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CLAMPING FORCE OF INTERMEDIATE FASTENERS AND THEIR DETERMINATION

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ABSTRACT:

The article considers the main type of intermediate rail fastening used on the railways of Uzbekistan. The elastic characteristics of various types of terminals are presented, as well as a developed measuring device that allows you to evaluate the force of pressing the terminals on the sole of the rail under operating conditions.

Keywords: elastic characteristics, bonding, evaluation, clamping force, measurements.

INTRODUCTION:

The most important component of the structure of the upper structure of the track is the intermediate rail fasteners that ensure the attachment of the rail c to the sub-rail base. The main parameter that determines the reliability and operational properties of any type of intermediate rail fasteners is the clamping force of the terminals of the intermediate rail fastener on the sole of the rail.

The main type of intermediate rail fastening for the main and station tracks of JSC "Uzbekistan Railways", including on the sections of high-speed and high-speed train traffic, is the Pandrol Fastclip type of fastening (Fig. 1), which has elastic rod terminals [1].

The stable force of pressing the terminals on the sole of the rails during the long-term operation of the structure of the upper structure of the track guarantees the stability of the jointless track, the absence of theft of the rail threads under the influence of temperature forces, traction forces, braking, etc.

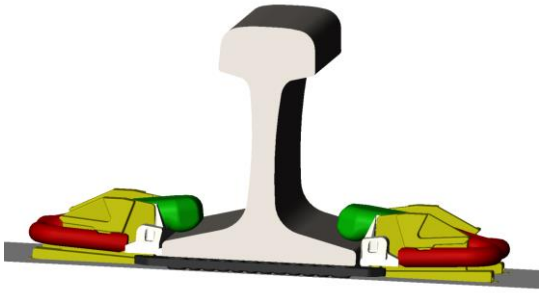

Figure 1. General view of the Pandrol Fastclip type bonding unit.

The elastic characteristics of the terminals of various types of intermediate rail fasteners of the world's leading companies are shown below in Figure 2.

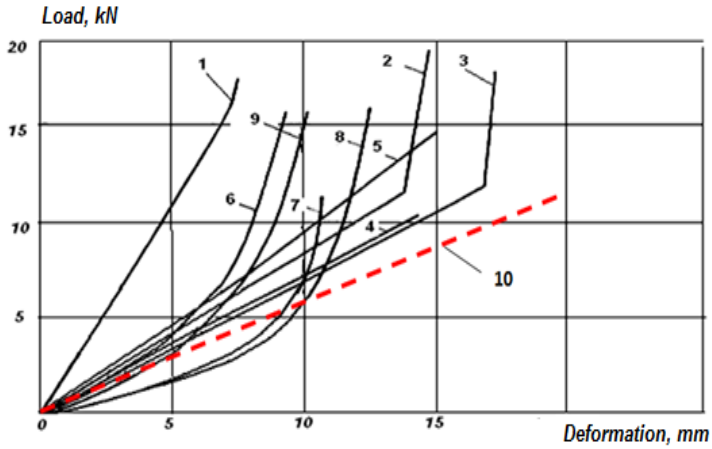

Figure 2. Elastic characteristics of rail fasteners.

1 - type SKL – 2; 2 – type NM; 3 – type WS8; 4 – type "Pandrol" with a bar diameter of 18 mm; 5 – the same with a bar diameter of 20 mm; 6 – type ZHBR and BPU – 65; 7 – type KB with a two – turn washer with a cross section of 8X10 mm; 8 – the same with a three - turn washer; 9-type "Vossloh" with a three-turn

washer; 10-type "Pandrol Fastclip" with a bar diameter 15 mm.

Evaluation of the Actual Pressing Forces of the Terminals:

In determining the value of the clamping force, the intermediate bond ARS-4 is unique in its kind, for which several possible ways of measuring the clamping force are given in the literature [2]. During operation, the clamping force is reduced both due to wear and due to the deformation of individual fastening elements under the influence of static and dynamic loads. To decide whether to adjust the binding, a special device periodically checks the clamping force. This device is a lever, one end of which is connected to the terminal, and the operator applies a load to the other. The intermediate support of the lever is installed on the rail head. The force at the terminal is determined by the deflection of the lever using the indicator. This method measures the load on the terminal with high accuracy (<4 %).

However, it is difficult to fix the moment of separation of the terminal from the rail. Let us consider how the deformation of the terminal changes at the point of its contact with the rail. First, the load through the device increases without deflecting the terminal. When the load becomes equal to the force of pressing the terminal against the rail, an elastic deformation appears in it. This moment characterizes the clamping force. Figure 2 shows the dependence of the terminal deformation on the force applied to it for "separation". Using the reduced dependence δ = f (P) and the permissible elastic deformation of the terminal, equal to 0.1—0.2 mm, it is possible to determine the clamping force of the terminal with sufficient accuracy for practice [5].

