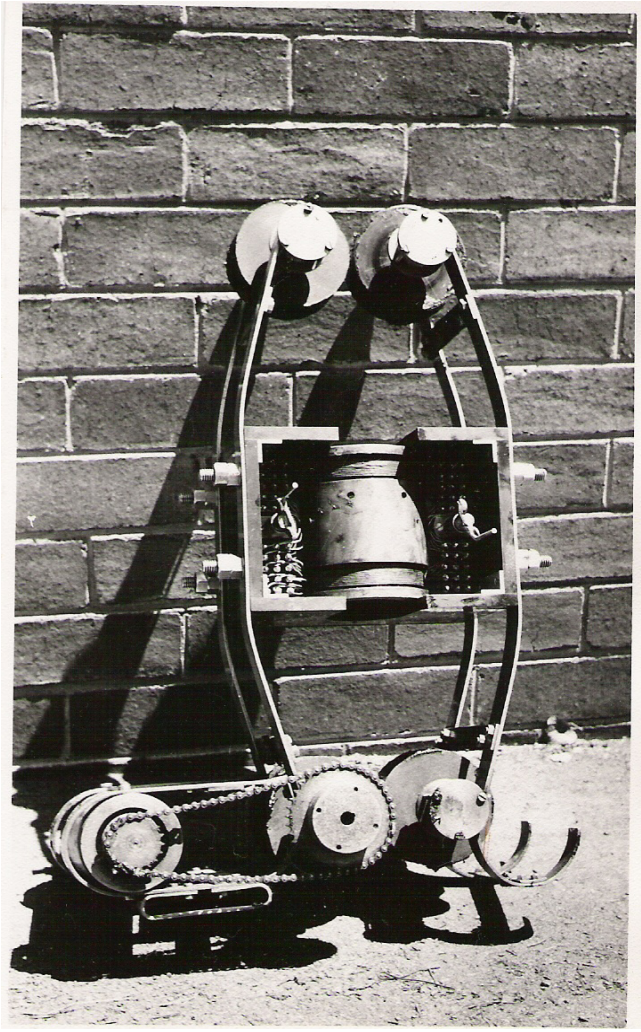
Code of practise for Steel wire ropes

SANS 10293

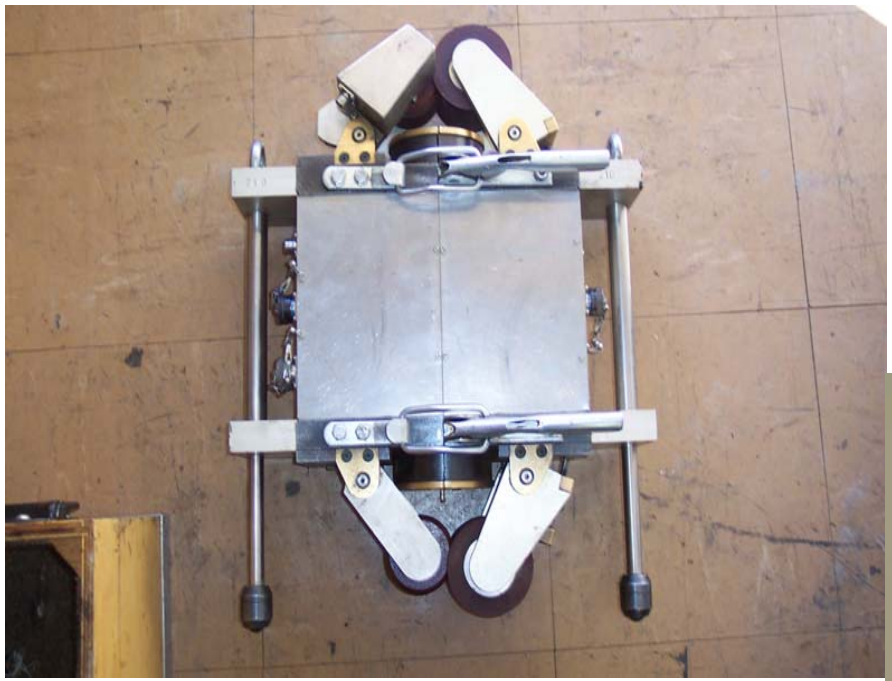
April 2006

RCA instrument in 1959





RCA instrument in 2006



REGULATION 16.33

The condition of a winding rope or balance rope must be assessed in accordance with the South African Bureau of Standards Code of Practice of the Condition Assessment of Steel Wire Ropes on Mine Winders, SANS 10293, as amended, and the rope may not be used if the condition thus assessed at that point in the rope has reached the discard criteria.

ROPE CONDITION ASSESSMENT AS PER SANS 10293 CODE OF PRACTICE FOR STEEL WIRE ROPES

ROPE CONDITION ASSESSMENT IS BASED ON:

- Selection, training and certification of staff
- Discard criteria
- Equipment specifications
- Techniques & Procedures

SELECTION TRAINING AND CERTIFICATION OF STAFF

- **Theoretical training - 5 Modules**
- **Study Guide**
- **Practical Aspects of Rope Inspection**
- **Magnetic Rope Testing Instruments**
- **Technology of Wire Ropes**
- **Destructive Testing of Wire Ropes**
- **An Introduction to Mine Winders**

Practical training
On the job

- Start as a trainee
- Go out on the Physical RCA inspections with a level 2 inspector
- Learn to setup instrument and calibrate
- Learn to do visual assessments (Wear, Plastic deformation, Corrosion, Other Defects)
- Learn to relate the instrument indications to the actual rope defect
- Get to know all the mines as well as all other areas

