

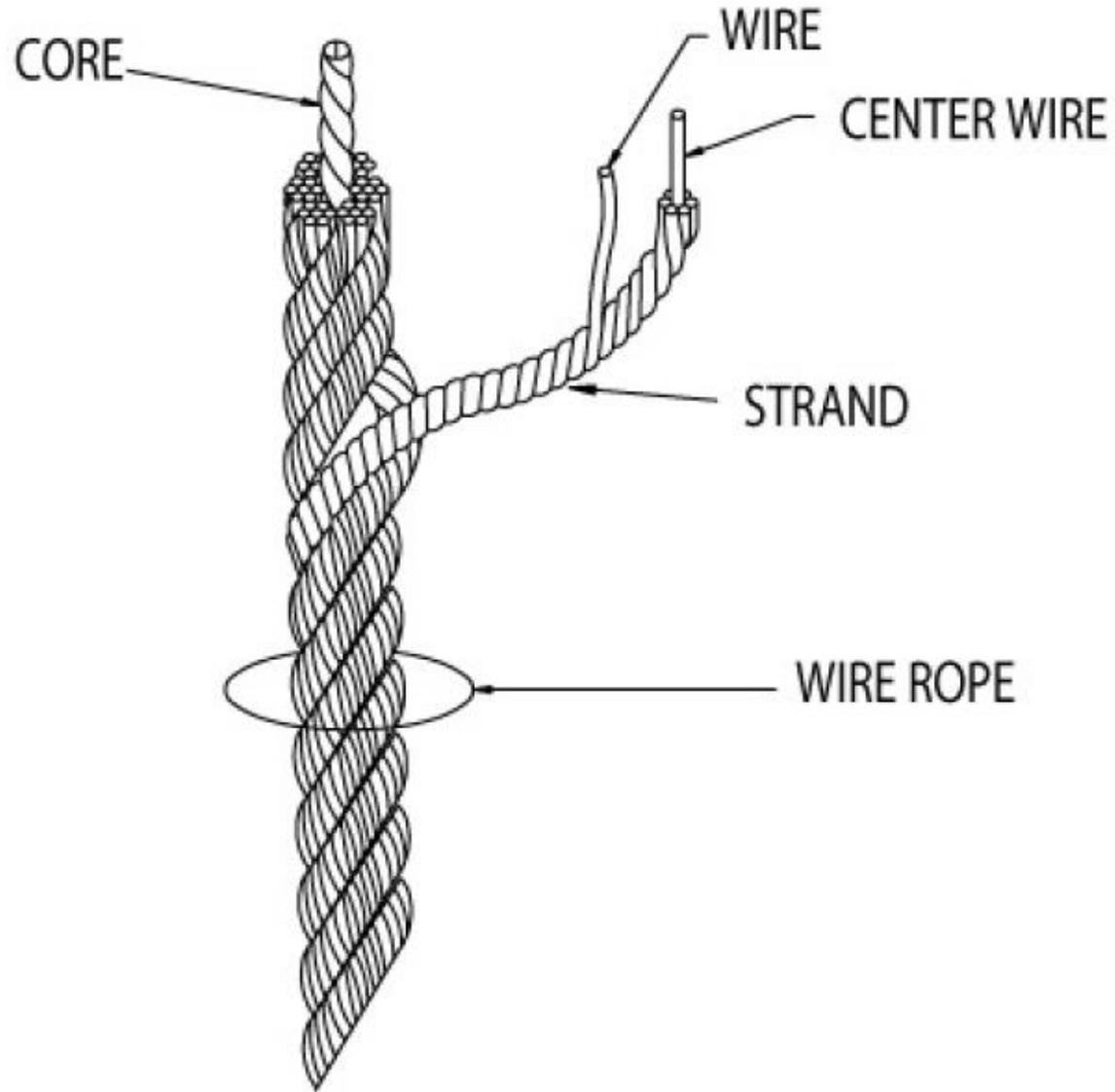
***Providing integrity of flare stacks at refineries
by MFL inspection of guy ropes***

***1st Oman inspection & Integrity Conference
16-17 October 2019***

Flare stack and mast



The wire rope



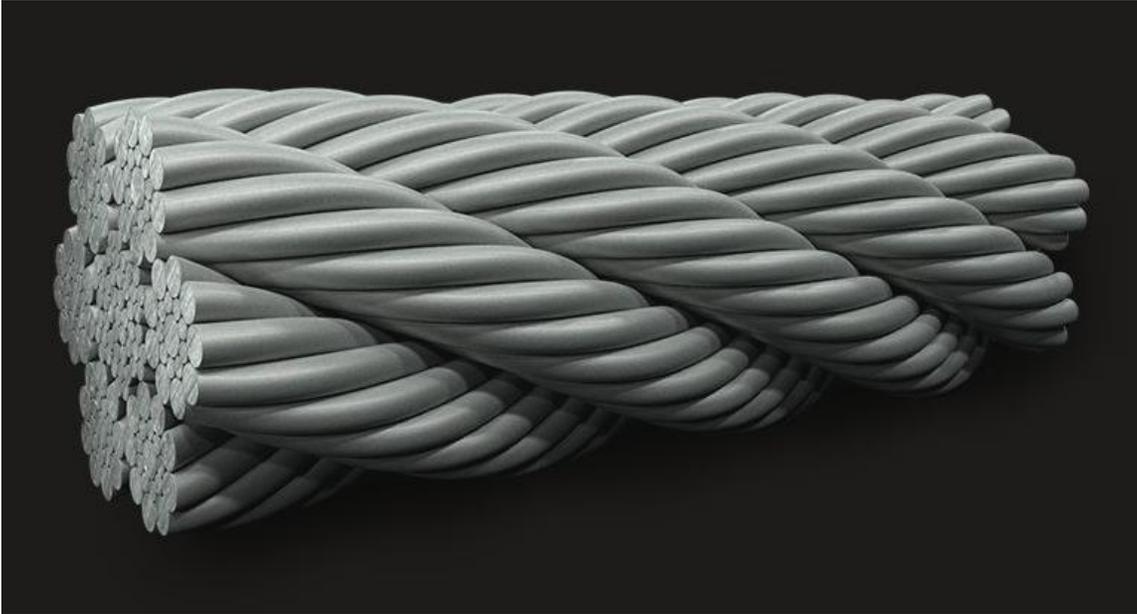
Ferrous steel wires

Diameters from 13 to 45 mm

Lubricated

Guy rope types

Six-stranded IWRC rope



Spiral strand rope



Guy rope wear

Operate in sedentary environment.

Subject to deterioration.

-**Axial tension** causes **stress**.

-**Wind loads** cause **vibration**
– leads to internal wire **nicking**.

-**Sand storms** cause surface **abrasion**.

-**Atmosphere precipitation** causes **corrosion**.

-**Combustion products** of flare causes **etching**.

-**Mishandling during installation** causes **kinks**.

LMA (Loss of Metallic cross-sectional Area)

& **wire breaks** (Local Faults).



Guy ropes will eventually fail unless timely replaced!

Visual inspection of guy ropes

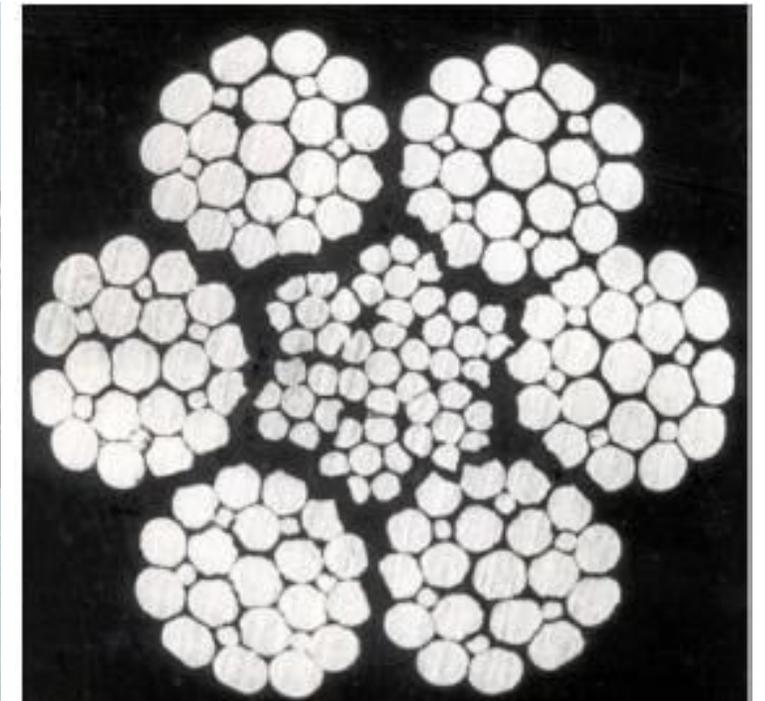


Visual inspection limitations

Presence of surface lubrication, pollution and icing hinders accuracy.

