

Practice of Non-Destructive Testing of Steel Wire Ropes and Rope Conveyer Belts

Vasily Sukhorukov, Alexander Mironenko (Intron Plus, Ltd., Moscow)

Being involved in non-destructive testing (NDT) of ropes from early 1990-th, Intron Plus, Ltd. is now well recognized supplier of equipment and services for rope inspection. The company grows and expands the business. About 200 modern instruments INTROS for NDT of ropes have been sold to customers worldwide, including Russia and NIC, USA, Germany, Netherlands, Japan, Taiwan, Singapore, Malaysia, India. Services on NDT of ropes were provided in Russia, Ukraine, Kazakhstan, Austria, Iran, Latvia and other countries. Intron continues improvement of existing equipment and develops new ones. The paper presented by Intron in September 1998 in Podbanske, was dedicated to NDT of ropes in Russia [1]. Now the authors describe the progress in product line and its applications.

Instruments for rope NDT

Reliability and safety of many industrial and entertaining objects, transport depends on technical condition of ropes. For this reason ropes are usually subject of proper inspection during its life- time. The family of MFL instruments INTROS were created for inspection of different kind of ropes: round, flat and steel rubber constructions, with diameter range from 6 to 64 and from 100 to 152 mm, with width up to 450 mm. They are comparatively small and light, easy to install and inspect, provide storing test data into portable data logger for further computer processing. The customer may under his choice also connect chart recorder or a PC for on-line monitoring of test data. Wide range of magnetic heads is available. The above makes this instrument applicable at any rope installation: mining hoists, ropeways, elevators, cranes, shipyards, offshore platforms, etc.

Application

a) The most known application is inspection of ropes in mining industry. Mining ropes are subject of strict supervision in Russia. Safe use of ropes is usually provided with different methods of inspection: destructive inspection with tearing machines, NDT with visual and instrumental inspection. Destructive inspection can only bring the information about tested part of rope. Moreover, the tested part of rope usually is not representative due to different kind of wear and leads to shortening of rope. When rope is too short to cut the sample for testing, it must be discarded. During 1977-2000 about 33,636 m (295,443 kg) of ropes with various constructions, length and diameters were discarded at the company Norilsky Nickel. The company spends annually about 26,000 working hours for visual inspection of ropes, but it is not possible to measure LMA and detect internal LFs visually. The company widely uses instrumental NDT of ropes with the INTROS for many years. It was proved that costly and long time visual inspection can be substituted by NDT with flaw detector INTROS and terms of destructive testing can be increased 2 times. As a result the company substituted visual inspection of ropes with more frequent non-destructive testing and this was approved by officials starting from the last year [2].

b) Crane ropes in Russia were not a subject for proper supervision for a long period. It was not easy to bring an idea of non-destructive instrumental inspection of ropes to

Vasily Sukhorukov, Alexander Mironenko, Intron Plus, Ltd., Krasnokazarmennaya Str.,
17, Moscow, Russia, [e-mail:info@intron.ru](mailto:info@intron.ru)

the owners of cranes and even to the officials. However facts are stubborn things. Only during last 6 years many accidents happened with cranes due to poor condition of ropes. Some of those accidents ended in tragedy. We thoroughly investigated ropes after some of those accidents and proved that NDT of ropes is necessary mean to provide its safe use [3]. Dozens of inspection companies in Russia now actively uses NDT of ropes during installation of cranes and its periodical maintenance. This mean is especially important for guy ropes, for ropes of cranes used at hazardous conditions and considering that about 90% of cranes in Russia ended its life time and so must be properly checked before extending exploitation.

c) Unlike ropes of crane elevator ropes usually work in good conditions and service of these ropes practically never includes NDT. In 2002 Intron Plus along with some inspection companies investigated condition of ropes installed at elevators in different areas of Russia. 227 ropes of 68 elevators were investigated during this experiment. It was opened that 21 of ropes installed on 19 elevators reached retirement criteria (too high quantity of broken wires) and must be replaced for safety reasons. Some of those broken wires were detected inside the rope and so were invisible. However external broken wires could be and must be detected during rag-and-eye inspection. The fact that they were not detected during periodical maintenance shows that operators did not pay proper attention during their inspection. Use of instrumental NDT will obviously discipline maintenance people.

Ropes of different objects move with different speed. Ropes of winches at shipyards move with very low speed (about 0,06 m/s). Ropes of ropeways move with much higher speed. Both of them can be non-destructively tested with INTROS. One of the most important problem was solved recently by Intron. The method of rope NDT nearby sleeves was developed and successfully tested. This is the very important to proper inspect the part of guy rope in the above area because of intensive corrosion their. Accumulated experience in the area of rope NDT was presented on OIPEEC meetings, world and European NDT conferences [4,5,6,7].

Personnel for rope NDT

Considering character of rope NDT with flaw detectors, Intron is providing training of inspecting people. This training has been providing under approved program, which includes different topics: construction of ropes, theory of MFL method and principle of INTROS operation, current state of rope NDT, identification of test results, national and international regulations, etc. Training can be provided either at Intron facility or at customer's site and lasts 4 working days, including lecturers, practical training with the instrument in the laboratory and exams. More than 300 experts from 11 countries have been trained by Intron Plus.

New products of Intron Plus

a) New instrument in the family INTROS named Monoblock MB 8-24 appeared on the market in 2003. It is dual-functional flaw detector intended for testing round ropes with diameters 8-24 mm. Unlike previous models of INTROS, which consist from a magnetic head and basic unit (data-logger) connected with cable, MB8-24 is manufactured in the same ruggedly designed housing. This construction has some advantages for those customers, who test elevator and crane ropes. Due to narrow

distance between elevator ropes special sliding device is now available to extend this distance during test.

b) Development of flaw detector INTROCON for testing rope conveyer belts was successfully finished this year by Intron Plus and the product was presented on the market. Unlike INTROS, which realize magnetic (MFL) principle of operation, INTROCON is eddy-current instrument. It detects broken ropes and pitting corrosion inside the belt, measures the distance between the ends of broken ropes. The instrument can be used for belts of any construction with width up to 3000 mm, speed of conveyer belt under test is up to 4 m/s.

References

1. V.Sukhorukov. In-situ nondestructive testing of steel wire ropes in Russia: current state. International conference on investigation, production and use of steel ropes. Podbanske, 1998.
2. V.Sukhorukov, A.Mironenko, A.Perepelitsyn, A.Saplin. Monitoring of Mine Hoist Ropes at The Norilsk Nickel Company. «Mine Hoisting 2003», Szczyrk, Poland
3. V.V.Sukhorukov, V.Kotelnikov, V.Zhukov, A.Khudoshin, Importance of ropes NDT for loading cranes safety rising. OIPEEC Technical meeting. Lenzburg, Switzerland, 2003.
4. V.Sukhorukov, I.Shpakov. Testing of the Tower Crane Guy Rope Termination by Magnetic Method: Problems & Solutions. OIPEEC Technical meeting. Bethlehem, USA, 2001.
5. B.Cook, O.Gronau, V.Sukhorukov, E.Verdegaal. Steel rope NDT in the offshore industry and shipyards. 8-th European NDT conference. Barcelona 2002.
6. A.Russold S. Belitsky. Inspection of Ropes for Austrian Ropeways Using Modern NDT Instruments. 15-th world NDT conference. Rome, 2000.
7. O.Gronau, S.Belitsky, V.Sukhorukov. NDT of Steel Ropes with Magnetic Flaw Detectors: Documentation and Interpretation of Test Results. 15-th world NDT conference. Rome, 2000.