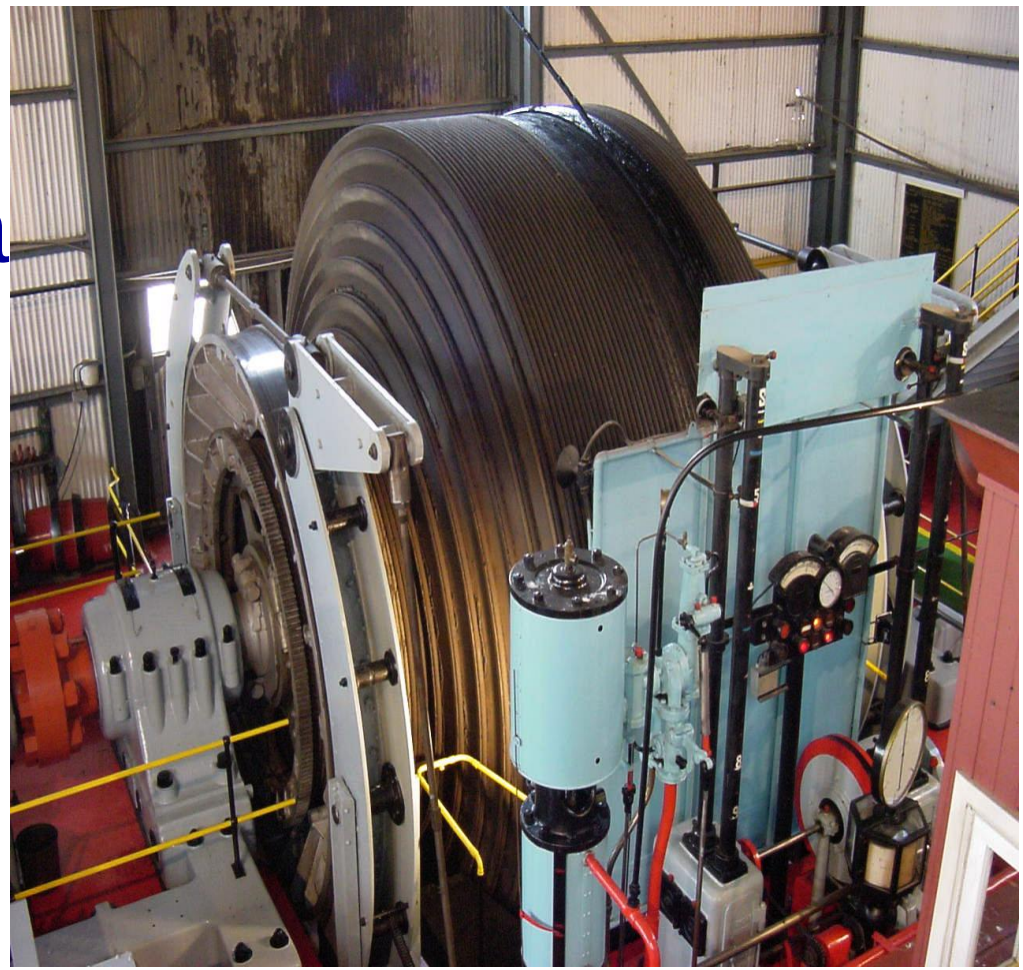
SAQCC CERTIFICATION - Level 1 + 2 Theory and Practical Exams

- After 1 Year Practical Training - Level 1 Theory and Practical Exam

- After another 18 months of training and less critical inspections under supervision - Level 2 Theory and Practical Exam

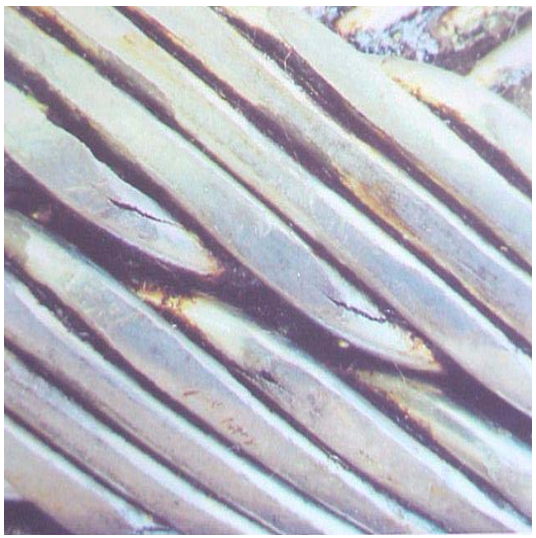
DISCARD CRITERIA ON :

- Broken wires
- Rope Steel Area
- Corrosion
- Rope diameter
- Lay length
- Waviness
- Bends