Only outer wires can be inspected, internal defects unseen.

A good wire rope can be discarded due to insignificant outer wear.



Visual inspection is inaccurate and misleading!

Visual Inspection Discard Criteria

Code of Federal Regulations (CFR)

§ 75.1434 Retirement criteria.

Unless damage or deterioration is removed by cutoff, wire ropes shall be removed from service when any of the following conditions occurs:

(a) The number of broken wires within a rope lay length, excluding filler wires, exceeds either—

(1) Five percent of the total number of wires; or

(2) Fifteen percent of the total number of wires within any strand;

(b) On a regular lay rope, more than one broken wire in the valley between strands in one rope lay length;

(c) A loss of more than one-third of the original diameter of the outer wires;

(d) Rope deterioration from corrosion;

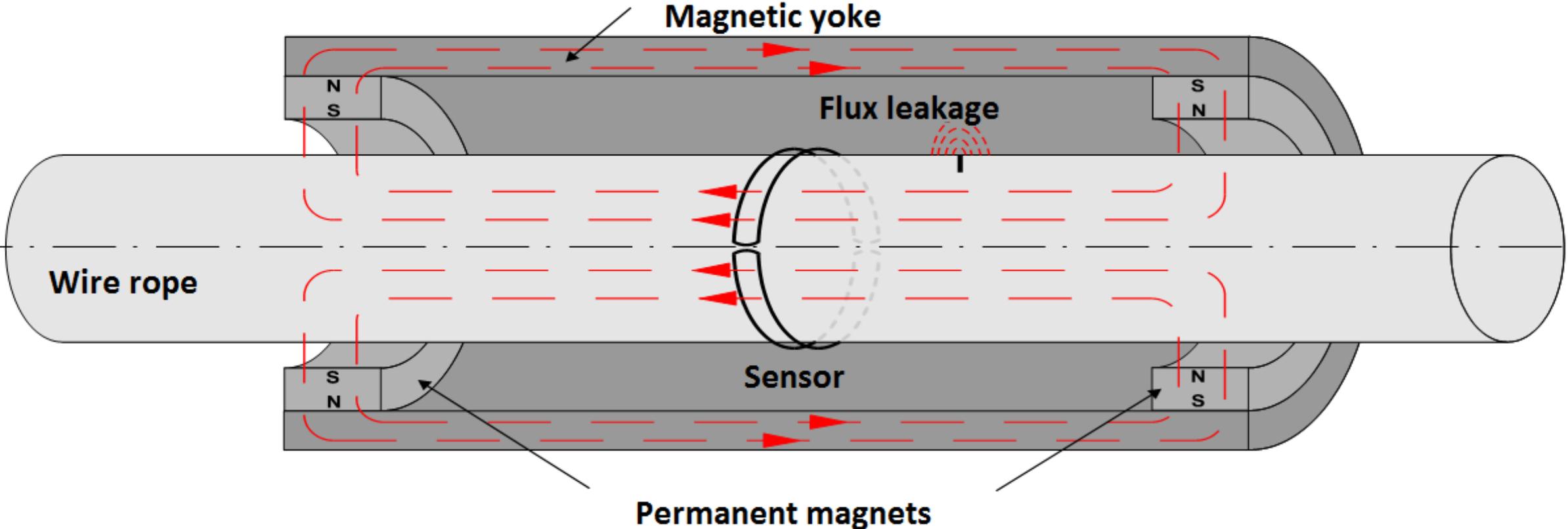
(e) Distortion of the rope structure;

(f) Heat damage from any source;

(g) Diameter reduction due to wear that exceeds six percent of the baseline diameter measurement; or

(h) Loss of more than ten percent of rope strength as determined by non-destructive testing.

Magnetic Rope Testing (MRT)



MRT is mandatory in many industries

INTERNATIONAL
STANDARD

ISO
4309

Fifth edition
2017-11

Cranes — Wire ropes — Care and maintenance, inspection and discard

*Appareils de levage à charge suspendue — Câbles en acier —
Entretien et maintenance, inspection et dépose*

This fifth edition cancels and replaces the fourth edition (ISO 4309:2010), which has been technically revised and contains the following changes:

- magnetic rope test (MRT) methodology and discard criteria are introduced, as an aid to the internal inspection of wire ropes;
- guidance is given on when to use magnetic rope testing and how to combine its results with other inspection results;
- an example of an MRT report is provided.

BRITISH STANDARD

BS EN
12927-8

Safety requirements for cableway installations designed to carry persons — Ropes —

Part 8: Magnetic rope testing (MRT)

The European Standard EN 12927-8:2004 has the status of a British Standard

— 01.100

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BSi
British Standards



International Marine
Contractors Association

www.imca-int.com

Guidance on Examination of Steel Wire Rope Through Magnetic Rope Testing (MRT)

IMCA LR 004, IMCA HSSE 023, IMCA M 197 Rev. I
October 2018



ROMA 1957
PARIS 1963
LUZERN 1969
WIEN 1975
MÜNCHEN 1981
GRENOBLE 1987
BARCELONA 1993
SAN FRANCISCO 1999
SINGAPORE 2005

StF : I-00188 ROMA — Via Suzzara, 19
Sekretariat: Amt für Seilbahnen
I-80ZEN Crispistr. 10
Email: info@oitaf.org

ORGANIZZAZIONE INTERNAZIONALE TRASPORTI A FUNE
INTERNATIONALE ORGANISATION FÜR DAS SEILBAHNWESEN
ORGANISATION INTERNATIONALE DES TRANSPORTS A CABLES
INTERNATIONAL ORGANIZATION FOR TRANSPORTATION BY ROPE
ORGANISACION INTERNACIONAL DES TRANSPORTES POR CABLE

O. I. T. A. F.

BOOK 3

SURVEY OF MAGNETIC ROPE TESTING OF STEEL WIRE ROPES

Compiled between September 2011 and February 2015
by the OITAF Work-Committee No II

Published in September 2015

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.



Designation: E1571 – 11 (Reapproved 2016)^{e1}

Standard Practice for Electromagnetic Examination of Ferromagnetic Steel Wire Rope¹

This standard is issued under the fixed designation E1571; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

^{e1} NOTE—Section 6.2 updated editorially in June 2016.

What do you need to carry MRT

Operate proper MRT equipment

Operate equipment by competent personnel

INTROS Wire rope flaw detector

Magnetic head on the rope.

Basic unit for logging data.

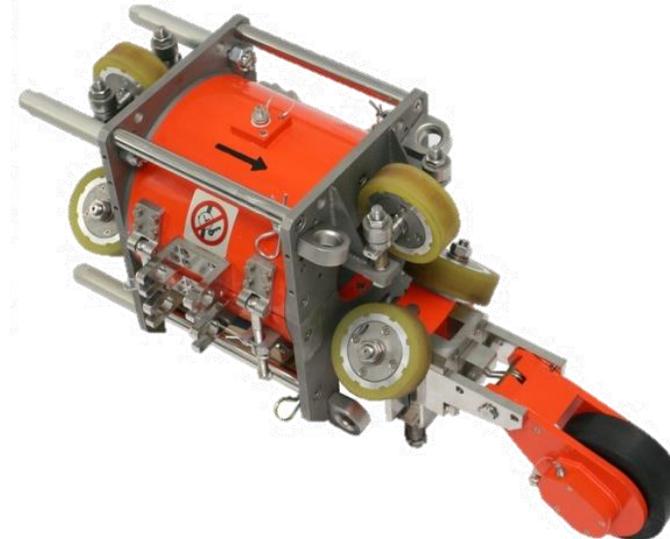
Wintros software.

