

Implementation of rope monitoring system at hazardous industrial facilities: results and problems

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Steel wire ropes are being used in many different hazardous industrial facilities, for example in lifting, drilling, mining and so on. The most dangerous types of rope defects – corrosion, abrasion, wire breaks, can be detected by means of magnetic rope testing. In this respect the purpose of magnetic rope testing consist in: 1. Preventing accidents caused by rope breakage, 2. Prolonging of rope service time according to its actual condition. It has approved itself as a reliable method of steel rope nondestructive testing, at the same time there are restrictions in its application, caused by the necessity of qualified staff to fulfill inspection operations and to interpret inspection results. At the same time monitoring of rope technical condition is critically important for some industrial facilities, such as drilling rigs or hoists of melting cranes, mine hoists. Automated monitoring of rope technical condition offers a solution of this problem. To build an automatic system of rope condition monitoring an automated rope tester Intros-Auto was developed. The rope tester consists of magnetic head placed at the rope and control and display unit located at operator console. It can perform both as a standalone instrument and as a part of computerized information system. Operator directly or remotely starts inspection procedure and after its completing get information about rope condition in simple and unambiguous manner (displayed according to traffic lamp principal “green/yellow/red”). If necessary detailed results analysis is possible after downloading of inspection results. Intros-Auto rope monitoring system was successfully implemented at drilling rigs of different oil and gas service companies, where it is used to check a rope condition at the beginning of each working shift. Main deterioration mechanism of hoist ropes consists in appearance of wire breaks and formation of their clusters. In that regard main task of hoist rope monitoring consists in detection of wire breaks and their clusters and estimation of quantitative characteristics of them. In that respect it is important that Intros-Auto has two different local faults measuring channels (Halls and coils), that increase reliability of faults detection. Based on Intros-Auto instrument rope monitoring systems were also implemented at more than 30 mine hoists for everyday rope condition monitoring. In this case magnetic head is installed stationary at hoist ropes. Its application has significantly reduced time expenditure for rope non-destructive testing. Measured loss of metallic area and wire breaks both are to be considered as a complex discard criterion for these ropes. It is important that inspection results can be automatically provided to authorized persons in a customized representation. Everyday monitoring of rope condition allows to use not only conventional discard criteria – loss of metallic area and number of wire breaks over fixed length (for example 30 D, D – rope diameter), but to impose additionally dynamic condition criterion – increment of LMA or LF between two consequent rope tests. Worth of this criterion lays in its potential ability to estimate indirectly fatigue of the rope and to foresee snowballing development of wire breaks, which precede disruption of the rope. It should be mentioned that numeric value of this criterion consider theoretical substantiation and experimental validation. Broad implementation of monitoring systems requires development of new technical norms and adaptation of regulatory framework to consider new possibilities of such systems at hazardous industrial facilities.