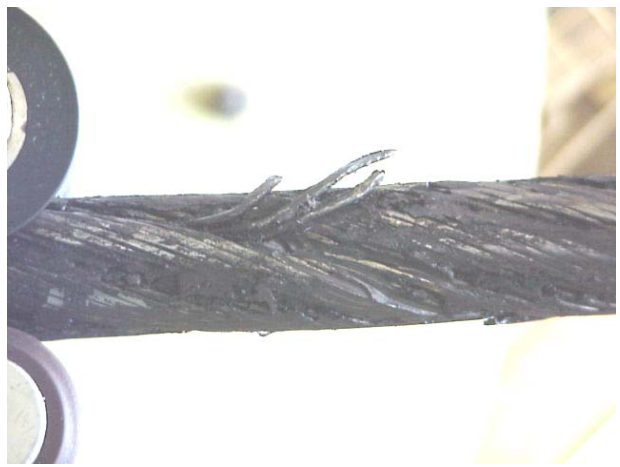


DISCARD CRITERIA BROKEN WIRES

- **VISIBLE BROKEN WIRES**



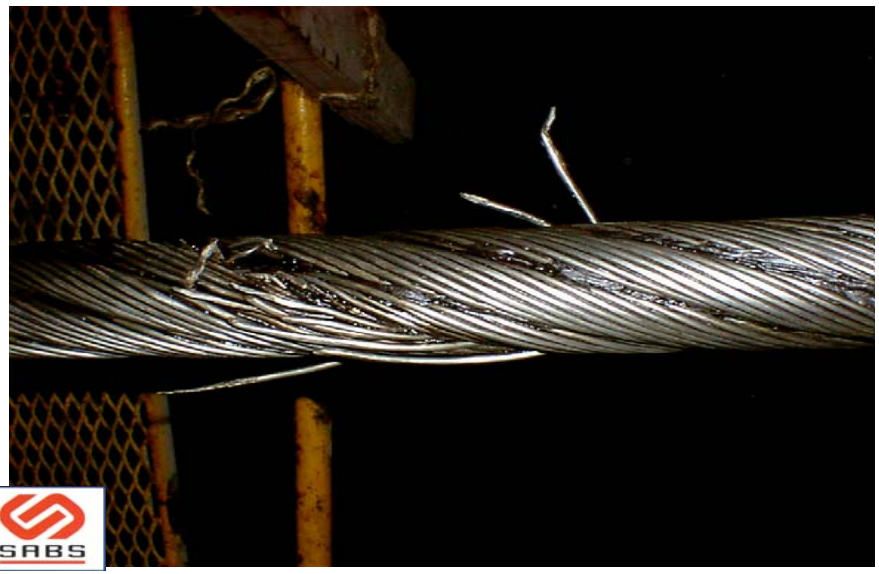
- ASYMMETRICALLY
- SYMMETRICALLY
  - * 1 lay length
  - * 5 lay length

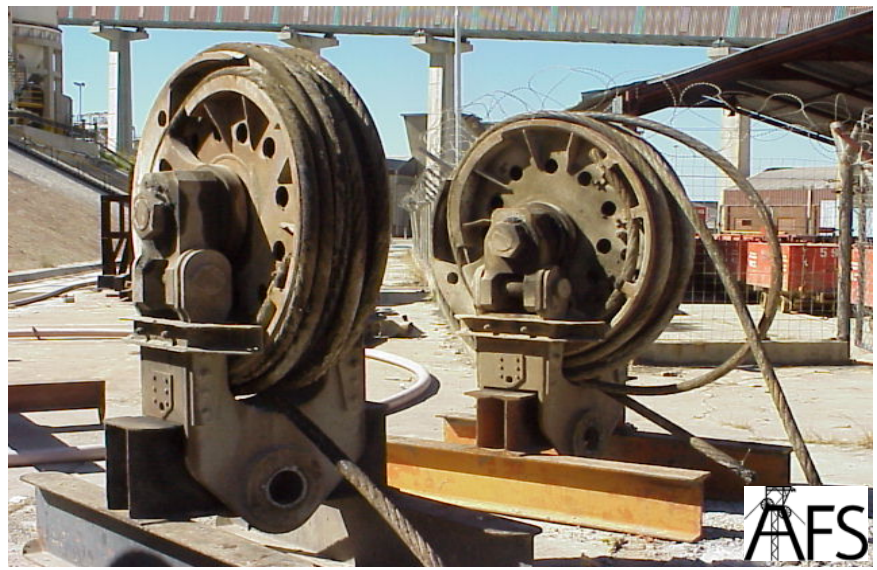


DISCARD CRITERIA
BROKEN WIRES

VISIBLE BROKEN WIRES

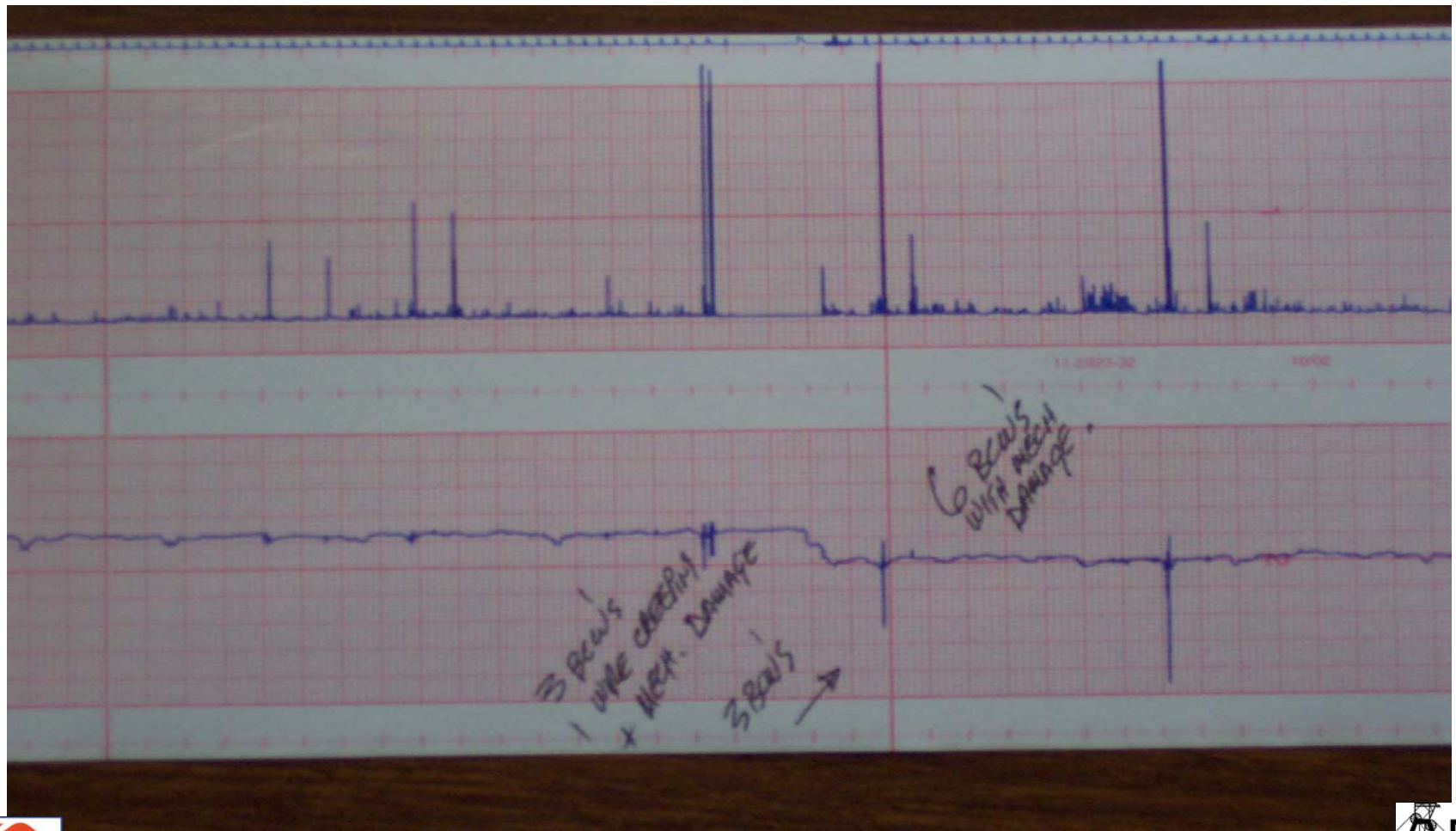
			DISCARD LEVELS
In 1 lay length	-	symmetric (Δ + 0)	> 7 % of nominal steel area
	-	asymmetric (Δ + 0)	> 4 % of nominal steel area
	-	single strand (All)	> 2 adjacent strands
			> 40 % of total number of outer wires in 1 strand
In 5 lay lengths (Δ + 0)			2 x the above
Broken wires at terminations (All Ropes)			NONE