Over **1000** kits sold to

Over **250** customers in

Over **50** countries

Over the past **20** years!



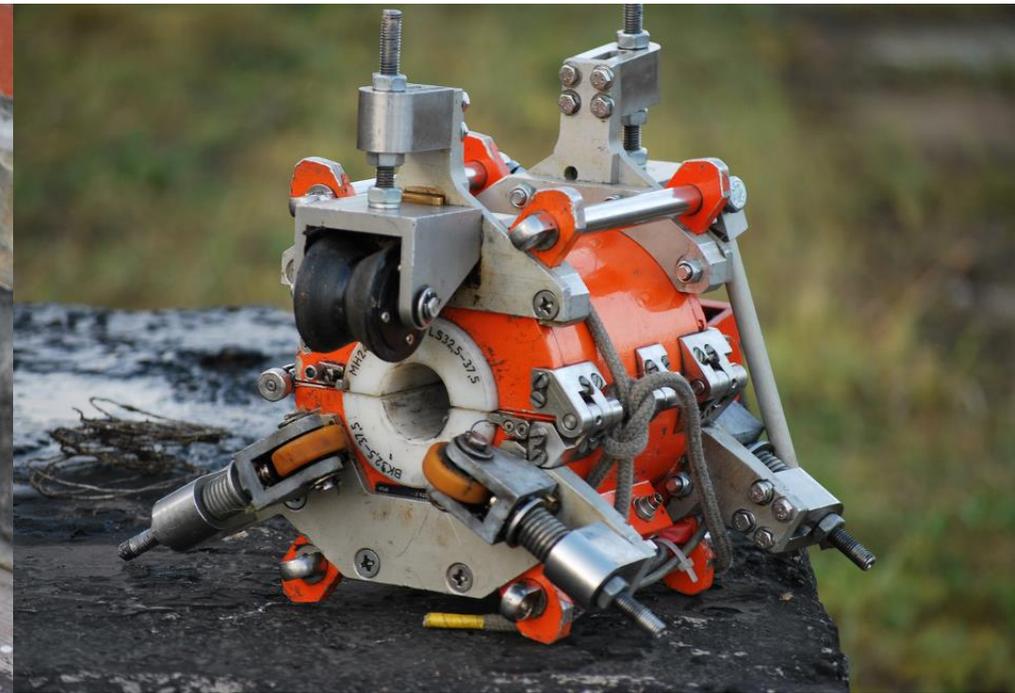
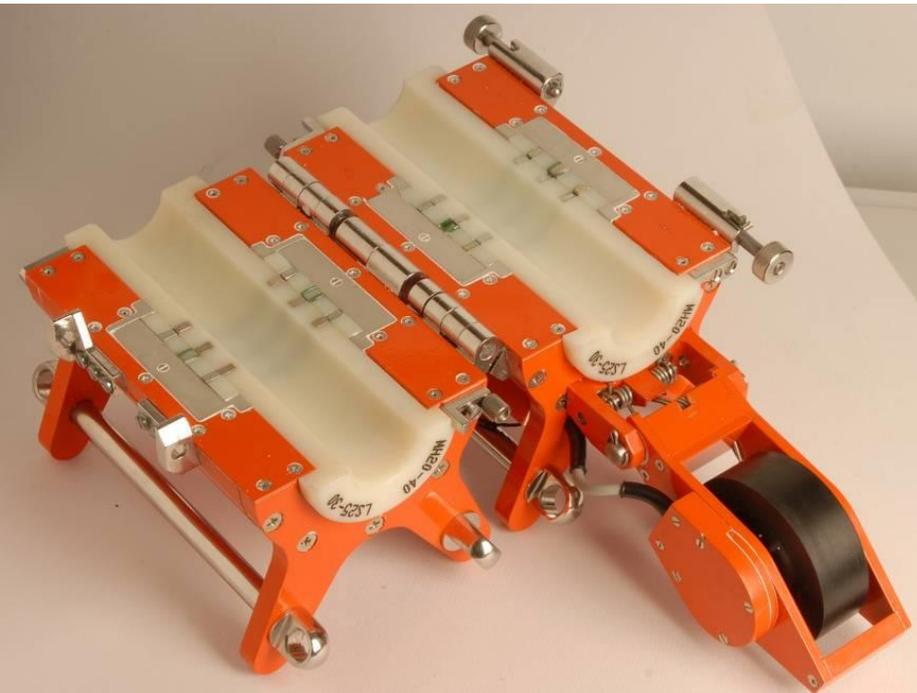
Inspection Procedure – Equipment preparation

Selection of magnetic head.

Installing corresponding sensors and sleeves.

Affixing the calibrated Basic Unit to the Magnetic Head.

Setting up roller system (optional).



Inspection Procedure – Calibration

Requires two known LMA values:

A **whole rope (0% LMA)** and a section with **known LMA** (amount of broken wires),

-or-

A **whole rope (0% LMA)** and additional wires taped on (**negative LMA**),

-or-

A **whole rope (0% LMA)** and **no rope (100% LMA)**.



Inspection procedure - Setup

Input of zero distance point.

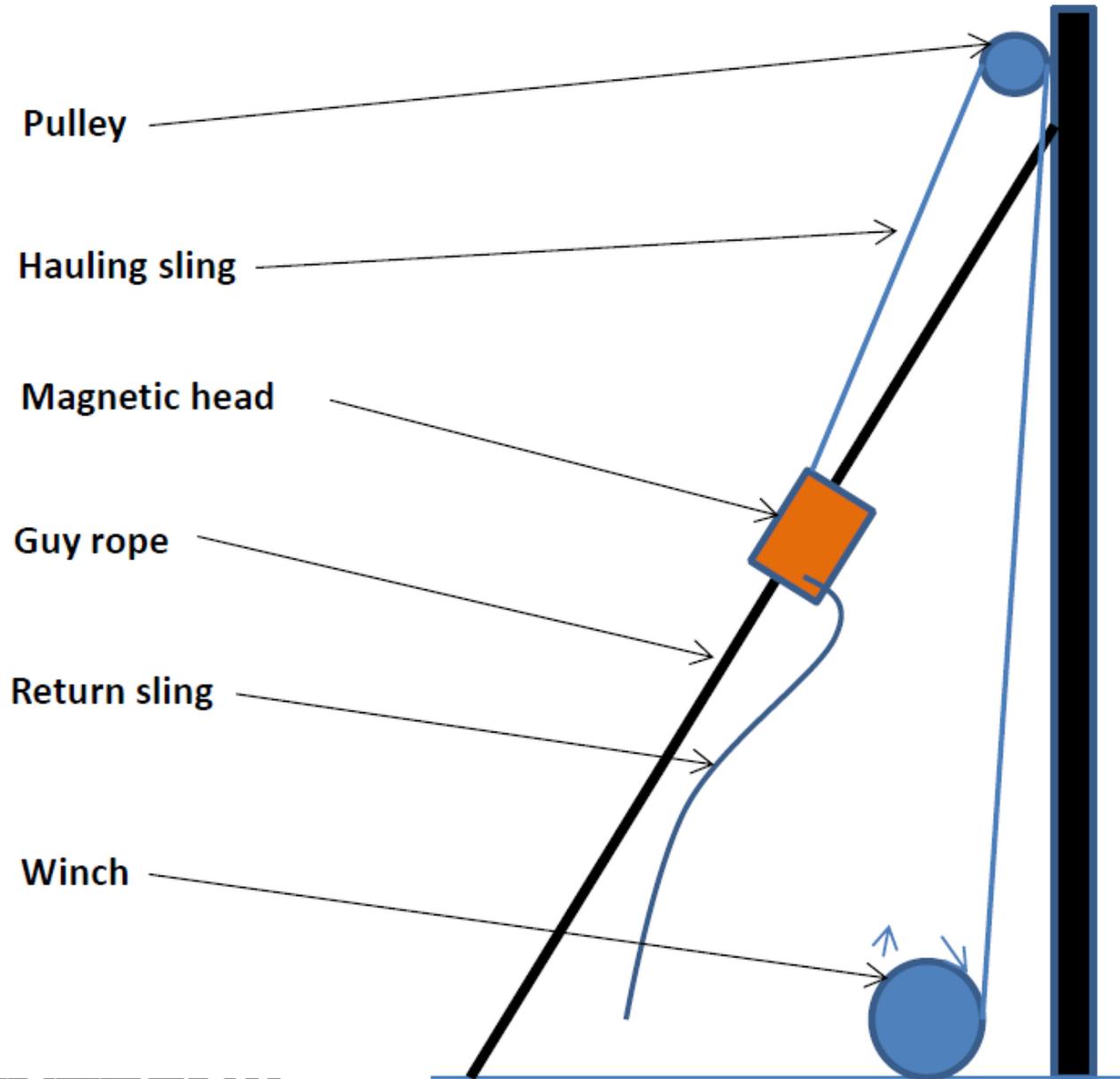
Installation of the INTROS on the rope.

