



Topic: Non-DESTRUCTIVE TESTING of metal STRUCTURES in
railway transport

The importance of non-destructive testing methods in ensuring the safety of railway transport

- The most important problem of Railways is ensuring transport safety and environmental safety Features of the operation of Railways in Latvia and other Baltic countries : excessive terms of use of track structures, rolling stock, electric traction complex; insufficiently high technical level of operation of track structures, rolling stock, electric traction complex; difficult climatic conditions for diagnostics of technical devices during their operation; growth in transit traffic volumes on the international transport corridor East-West; increasing the weight of trains and the speed of movement. Prevention of accidents and man-made disasters in real conditions is associated with the need for monitoring, as well as diagnostics of the technical condition of railway transport devices by non-destructive testing methods

Classification of defects in metal structures of railway transport

- Defect - each non-compliance of the controlled device with the requirements of regulatory documentation

Defects are divided into: permissible and unacceptable; obvious, hidden; correctable and incorrigible; critical, significant, low-sensitive; production and technical - metallurgical (casting, rolling) and technological (during welding, surfacing, mechanical and heat treatment); operational (material fatigue, corrosion, wear, overload, improper operation).

Main features of ultrasonic testing

- These ultrasonic testing methods allow you to carry out one hundred percent control and assess the technical condition of materials, parts or structures during operation without damaging them, changing their performance characteristics or disrupting the operating mode. A wide range of methods and means of ultrasonic control provides effective preventive control, the results of which allow you to make informed decisions about the permissibility of further operation of the object of control. Ultrasonic control allows you to detect internal defects in technical objects that are not available to other non-destructive methods. This method is used in transport to control the elements of subassemblies, access to the surface of which is closed by other parts and which are not disbanded. In particular, ultrasonic methods are used to control the approach parts of the wheelset axle without removing the wheels, the axle necks without removing the inner rings of roller bearings on a hot landing, etc. Ultrasonic monitoring serves to prevent emergency situations and man-made disasters during operation.
- Main features of ultrasonic monitoring.

Defects of metal structures detected by ultrasonic inspection methods

- Casting defects: shrinkage shells (cavities formed during uneven shrinkage of metal during solidification), porosity (small accumulation of gas or shrinkage shells with a coarse-grained metal structure), liquation (unevenness of the chemical composition of the metal in the casting body, formed at different solidification temperatures of pure metal and impurities contained in the melt), sand shells, slag shells, etc. Defects of rolled and forged metal: cracks, flocks (hairline cracks caused by the presence of hydrogen, which did not have time to be released from the metal during rapid cooling, hairlines (small cracks from gas bubbles), etc. Defects of welded joints: cracks in the deposited metal, in the seam from the seam to the base metal and in the transition zone, non-welding, pores and sinks, slag inclusions, Defects that occur during various types of technological processing of parts (during quenching, grinding, drilling, stamping). Defects that occur during the operation of products - fatigue cracks, corrosion damage, cracks as a result of high systematic and one-time applied stresses, mechanical damage.

Classification of types of non-destructive testing of metal structures

- A type of NC is a group of methods, tools and technologies United by a commonality of physical phenomena that allow registering primary informative parameters. The primary informative parameter means one of the recorded physical quantities whose distortion is caused by the presence of a defect in the controlled object: characteristics of magnetic or electric fields, parameters of ultrasonic vibrations, x-rays, infrared, ultraviolet and gamma rays. the methods of non-destructive testing are based on physical phenomena that allow registering primary informative parameters depending on the physical phenomena underlying the methods of non-destructive testing, they are divided into nine main types: **1. Visual, 2. Magnetic 3. Eddy Current, 4. Ultrasonic, 5. Radiation, 6. Thermal 7. Electric. 8. radio Wave 9. Capillary on railway transport**, visual, magnetic, eddy current and ultrasonic types of NC are predominant.

Areas of application of the magnetic type of control in railway transport

- Of the methods of magnetic type of control in railway transport, the most widespread are the following: magnetic Powder (used everywhere); magnetic powder control is subjected to the following objects of rolling stock: parts of shock-traction and braking equipment, bogie frames of various models both assembled and by elements, axles of wheel pairs of all types both assembled and in a free state, disks, comb and spokes of locomotive wheels, etc. Fluxgate method of control – used in railcar and locomotive sector for the control of parts and components of locomotives and wagons. Induction method is used in the road economy is to control the rails.

Brief description of the eddy current type of non-destructive testing

- Eddy-current testing is based on the interaction of the external alternating electromagnetic field generated by the exciting coil, with the field of eddy currents induced in this exciting coil in the tested object. When exposed to an alternating electromagnetic field produced by the magnetizing coil, a controlled metal part eddy currents, which create their own electromagnetic field opposing the external field. The measuring coil. the resulting field is fixed discontinuities of the controlled product increase the electrical resistance of the surface layer of the metal, which leads to a weakening of eddy currents. Information about the presence of a defect is obtained by recording changes in the resulting electromagnetic field in the presence of a defect. Eddy current nondestructive testing is used to detect surface and subsurface defects in conductive materials.

Areas of application of eddy current type of non-destructive testing in railway transport

- On railway transport, the following components are checked by eddy current control : - all-rolled wheels of the wheel pair; - elements of the axle box unit; - elements of bogies of various models and axle bearings; - brake transmission devices, automatic coupling device. Eddy current monitoring is widely used to detect hidden metal and metal-containing objects. The method detects all types of metals and even objects with a very low metal content eddy Current methods have two main limitations -- they are used only for the control of electrically conductive products – they have a small depth of control associated with the peculiarities of penetration of electromagnetic waves into the object of control.

Areas of application of ultrasonic nondestructive testing in railway transport

- Today, ultrasonic methods control more than 40% of devices for which the regulations provide for diagnostics of their technical condition during operation in some cases, ultrasonic control is the only possible technological operation that allows during operation to identify hidden defects in such objects of responsible purpose as rails, welded joints of rails (more than 90% of the provided control), elements of switches – axles and wheels, locomotives, motor-car rolling stock and wagons – - crankshafts of diesel engines and compressors, parts of traction gears of locomotives – - side frames and over-spring beams of bogies of freight cars – - inner rings of bearings – - supports of the contact network and other metal structures.