8 BROKEN WIRES ON 1 STRAND (28 ON 3 STRANDS WITHIN 5 LAY LENGTHS)

INSTRUMENT INDICATION OF BROKEN WIRES



DISCARD CRITERIA
ROPE STEEL AREA

⌘ **REDUCTION IN INDICATED AREA**

No Corrosion

With Corrosion

⌘ **DISCARD LEVELS**

* Maximum between highest and lowest calculated strength for the entire rope to be less than 7%
* Local variations not to exceed 4%

* As per corrosion graph
* Pronounced pitting

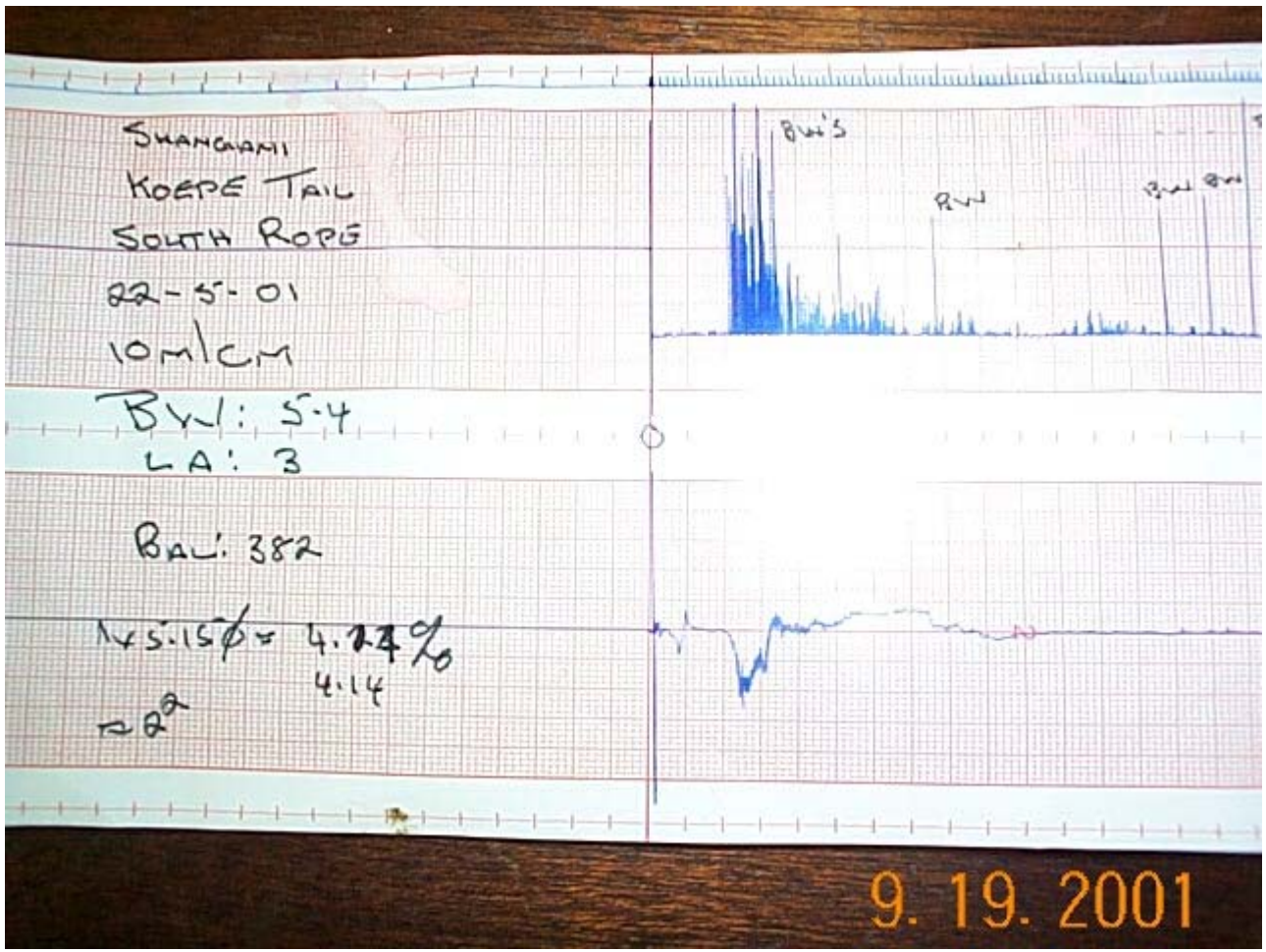
DISCARD CRITERIA ROPE STEEL AREA

- **CORROSION**

- PRONOUNCED PITTING OR ROUGHENING

- RCA ESTABLISHED LOSS IN BREAKING STRENGTH

INSTRUMENT INDICATION OF CORROSION 20m BELOW THE SKIP



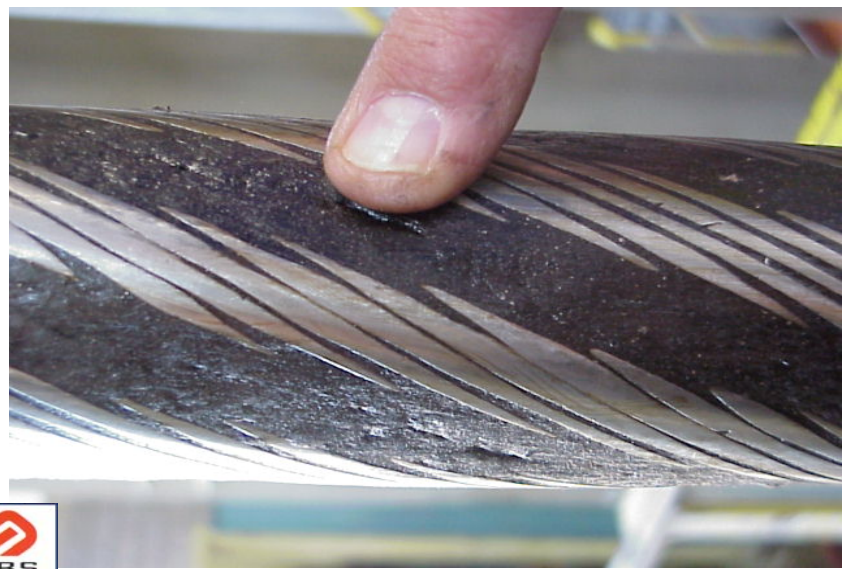
DISCARD CRITERIA
ROPE DIAMETER

- **CHANGE IN ROPE DIAMETER**
- **WEAR ONLY**
- UNIFORM
- MAINLY ON ONE SIDE
- **WEAR AND PLASTIC DEFORMATION**
- UNIFORM
- MAINLY ON ONE SIDE

DISCARD CRITERIA
ROPE DIAMETER

⌘ **CHANGES IN ROPE DIAMETER**

			DISCARD LEVELS
Abrasive Wear Only	-	uniform (Δ + 0)	> 7 % of nominal rope diameter
	-	mainly on 1 side (Δ + 0)	> 5 %
	-	uniform (N/S)	> 5 % of nominal rope diameter
	-	mainly on 1 side (N/S)	> 4 %
Wear & Plastic deformation	-	uniform (Δ + 0)	> 9 % of nominal rope diameter
	-	mainly on 1 side (Δ + 0)	> 7 %
	-	uniform (N/S)	> 6 % of nominal rope diameter
	-	mainly on 1 side (N/S)	> 5 %



DISCARD CRITERIA
ROPE LAY LENGTH

- **CHANGE IN LAY LENGTH**
  - GENERAL VARIATION
  - LOCAL VARIATION
  - SLACK STRANDS

DISCARD CRITERIA
ROPE LAY LENGTH

- **CHANGES IN ROPE LAY LENGTH**

Local variation	-	(Δ + 0)	> 12 % of nominal lay length
	-	(N/S)	> 5 %
General variation	-	increase (Δ + 0)	> 100 %
	-	decrease (Δ + 0)	> 30 %
	-	increase (N/S)	> 12%
	-	decrease (N/S)	> 12%