Hoisting of belay line (return sling).

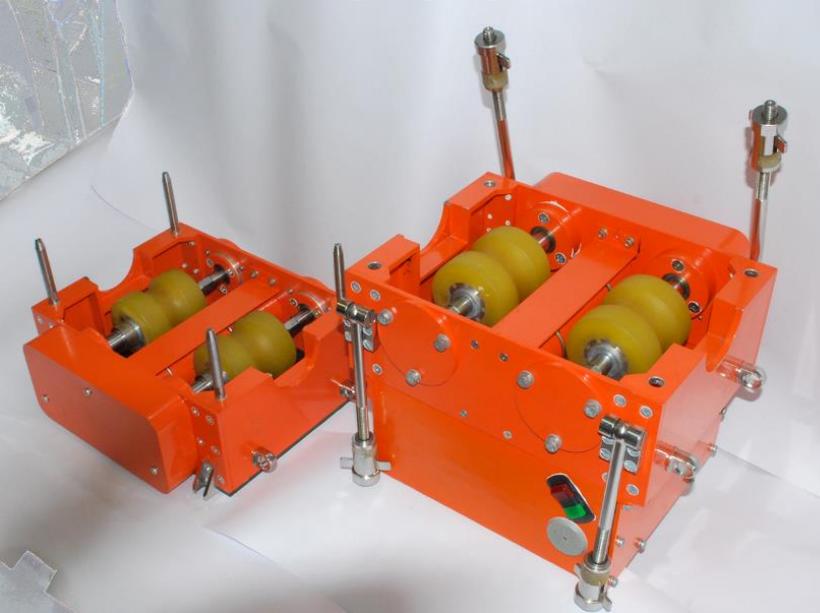
Installation of the Climber unit / Connecting winch hauling rope.



Inspection Procedure – Winch



Inspection Procedure – Climber



Inspection Procedure – Recording

Magnetic head to travel the whole length of the rope pushed by Climber / pulled by winch.

Return sling prevents rotation and aids to pull the Magnetic head down.

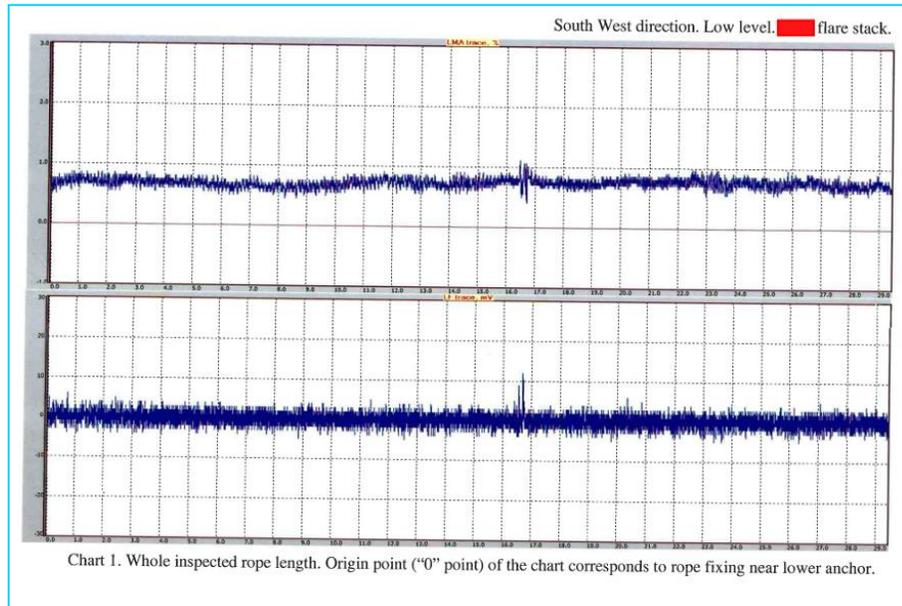


Inspection Procedure – Analysis

Express data viewing after inspection.

Visual verification of located breaks visually (if possible).

Report compilation.



INTRON PLUS Ltd.
NON-DESTRUCTIVE TESTING AND TECHNICAL DIAGNOSTICS
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Fax: +7 (495) 510-1769
info@intron-plus.com

CONCLUSION # 392/18
on flare stack guy rope inspection

Date: 20.12.2018

Type and title of installation: **plant flare stack, Kingdom of Saudi Arabia.**

Inspection performed accordingly following documents: **INTROS steel wire rope flaw detector, Operating Manual, 42 7638-006-11442921-2000 RE, Methodical guidance for magnetic testing of ferromagnetic steel wire rope, - RD 03-348-00, Standard practice for electromagnetic examination of ferromagnetic steel wire rope ASTM E 1571-11, ISO 4309:2017 Crane – Wire Ropes – Care, Maintenance, Installation, Examination and Discard.**

Discarding criteria: **ISO 4309:2017 Crane – Wire Ropes – Care, Maintenance, Installation, Examination and Discard.**

Rope construction, Nominal and measured diameter, Rope location, Manufacturer and certificate.	Rope's segments under the test.	Comment on signature, Detected defects and their description.	Resume
BGE flare, South West direction, Low level, Diameter 1/2" Spiral construction, A586, Class A, galvanized, Manufactured by SPS Corp.	29.5 m.	No broken wires were detected, LMA maximum value: 1.1 % at 16.5 m, Rope deformation at 16.5 m, Minimum safety factor: 13.2.	The rope is suitable for further use according to ISO 4309:2017

Equipment, used for test: **INTROS steel wire rope flaw detector, Magnetic head INTROS MH 6-24 s/n # 201918, basic units INTROS s/n # 400057.**

Recorded data: **Loss of Metallic Cross-Sectional Area (LMA) and Localized Faults (LF).**

Place of magnetic head installation: **near lower anchor rope termination.**

Direction and speed of MH movement: **Down, 0.1 m/s.**

Test date: **06.12.2018.**

NEXT INSPECTION DATE recommendation (if rope is suitable for further use, otherwise recommendation for discarding): **until December 2023**

