

Assessment of the Condition of Intermediate Rail Fasteners by Diagnostic Tools

Lesov Kuvandik, Halfin Gali-Askar

Tashkent State Transport University, Tashkent, Uzbekistan

ABSTRACT

The article presents the design of the developed diagnostic tool DS-F01 for measuring the pressing force of the Pandrol Fastclip fastening terminal on the rail, as well as a special calibration stand ST-F03 for verification and calibration of the diagnostic tool DS-F01. The developed diagnostic tool is used to predict the reliability of the track structure and improve the safety of train traffic.

KEYWORDS: jointless track, intermediate rail fasteners, clamping force, diagnostic tool, stand

INTRODUCTION

The most progressive and popular design of the upper structure of the track is a jointless track. In the developed countries of the world, in particular in France, Germany, Spain, Japan, China, Russia, great attention is paid to expanding the range of its application and is one of the priority areas for researchers and railway transport workers. However, despite the many indisputable advantages over the link, the jointless path has a feature that limits the polygon of its expansion. This is the occurrence of significant longitudinal forces in the rail lashes when the temperature of the rails changes relative to the fixing temperature. If the clamping force of the intermediate rail fasteners is insufficient, the theft of rail lashes may occur. Its standard value should be at least 10 kN [1, 2, 3]. At smaller values, longitudinal movements of rails can occur under the action of rolling stock, in other words, track hijacking. The hijacking of rails leads to a change in their stress-strain state, which can cause the ejection of the track when the temperature rises and the rupture of joints when it decreases [4, 6-9]. The hijacking of the track leads to the displacement and distortion of sleepers, the loss of under-rail gaskets. Elimination of the consequences of rail theft is associated with the performance of complex and time-consuming work on the adjustment of gaps and discharge of temperature stresses in rail lashes. Therefore, in order to further expand the joint-free track landfill, it is necessary to introduce a set of diagnostic tools that allow monitoring the condition of intermediate rail fasteners, improve train safety, stability of the joint-free track and reduce the cost of its current maintenance [10-15].

THE RELEVANCE OF THE PROBLEM

Scientific research works aimed at the creation and improvement of methods and means of diagnostics and monitoring of the state of intermediate fasteners in a seamless way are carried out in the world. However, diagnostic tools for assessing the technical condition of the terminals of intermediate rail fasteners have not been sufficiently developed.

According to the Decree of the President of the Republic of Uzbekistan dated February 7, 2017 No. UP-4947 Action Strategy for the five priority areas of development of the Republic of Uzbekistan in 2017-2021 and the Decree of the President of the Republic of Uzbekistan No.PP-3422 dated December 2, 2017 "On measures to improve transport infrastructure and diversify foreign trade routes of cargo transportation for 2018-2022", the implementation of projects of transport and communication infrastructure, the development of fundamentally new technologies, the widespread introduction of energy-saving technologies into production. In this regard, special attention is paid to the development of diagnostic tools for assessing the technical condition of the terminals of intermediate rail fasteners, which will not only secure the laid jointless track, but will also extend the service life of the track, and therefore reduce the cost of updating.

THE MAIN PART

Diagnostic tool for measuring the force of pressing the Pandrol Fastclip fastening terminal on the rail of the operated railway track is designed to predict the reliability of the track structure and improve train safety. A patent for an invention was obtained for a diagnostic tool in the Agency for Intellectual Property of the Republic of Uzbekistan [5].

The diagnostic tool DS-F01 consists of a cylindrical housing 1 with a vertical rod with a handle 2 for rotating the rod (Fig. 1). In the lower part of the device there is a special grip 3, which provides the possibility of fixing the end part of the fastening terminal of the Pandrol Fastclip type. The design of the diagnostic tool DS-F01 in the section is shown in Fig.1.

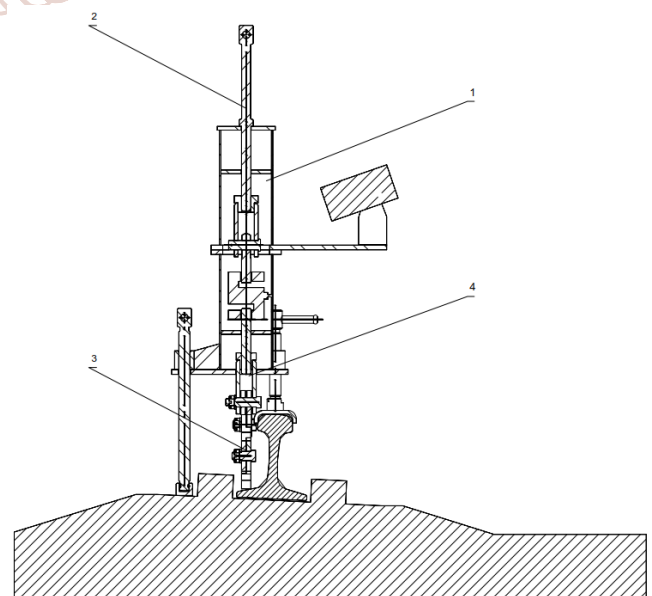


Fig. 1 The design of the diagnostic tool DS-F01 in the section

Fixing of the terminal part of the Pandrol Fastclip type fastening terminal is carried out through a system of levers 4, the drive of which is connected with the rotation of the vertical rod of the diagnostic tool DS-F01.