DISCARD CRITERIA
ROPE DEFECTS

- **MALFORMATION, DISTORTION AND DETERIORATION**

- \- WAIVINESS
- \- BENDS
- \- KINK
- \- FIBRE CORE FAULURE

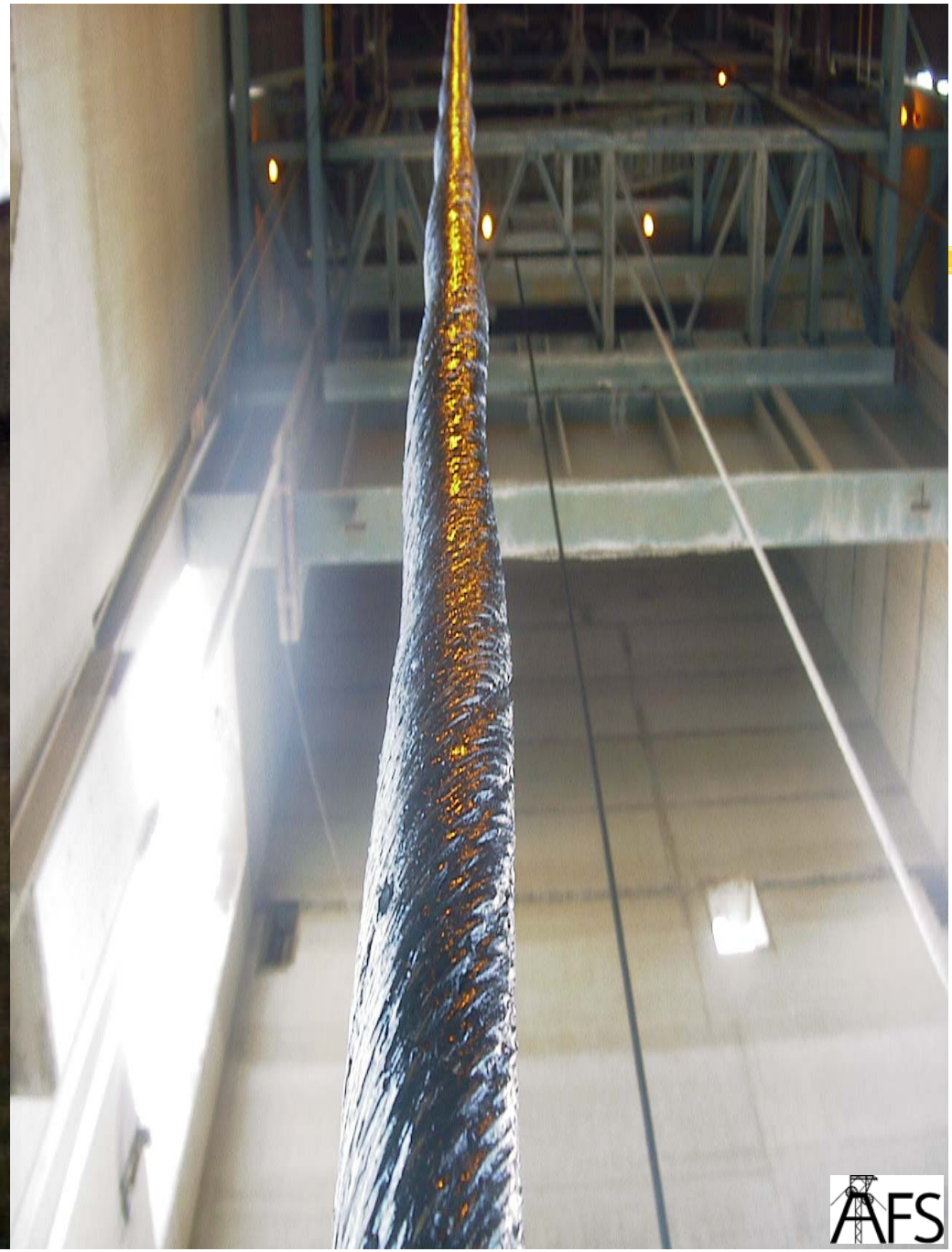
DISCARD CRITERIA
ROPE DEFECTS

- **MALFORMATIONS, DISTORTION AND DETERIORATION**

Any localised increase or decrease in rope diameter	> 7 % of nominal rope diameter

- **DISTORTION**

Waviness	> 25 % of nominal rope diameter
Angular bends (over 2 lay lengths)	> 6 %
Kink	All

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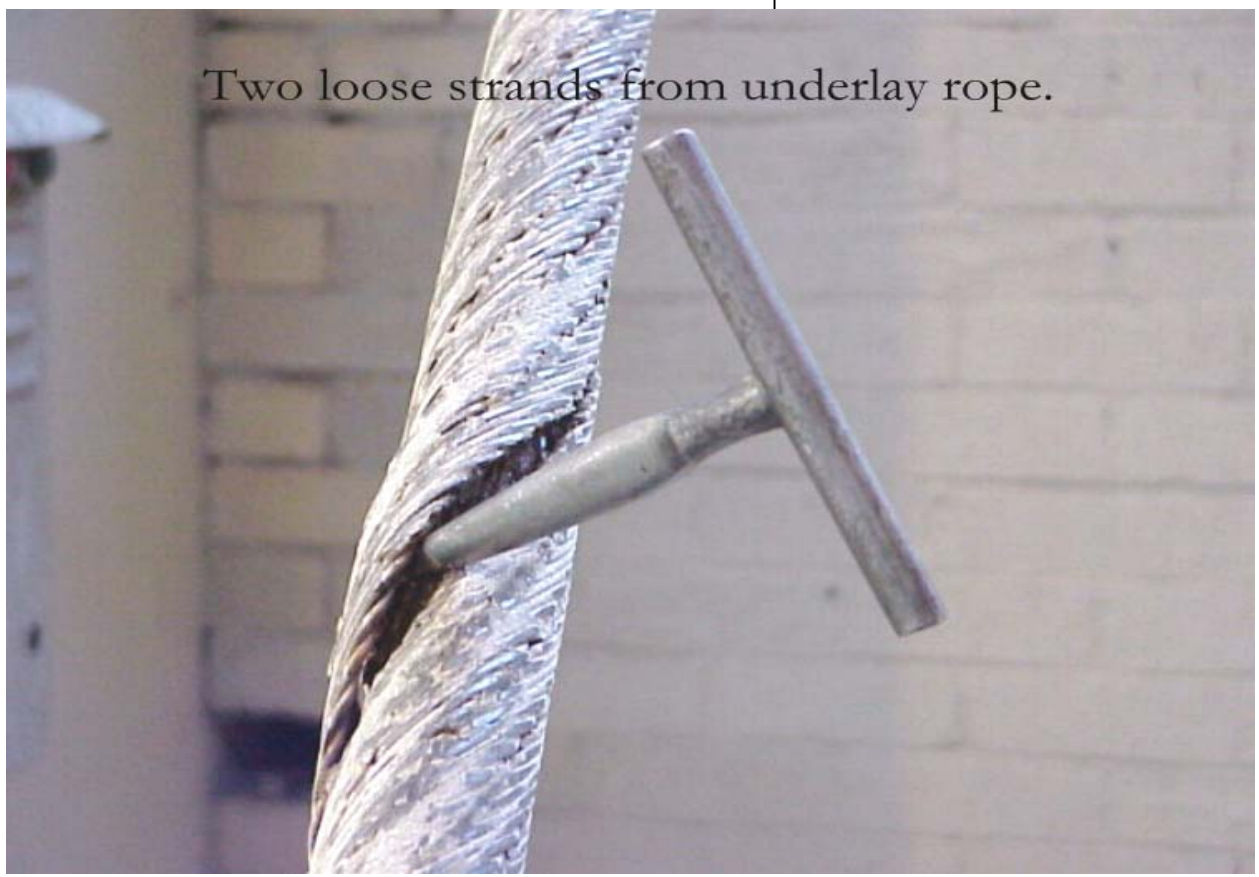
DISCARD CRITERIA
ROPE CORE DEFECTS

- **ROPE CORE DEFECTS**

  Any failure fibre, independent strand core or wire main core failures

DISCARD LEVELS

All



DISCARD CRITERIA
OTHER DEFECTS

⌘ **HEAT DAMAGE**	ANY
⌘ **MECHANICAL PROPERTIES**	
Strength loss	> 10 % of original
Plastic fraction of elongation (plastic strain per unit length)	> 0.5 %
⌘ **SHORT ROPE**	Less than 3 turns

MECHANICAL DAMAGE

CALCULATIONS

⌘ COMBINED EFFECTS

- * DISCARD FACTORS
- DF = $\frac{Rw}{Rpw} + \frac{Rp}{Rpd}$

⌘ Rw = ACTUAL REDUCTION IN STEEL AREA DUE TO BROKEN WIRES AS A % OF ROPE STEEL AREA

⌘ Rpw = PERMITTED REDUCTION IN STEEL AREA DUE TO BROKEN WIRES AS A % IF ROPE STEEL AREA

⌘ Rd = ACTUAL REDUCTION IN DIAMETER AS A % OF NOMINAL ROPE DIAMETER

⌘ Rpd = PERMITTED REDUCTION IN DIAMETER AS A % OF NOMINAL ROPE DIAMETER

CALCULATIONS

COMBINED EFFECTS (Continue)