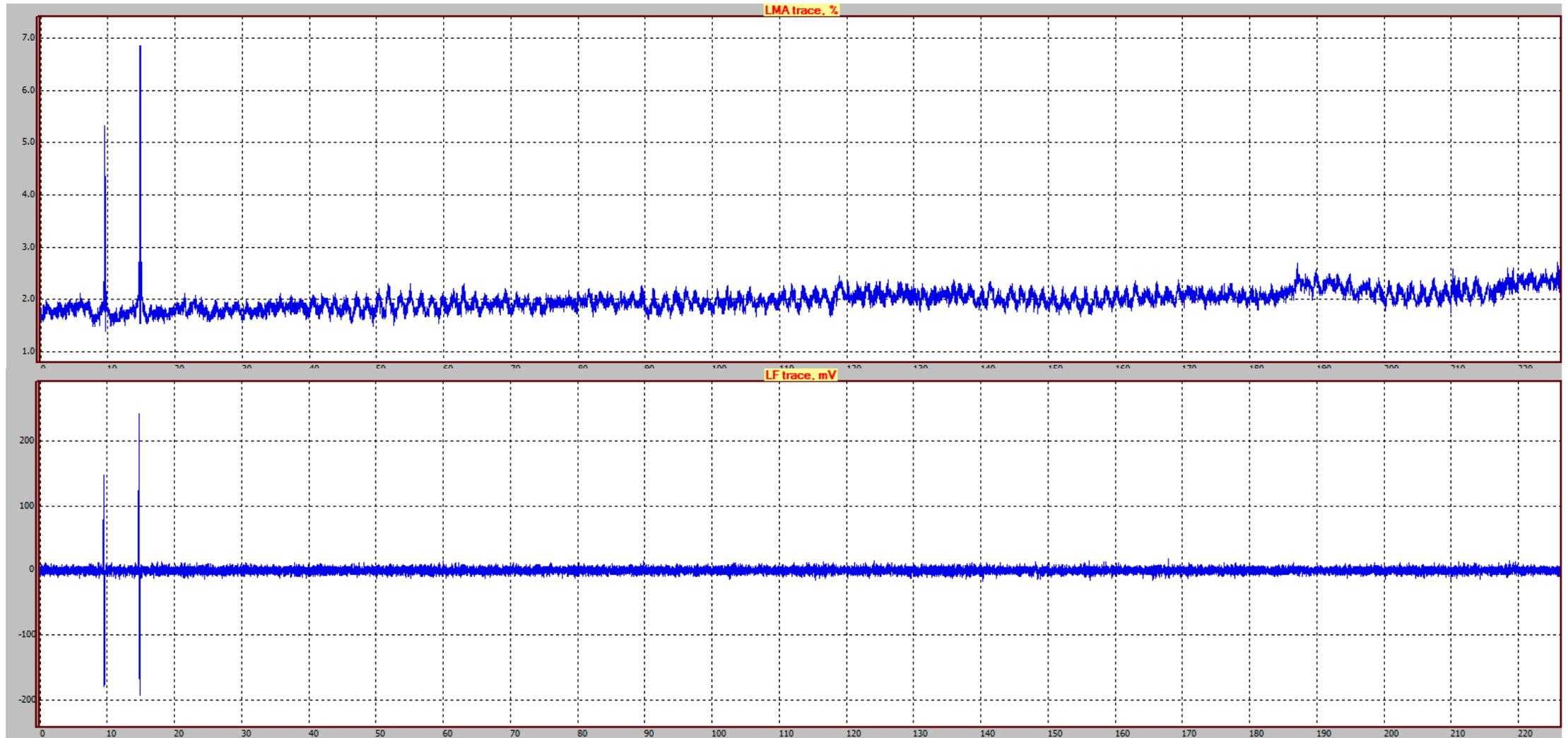
Inspector name and signature: **Alexander Zhirmov**

Conclusion issued by inspector

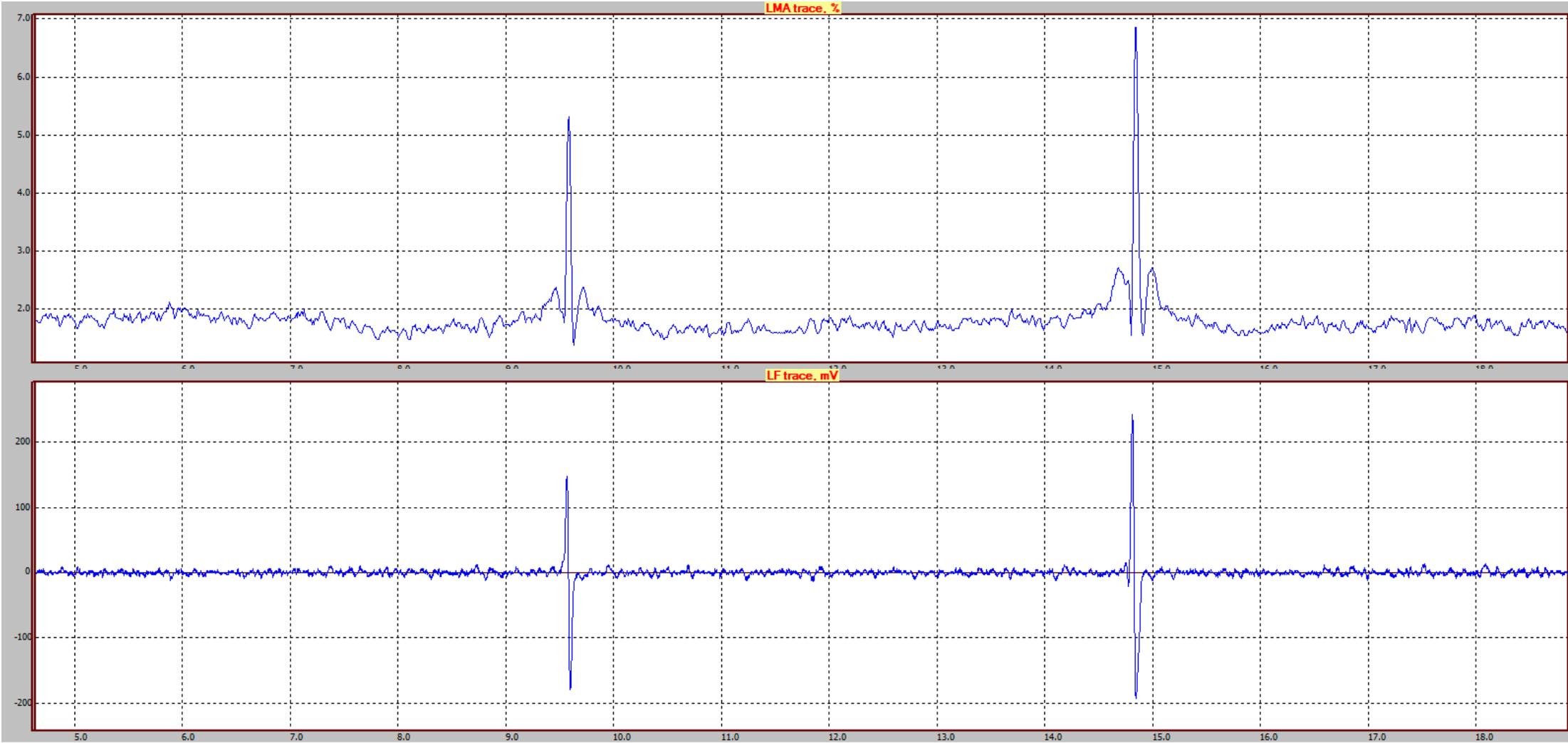
Inspector certificates: **14-II**

Head of NDT laboratory: **Sukanov**

LMA and LF traces of 45 mm guy rope



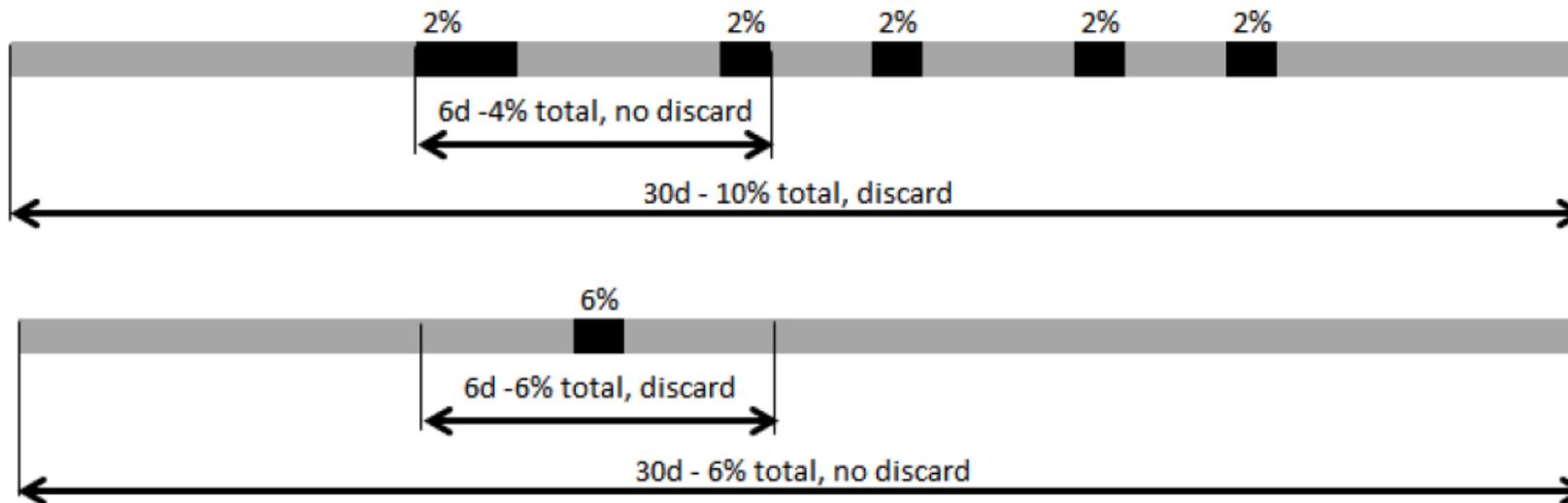
Zoom-in section of 45 mm guy rope containing defects