It is experimentally established that the elastic characteristics of the terminal within its deformation by 0.1-0.2 mm allow us to estimate the clamping force with an error of no more than 4-7 %. This principle is the basis for the application of the ApATeK IPK-ARS device [3].

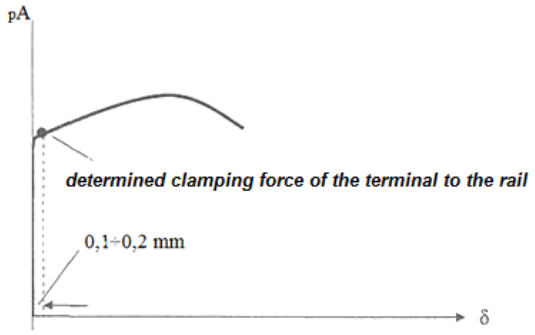

Fig. 2 Dependence of the terminal strain on the force

The importance and relevance of periodic checks of the values of the clamping force of the terminals of the fasteners to the sole of the rail are reflected in the Instructions [4], according to which it is prescribed to measure the clamping force of the terminals every six months. To do this, there must be an IPK-1 device on each area where the ARS - 4 bond is operated. Based on the measurements of the pressing forces of the terminals, mass adjustment of all the fastening units is carried out, which ensures the stability and reliability of the joint-free path.

To assess the actual efforts of pressing the terminals on the sole of the rail in the conditions of the operated track, a special measuring device has been developed (Fig. 3), the production of which is planned to be carried out en masse by the enterprises of JSC "Uzbekistan Railways" for conducting scientific research, as well as for equipping track crews of track distances for periodic monitoring of the condition of intermediate rail fastening units of the Pandrol Fastclip type [6].

The device is designed to measure the force of pressing the terminal of the intermediate rail bond of the Pandrol Fastclip type on the sole of the rail in the operated track.

The principle of operation of the device: measurement of the value of the spring deformation in the device body when the terminal is raised above the rail sole by a value of 0.10-0.15 mm.

Device characteristics:

- Measured pressure force of the terminal on the rail sole: 0-15 kN;
- Price of divisions on the indicator (on the scale): 0.1 kN;
- Measurement accuracy: ≤ 5 %;
- Maximum vertical movement of the terminal base above the rail sole: 10 mm.

The device is a portable screw jack, which is installed in the rail fastening unit above the terminal. With the help of a special device, the terminal is gripped. The terminal is raised above the sole of the rail by means of the screw device of the device. A plate (probe) with a thickness of 0.10 – 0.15 mm is placed under the terminal. The terminal is lowered to full contact with the sole of the rail (through the plate). The plate is attached to the device body via a spring. To measure the pressure of the terminal, the screw mechanism of the device is raised again until the plate located under the terminal is released by the spring. According to the measuring scale of the device, the value of pressing the terminal on the sole of the rail is set (the scale of the device is graded in kN) [6].

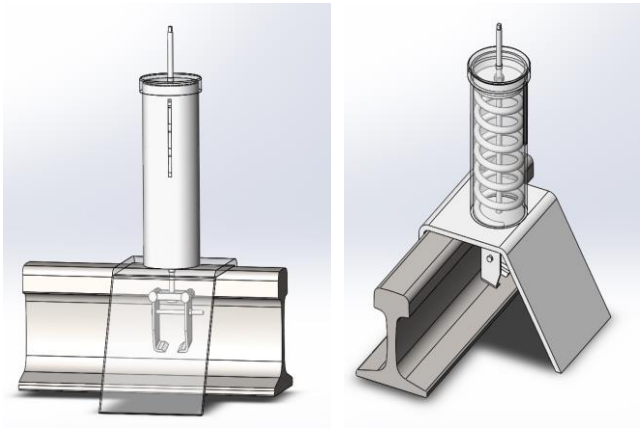

Figure 3. General view of the device.

The device provides the ability to perform calibration and check the accuracy of measurements. At the same time, it is possible to replace the spring in the device body for calibration of the device or in case of loss of spring elasticity. The accuracy of the device and the errors in the measurement process will not exceed 5% of the measured value of pressing the terminals on the sole of the rail.

CONCLUSIONS:

Serial production of devices will provide:

- Conducting a complex of scientific studies to study the operation of the Pandrol Fastclip type intermediate rail fastener in various operating conditions, including on railway sections with a complex plan and profile;
- The possibility of systematic monitoring of the forces of pressing the terminals on the sole of the rail of the operated track;
- The ability to quickly respond to changes in the parameters of the rail fastener during its operation;
- Guaranteed absence of theft of the lashes of the jointless path under the action of longitudinal forces;
- Ability to evaluate changes in terminal pressure during long-term operation of the track structure;
- Justification of the actual service life and replacement time of the intermediate rail fastener parts;
- Rejection of intermediate rail connection terminals that have lost their elastic characteristics;
- Carrying out work on adjusting the force of pressing the terminals when detecting a shortage of pressing the terminals on the sole of the rail;
- Guaranteed stability of the lashes of the non-jointed track of increased length to the length of the block section and the stage.

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