= Actual change in steel area due broken wires / Maximum allowable change in area

= Actual change in diameter due wear and plastic deformation / Maximum allowable change in diameter

EXAMPLE

6 X 29 T construction - DIA 41 mm Rope

- 2 broken wires on one strand, 1 broken wire on an adjacent strand
- no corrosion
- actual diameter measured - 40.2 mm
- uniform wear and plastic deformation

(a) Actual change in area due to broken wires

$$= \frac{\text{Steel area of 1 wire x no of broken wires}}{\text{area of rope}}$$

$$= \frac{8{,}042 \times 3}{773{,}2} \times 100 = 1{,}04\%$$

CALCULATIONS

COMBINED EFFECTS (Continue)

- (b) Maximum allowable = 5%
- (c) Actual change in rope diameter

$$= \frac{41 - 40{,}2}{41} \text{ X } 100 = 1{,}95\%$$

- (d) Maximum allowable = 9%

$$DF = \frac{1{,}04}{5} + \frac{1{,}95}{9} = \mathbf{0.42}$$

CLASS OF ROPE

Table 1 - Assessment intervals

1	2	3
Normal rope life	Assessment interval	
	Class I rope	Class II rope
Less than 9 months.	One month	Two months
9 Months or more but less than 18 months	Two months	Three months
18 Months or more but less than 36 months	Three months	Four months
36 Months or more	Three months	Six months
NOTE – In the case of a new or modified winder installation for which there is uncertainty regarding the normal rope life that can be achieved, the assessment intervals shall be as for a 9 months' life for the first 9 months, as for a 9 to 18 months'		

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- **TECHNIQUES AND PROCEDURES**
  - Certification of equipment
  - Condition of equipment
  - Assessment intervals
  - Sections to be assessed

- **ASSESSMENT REPORTS AND ACTION**
  - On site Hand written report - Recommendation of action to be taken.
  - Typed report at Month end - Recommendation of action to be taken.

TECHNIQUES AND PROCEDURES

- **N.B.** Sole dependence on the results of magnetic rope tests is not acceptable. A magnetic apparatus is used mainly to detect the presence and location of defects and to assist in the assessment of loss of strength. Additional measurements and visual examination are essential when the condition of a rope is being assessed.

- **CERTIFICATION OF EQUIPMENT**
  All MRT instruments in use shall be submitted for certification at intervals not exceeding twelve months or immediately after any damage, repair or modification that could affect the performance or calibration of the instrument.

- **CONDITION OF EQUIPMENT**
  Shall be maintained in sound operating order

- **ASSESSMENT INTERVALS**
  A new rope, or used rope returned to service, but not later than two weeks after installation in the case of class I ropes and not later than six weeks after installation in the case of class II ropes.

TECHNIQUES AND PROCEDURES

- **ROPE SECTIONS TO BE ASSESSED**

  Every normal rope condition assessment shall cover the complete length of rope between the conveyance and the drum when the conveyance is at the lowest loading station.

  The condition of the dead turns (I.e the length of rope that remains coiled in the drum when the conveyance is at the lowest loading station) shall, in case of class 1 ropes, be assessed magnetically every second time the rope back end is pulled in.

- **PREPARATIONS FOR ASSESSMENT**

  The winding rope inspector shall give adequate advance notice to the engineer regarding any special requirements for the rope condition assessment, including access to site, test locations, platforms, attachments, power supply and any issues that could affect proper execution of the assessment or the safety of personnel or both. The engineer shall be responsible for supplying the necessary infrastructure.

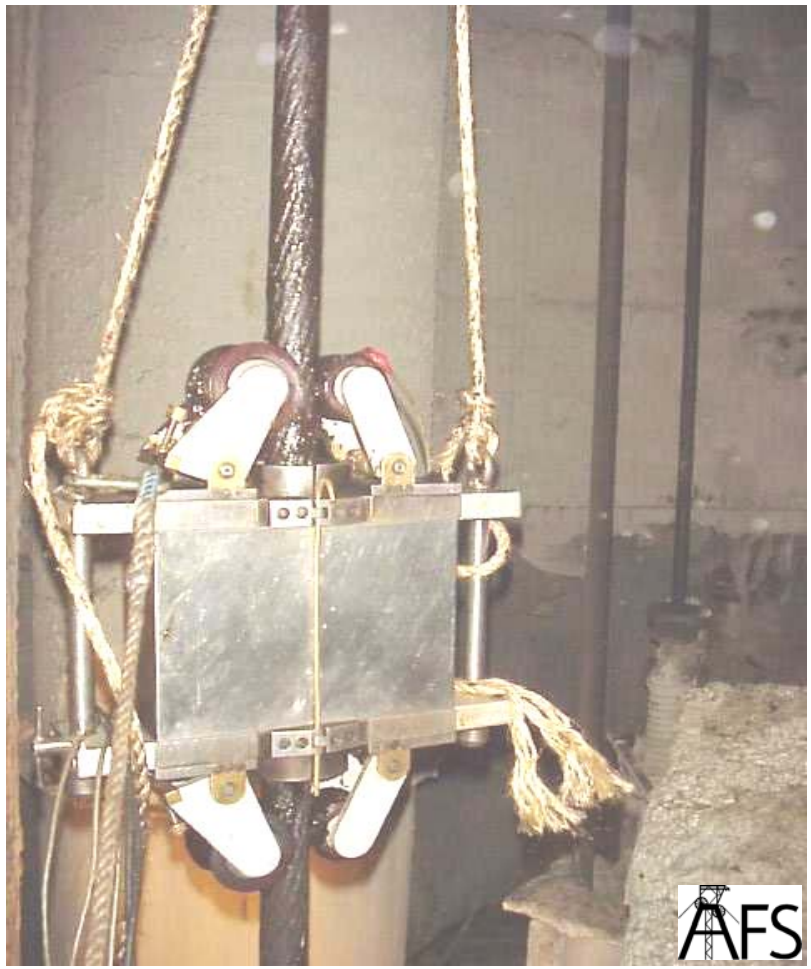
TECHNIQUES AND PROCEDURES

- ASSESSMENT OF ROPES CAN BE DONE AT ANY OF THE FOLLOWING PLACES
  - ON THE COLLAR, AT THE DRUM, FROM A KIBBLE, FROM A CABLE CAR, ECT.