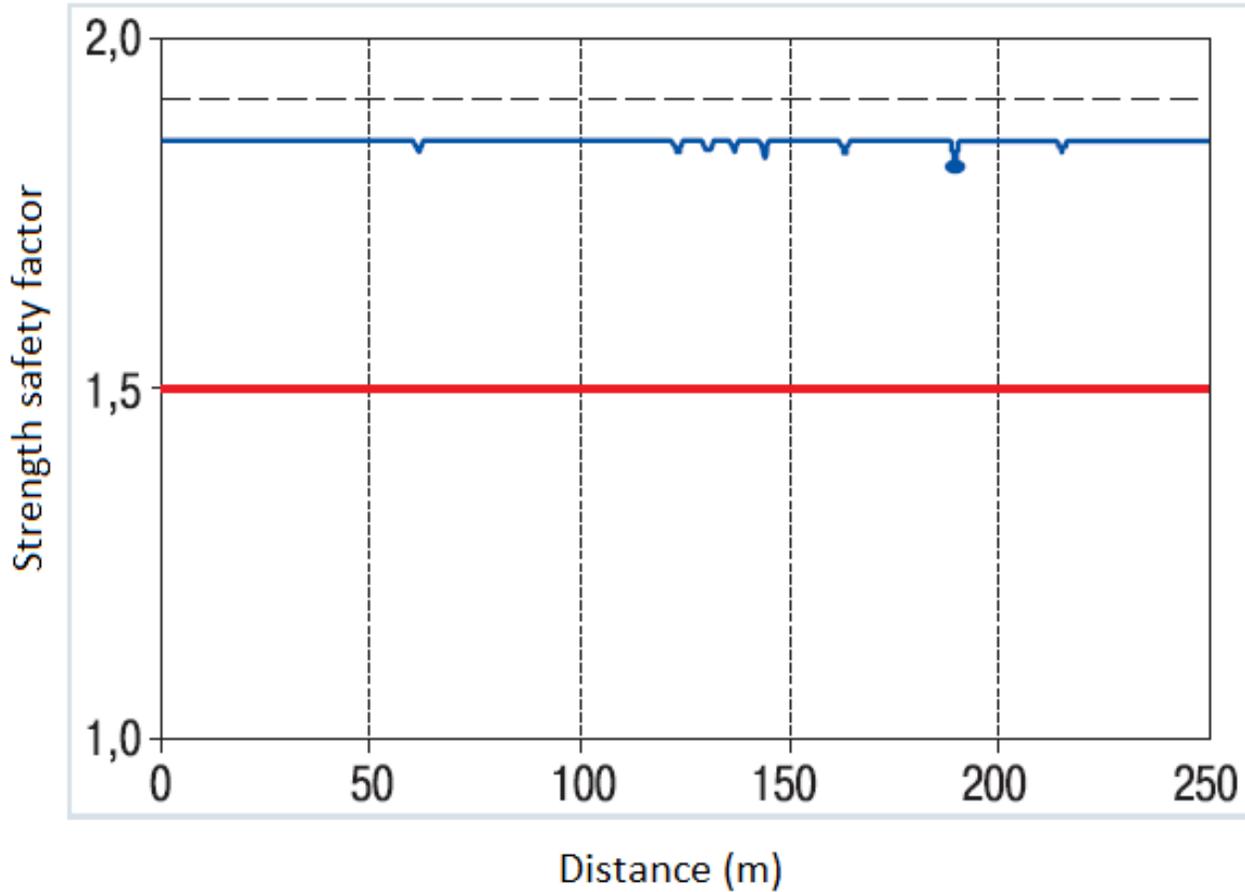
Inspection Procedure – Discard Criteria

Current standard: ISO 4309:2017

	Loss of Metallic Area (expressed in %)
Over a length of $6d^a$	6
Over a length of $30d^a$	10
^a d = nominal diameter of rope.	

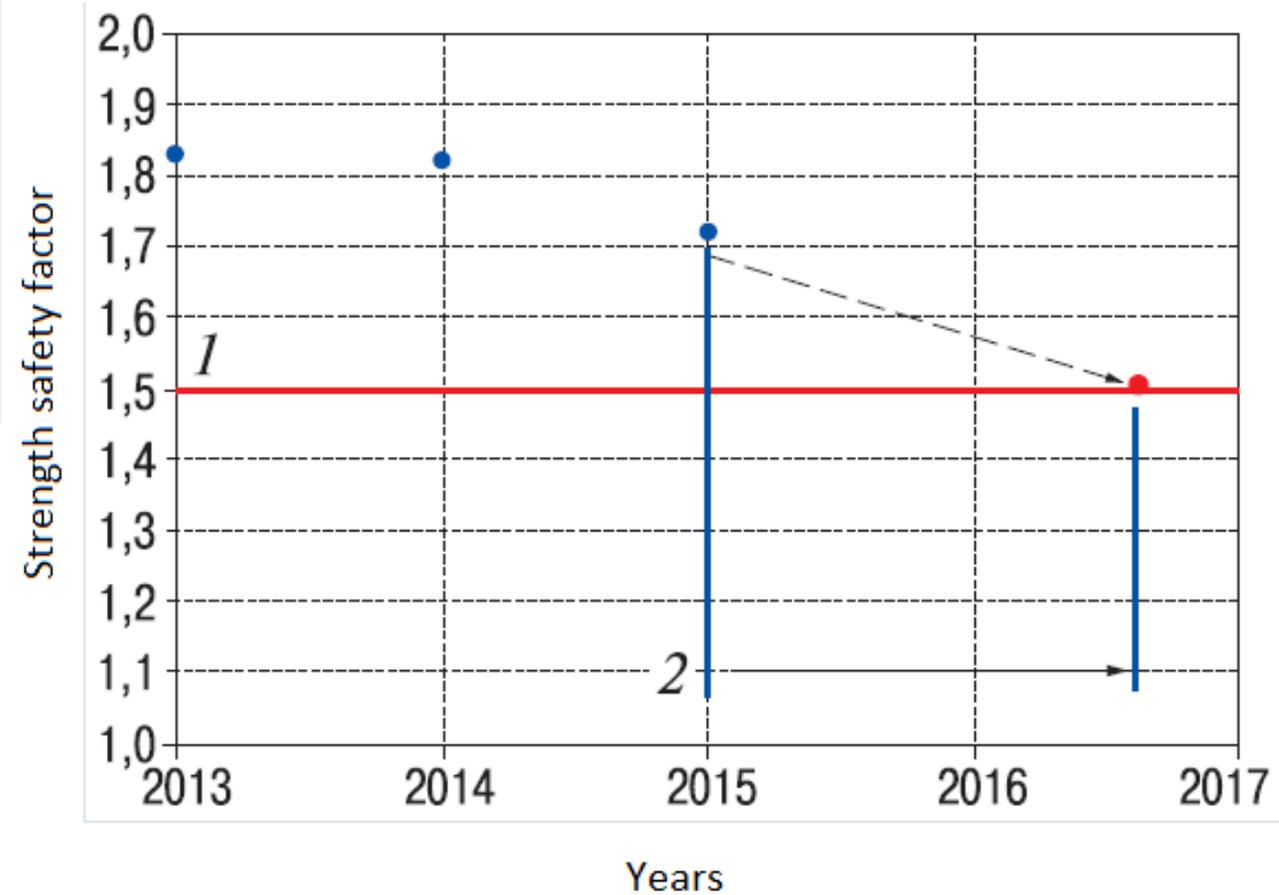


Rope Strength Safety Factor Calculation



Strength safety factor.