DS-F01 has three vertical screws 5 for fixing the device on a reinforced concrete sleeper 6 above the fastening terminal 7, the pressing force of which on the sole of the rail needs to be measured. By rotating the screws, it is necessary to ensure the vertical position of the DS-F01 before the measurement begins.

In the lower part of the device there is a console 8 with a spring 9, to which a flat probe 10 with a thickness of 0.1 – 0.2 mm is attached. The design of the DS-F01 diagnostic tool assembly is shown in Fig.2. Inside the cylindrical part of the device there is an S-shaped load cell Zemic H3-C3-2.0t-6B, which is the base of the measuring system of the device. When the vertical rod rotates, it transmits the lifting force of the fastening terminal to the load cell, which generates an electrical signal proportional to the force applied to the load cell.

The electrical signal from the load cell is transmitted via cable to the electronic indicator Zemic HF-12 E, which is located on the console of the device. According to the digital scale of the indicator, the value of the vertical force in kilograms of force applied to the end part of the fastening terminal during the measurement of the pressure force of the terminal on the sole of the rail is displayed.

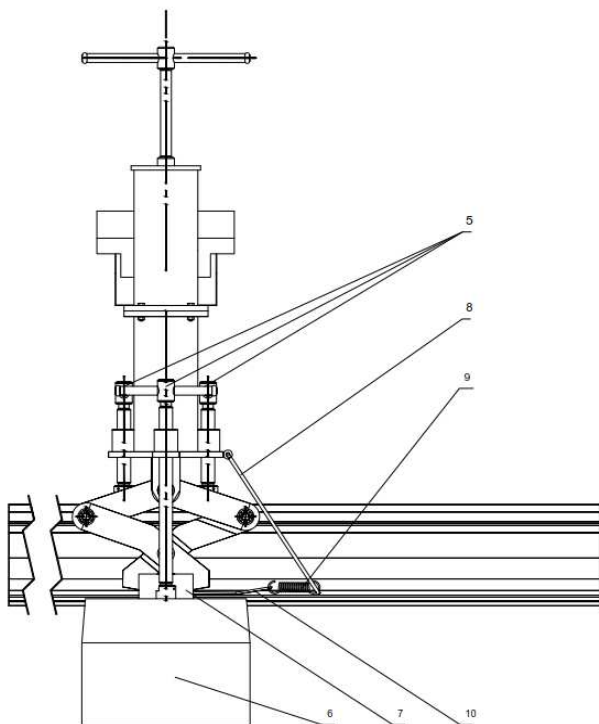


Fig 2 The design of the DS-F01 diagnostic tool assembly

During the verification and calibration of the diagnostic tool DS-F01, a special calibration stand ST-F03 is used. The general view of the stand ST-F03 is shown in Fig. 3.

The measuring base of the stand is formed similarly to the diagnostic tool DS-F01 and includes an S-shaped load cell Zemic H3-C3-2.0t-6B and an electronic indicator Zemic HF-12 E.

The load cell and electronic indicator installed on the calibration stand ST-F03 are reference and undergo

metrological examination in the divisions of the Uzbek Agency for Technical Regulation.

During the verification, an external inspection is carried out and the compliance of the diagnostic tool DS-F01 with the following requirements is established:

- the device must be fully equipped;
- the surfaces of the parts are clean and have no mechanical damage and traces of corrosion;
- the diagnostic tool DS-F01 is fixed on the calibration stand by gripping a part of the stand that simulates the end part of the intermediate fastening terminal and three mounting screws of the device;
- all screws of the DS-F01 diagnostic tool are lubricated and rotate freely;

The indicators of the diagnostic tool DS-F01 and the stand are set to zero values.

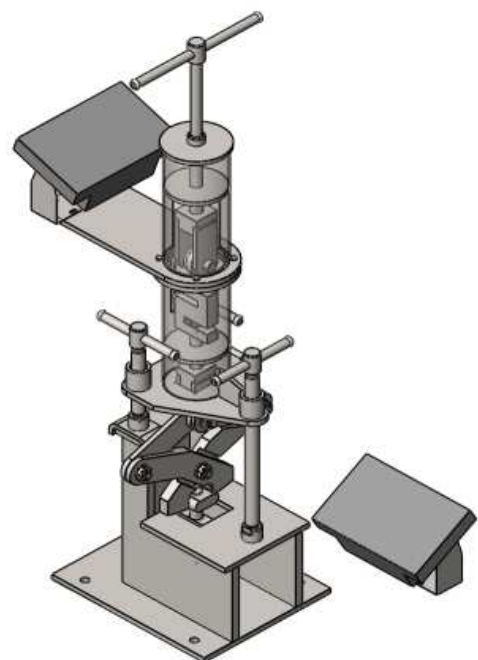


Fig. 3 General view of the CT-F03 calibration stand with the DS-F01 diagnostic tool

CONCLUSIONS

1. For further expansion of the landfill of the most progressive and in-demand design of the upper structure of the track - a joint-free track, it is necessary to introduce a set of diagnostic tools that allow monitoring the condition of intermediate rail fasteners and improve train safety.
2. The purpose and characteristics of the developed diagnostic tool for measuring the pressing force of the Pandrol Fastclip fastening terminal on the rail of the operated railway track are given in order to predict the reliability of the track structure and improve train safety.
3. For verification and calibration of the diagnostic tool DS-F01, a special calibration stand ST-F03 is recommended, indicating the basic requirements for verification.

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