- THE TEST HEAD CAN BE SUPPORTED IN VARIOUS WAYS DEPENDING ON THE TYPE OF ROPE THAT ARE ASSESSED AND ALSO THE POSITION FROM WHERE IT MUST TAKE PLACE
  - "A" FRAME FOR THE NORMAL ASSESSMENT, SUSPENDED FROM MANILA ROPES FOR BACK END ASSESSMENTS, ATTACHED TO THE CONVEYANCE WHERE THE ROPE THAT ARE ASSESSED IS STATIONARY.

ASSESSMENT OF OVERLAY ROPES ON UNDERGROUND AND SURFACE WINDERS

ASSESSMENT OF BACK END ON UNDERLAY ROPE AND OF A STAGE ROPE WITH THE STAGE TRAVELLING DOWN



ASSESSMENT OF GUIDE ROPES ON PERMANENT INSTALLATION AND STAGE/GUIDE ROPES IN SINKING SHAFT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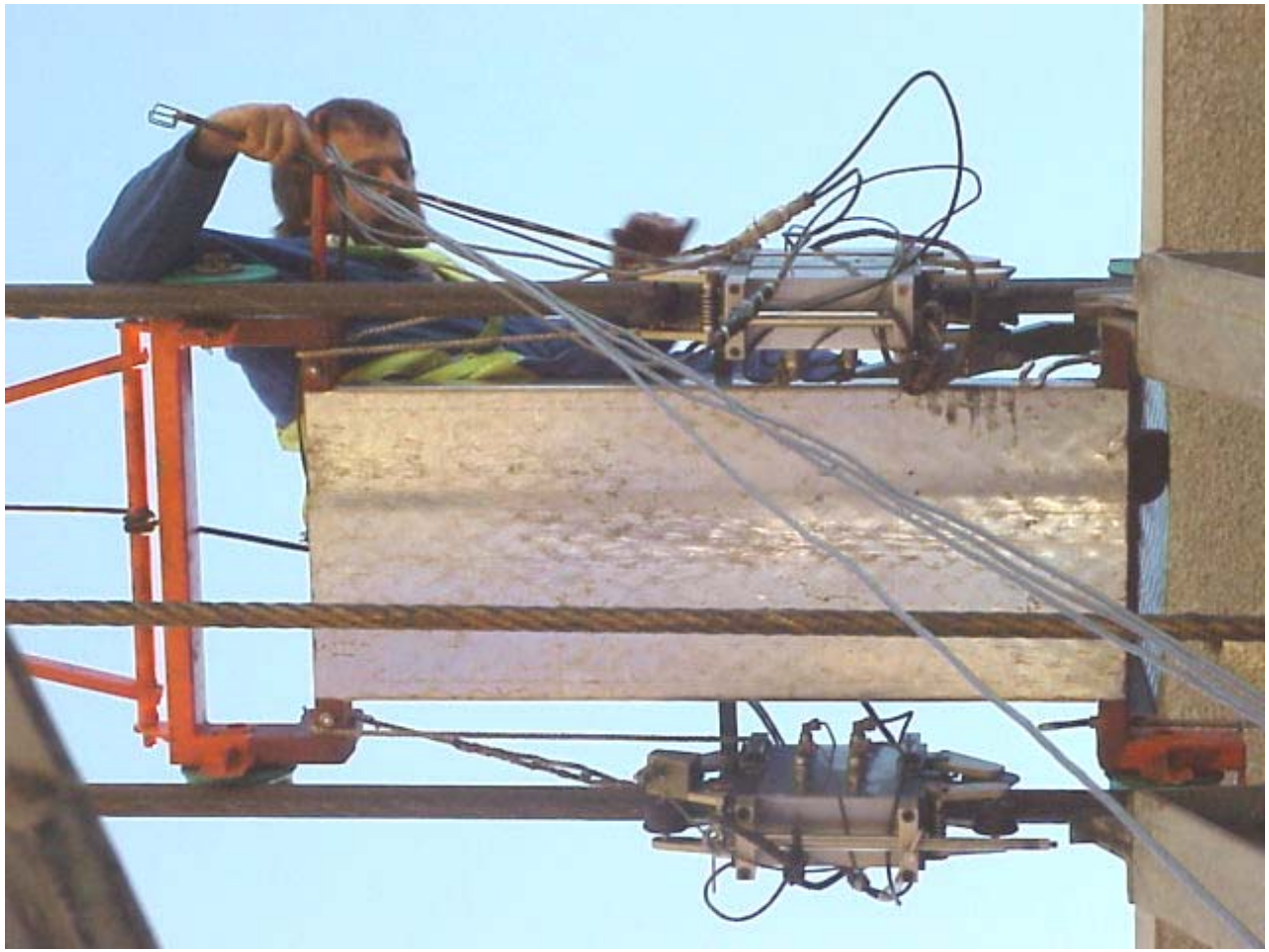
ASSESSMENT OF TRACK, HAUL AND HEEL ROPES

ASSESSMENT OF 2 TRACK ROPES FROM THE INSPECTION TROLLEY

CALIBRATING THE INSTRUMENT AT THE BEGINNING OF THE ASSESSMENT OF CABLE CAR TRACK ROPES



ASSESSMENT OF 2 KOEPE HEAD ROPES SIMILTANIOUSLY

ASSESSMENT OF THE BOTTOM LAYER SCRAPPER REMOVING OLD GREASE

WATCH OUT FOR DEFECTIVE DRUM BOLTS

Good Rope Storage

ASSESSMENT OF OFFSHORE CRANE ROPES

ASSESSMENT OF OFFSHORE CRANE ROPES

ANY QUESTIONS