Strength safety factor regression.



Our experience – Inspection of flare stack guy ropes

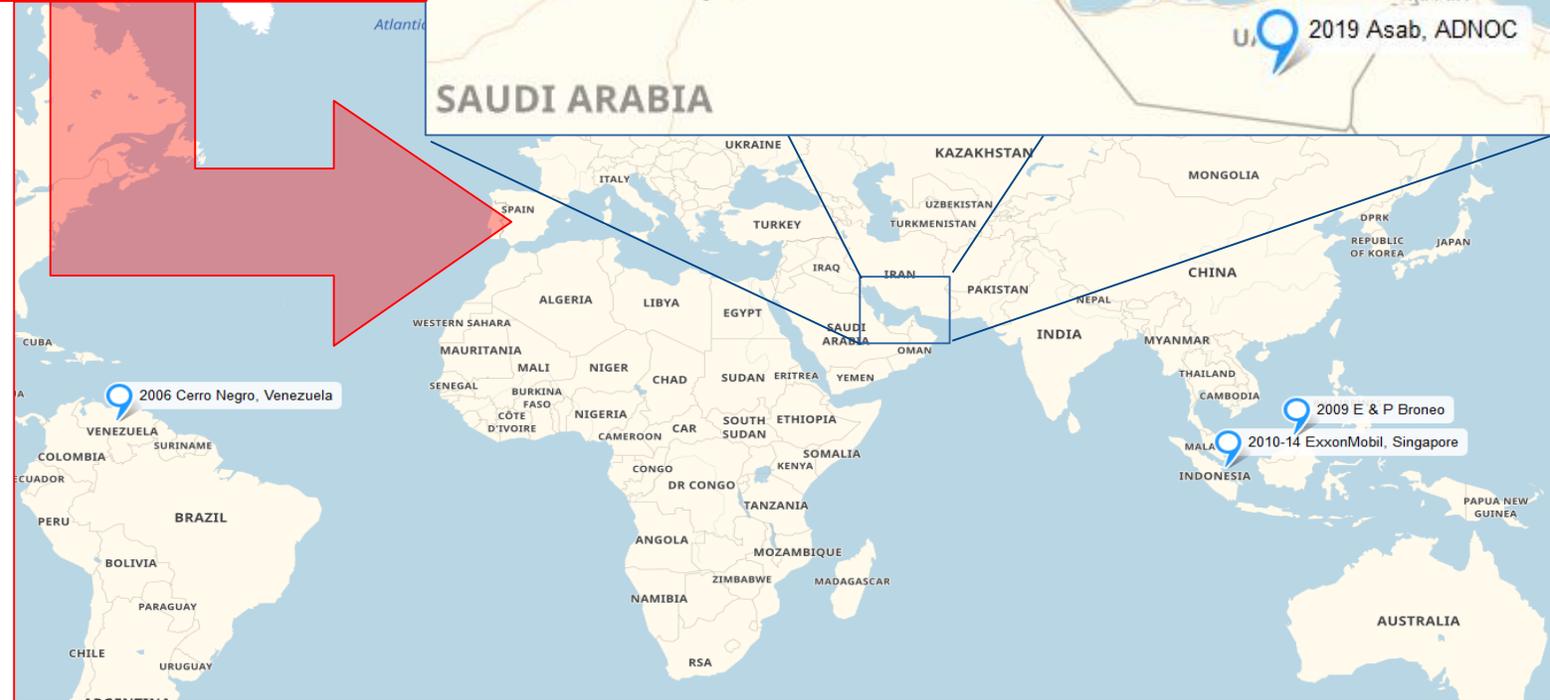
Contractors:



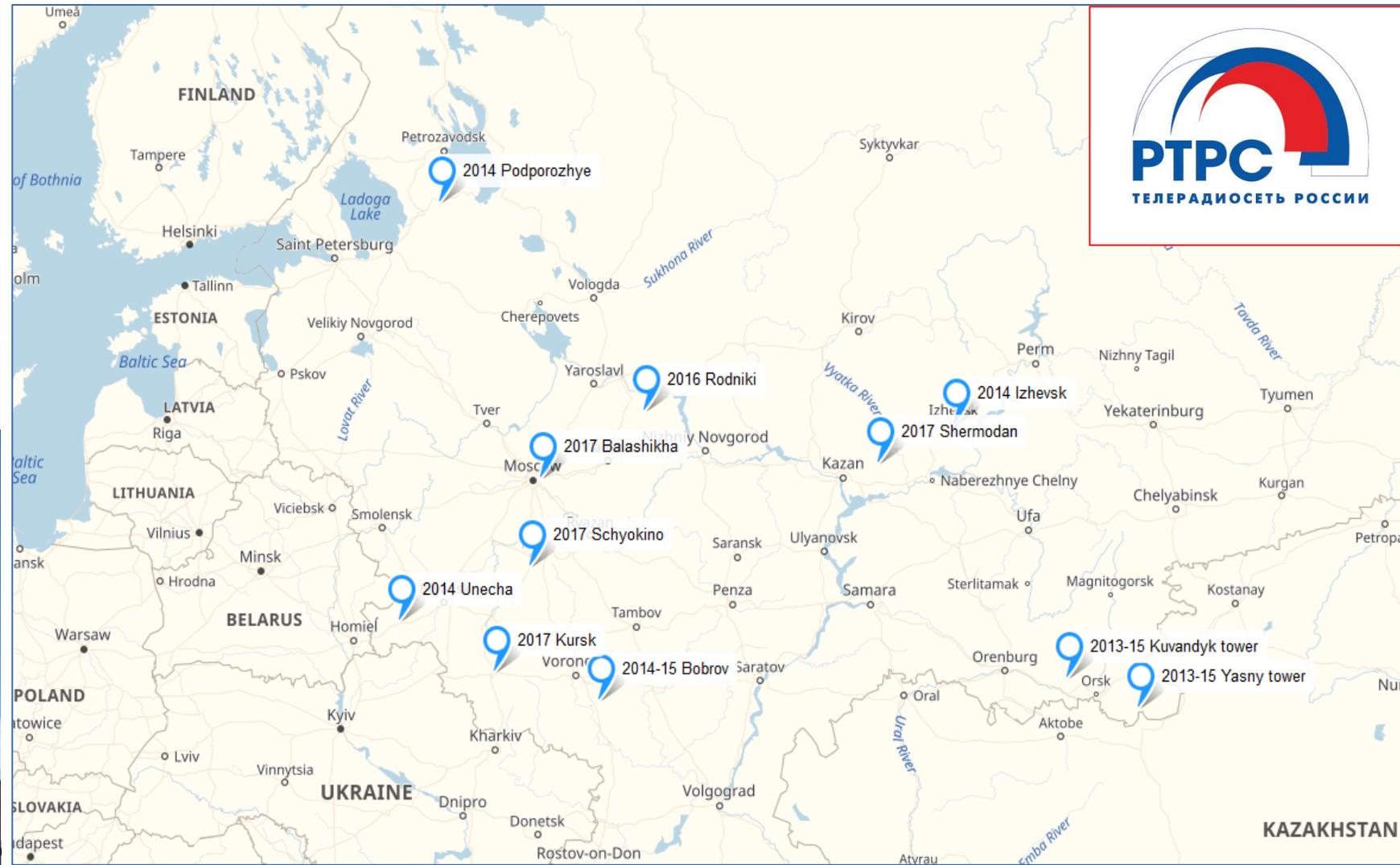
Clients:



RIGHT NOW



Our experience – Inspection of communication tower guy ropes



Our partner – Flameout International

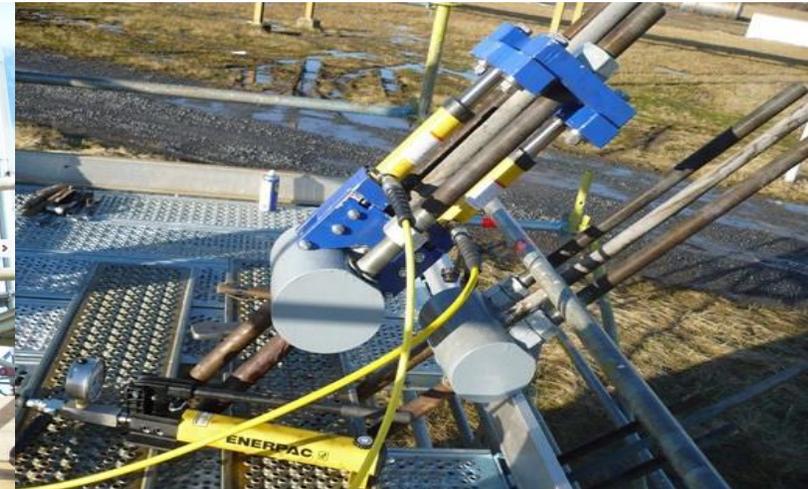
Tension measurement
& re-tensioning.

Verticality check
& correction.

Greasing
& re-greasing.

Tension meters & total
stations calibrated to match
correct guy wire.

Flare tip, deadman anchor
and guy wire replacement
also available.



Our referrals



اريس للخدمات البحرية والهندسية
ARIES MARINE & ENGG. SERVICES
P.O. Box 24496, Sharjah, UAE Tel: +971 6 5503300 Fax: +971 6 5503100
Email: ariesmar@em.ae Website: www.ariesgroupglobal.com

To whom it may concern

Aries Group of Companies is a multinational conglomerates in the Middle East with 43 companies operating in 15 countries across the world. Aries Marine and Engineering Services has the largest Inspection and Non-Destructive Testing (NDT) division in the Middle East. The spectrum of our services includes wire rope NDT and certification using Magnetic Flux Leakage (MFL) method with strong magnetization. For the purpose of wire rope NDT we selected MFL instrument INTROS manufactured by the company Intron Plus. With this instrument, we may currently inspect the wire ropes up to 64 mm in diameter regardless of their construction and presence of grease on the rope. INTROS is a specially designed instrument developed for NDT of wire ropes in the most reliable way. The design of the instrument allows its operation in difficult operating conditions, wherever the rope is installed. Our inspection team was trained and certified by the supplier of the equipment for operation of the instrument and data interpretation.

Due to strong rope magnetization the INTROS accurately measures loss of metallic area and detects outer and inner broken wires. The software Wintros enhances instrument capabilities for processing and interpretation of inspection data. We have inspected number of ropes, including ropes of cranes, Ship Lift, Flare Stack, etc. Data obtained from inspection allows extend rope life to avoid unreasonable costs related to discard and exchange, or timely discard the rope, if it is dangerous, to avoid accident.

We may recommend the Intros as reliable instrument for inspection of wire ropes in different situations.

Signature

Stamp

Date



To: Sergey Goncharov,
After sales Service Manager

INTRON PLUS LTD
Tel: +7 (495) 229-3747, Fax: +7 (495) 510-1769
Elektrohnaya Str., 11, Moscow, 111524, Russia

Subject: INTROS® basic unit and magnetic heads

We have had the pleasure of utilizing the INTROS® basic unit and magnetic heads for the Middle East Petrochemical, Oil and Gas industries during last 2 years. The INTROS® system is highly efficient, able to inspect more feet wire-rope per minute as compared to any other NDT equipment that we used before. The INTROS® system is extremely robust and able to withstand different weather conditions. It has been helping us to receive excellent feedback from our Clients.

Our experience shows that the INTROS® system is easy and convenient to fit and straight forward in use and in connection with a well prepared technician gives the best result. These factors play a major role in keeping down risks and costs.

We want to thank Intron Plus and its personnel for their continuous support and good service during these years, and give our highest recommendation to INTROS® system.

Juan Jose Montes Acosta
Section Head - Flare Division & Rope Access Dept.

Arabian Pipeline & Services Co. Ltd. (ANABEEB)
Champions of ... Industrial CARE

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Arabian Pipeline & Services Co. Ltd. (ANABEEB)

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رأس المال: ١٠٠ مليون ريال سعودي Share Capital SR 1,000,000



الشركة العربية للأنابيب والخدمات المحدودة (أنابيب)

ص. ب. ٢٣٤، الجبيل ٣١٩٥١، المملكة العربية السعودية

P.O. Box 234, Al Jubail 31951, Saudi Arabia

س. ت. ٢٠٥٠٠١١٦٢ CR 2055001162



To Whom It May Concern

REF:LOC/INT/IA/1216/01
7th December,2016

Sub: Letter of Commendation

Liftek, as a leading inspection company in the Middle East, offer a wide portfolio of services including crane and lifting equipment inspection, in particular, inspection of steel wire ropes.

For non-destructive inspection of steel wire ropes, we use wire rope tester INTROS with magnetic heads MH 20-40 and MH 40-64, manufactured by Intron Plus Ltd. A technician from Intron Plus Ltd. trained and certified our inspection team at our facility in UAE, which was very useful.

We use the equipment INTROS for inspection of wire ropes onshore and offshore, operated at cranes, winches, etc. The instrument INTROS has relatively small size and weight. MFL principle of operation with strong magnetization of wire rope ensures good performance, i.e. high LMA measuring accuracy and LF sensitivity. The software Wintros delivered along with the equipment enhances potential of the equipment dramatically. Design of the equipment is rugged enough to use it in a heavy environment and satisfies most of our applications. In certain cases, when we need assistance from Intron Plus Ltd., we receive on-time consultancy and advice.

Specialists of Intron Plus Ltd. demonstrate high qualification and reach experience, and we wish them great success with future developments and looking for more cooperation with this company.

Best Regards
John Alexander
Managing Director
Liftek

SHARJAH Hamriyah Free Zone Phase - 2, U.A.E. PO Box 41850. Tel: +971 6 525 0088, Fax: +971 6 525 008
DUBAI Tel: +971 4 338 4995, Fax: +971 4 338 4937 ABU DHABI Tel: +971 2 552 2072, Fax: +971 2 552 213
info@liftek-intl.com



شركة تهرس للمقاولات
EXPERTISE CONTRACTING CO.

ص. ب. ١٠٣٥٣، غرفة تجارة ٢٠٥٠٠، منطقة ١ - شارع ١٧٥
المملكة العربية السعودية
C.R. 2055009882, C.O.C. No. 169 388
Paid up Capital: 1,000,000.00 SAR

Date: 24-Jun-17

TO WHOM SO EVER IT MAY CONCERN

Our company has contracted Intron Plus for the inspection of flare stack guy ropes, which have being in operation for over 17 years. Intron Plus previously supplied us the INTROS wire rope flaw detector.

The inspection was carried out at Kemya Kop in Al Jubail, Saudi Arabia in February 2017 and was properly prepared and successfully completed. Inspection results, obtained with the INTROS MRT equipment and Intron's methodology, combined with visual examination, enabled us to thoroughly assess the actual guy rope condition.

Specialists from Intron Plus exhibited professionalism and expertise in MRT, and were fully committed to this job. It was very easy to communicate with the Intron team who were able to overcome all of the challenges and obstacles that arose during the project.

On behalf of Expertise Contracting Company I express my gratitude to Intron and voice my satisfaction from our cooperation and I am looking forward for future ventures with Intron Plus.

This letter may be shown to any third party for the purpose of reference.

Sincerely,

Divisional Manager

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Tel: (013) 340 8324, Fax: (013) 340 8322
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Kingdom of Saudi Arabia
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بريد الإلكتروني: admin@expertindus.com



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رأس المال: ١٠٠ مليون ريال سعودي Share Capital SR 1,000,000



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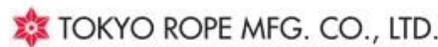
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Our key customers



Mercedes-Benz



Conclusions

- **Magnetic rope testing is the only practical way to non-destructively inspect guided structures, e.g. guys at flare stacks**
- **Non-destructive testing of guy ropes at flare stack is important mean to provide integrity of flare stacks at refineries**
- **Guy ropes can be non-destructively inspected at flare stacks either out or in operation**

Thank you for your attention!

www.intron-plus.com

Corporate membership

