

# Admittance to Exploitation of a Vehicle Equipped with ERTMS System

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The article presents problems of certification of ERTMS units installed on traction vehicles. The devices certification methods in accordance with the European Union law as well as with national law are illustrated. Because certification of ERTMS on the railway vehicle will be conducted for the first time in Poland, the way of performance with a set of documents required for admission the system to operate on the railway network in Poland was proposed.

**Keywords:** certification, ERTMS compatibility assessment, vehicle device, traction vehicle.

## 1. INTRODUCTION

In Poland the problem with certification of a traction vehicle equipped with ERTMS (European Rail Traffic Management System) is a relatively new problem. There is no experience neither from the equipment manufacturer's side nor the notified bodies (NoBo). The Polish National Safety Authority (NSA) – UTK (The Office of Rail Transportation) also does not have any experience in this matter. The additional complication are the requirements from the ordering party of the prototype development of on-board ERTMS equipment (concerns issuing intermediate certificates). The crucial complication is also the fact the traction vehicle equipped with the on-board ERTMS system still has to be operated with the ERTMS equipment disabled (switched off) until the on-board equipment is authorised for placing in service.

The certification process of rail traffic control-command system according to the European Community law is carried out for the first time in Poland. The certification of the traction vehicle equipped with on-board ERTMS has never been conducted. According to EC law both systems (Control Command System [CCS] and Rolling Stock) must obtain appropriate certificates – the overall EC documents state the both systems to be independent. Of course it would be true if there

were no interfaces between the two sub-systems. With the existing interfaces between the two sub-systems (mutual interaction of the sub-systems on each other) the issue is no longer unambiguous and easy to define.

In this article the process of the on-board ERTMS equipment certification procedure will be presented along with the proposal of the necessary documents needed for the certification procedure.

## 2. HOMOLOGATION OF RAIL EQUIPMENT IN POLAND

The following methods of rail equipment certification are in force in Poland (including equipment used for railway control-command and train traffic control):

- the Polish legislation (still in force everywhere the EU legislation is absent) – the effect is the equipment/system type certificate
- the EU legislation (in the scope of detailed regulations are in force – particularly TSIs) – the effects are:
  - certificate of conformity of interoperability constituents (elements/equipment/units for which the EU specifies 100% of requirements including methods of meeting requirements)

- certificate of conformity of sub-system (verification of conformity before authorisation for placing in service).

### 2.1. CERTIFICATION OF EQUIPMENT UNDER THE NATIONAL LEGISLATION

The certification of railway traffic control equipment is proceeded under the following Polish legal acts:

- The Act of 28 March 2003 on rail transport (unified text: Journal of Laws of 2007 No. 16, item 94, with subsequent amendments), in particular Art. 23,
- Regulation of the Minister of Infrastructure of 26 September 2003 on the list of types of buildings and equipment for rail traffic and the types of rail vehicles, which are issued certificates of placing in service (Journal of Laws No. 175, item 1706, with subsequent amendments),
- Regulation of the Minister of Infrastructure of 30 April 2004 on certificates of release to service type of buildings and equipment for railway traffic and the type of unit (Journal of Laws No. 103, item 1090, with subsequent amendments)
- Regulation of the Minister of Infrastructure of 12 October 2005 on the scope of research required to obtain certificates of release to service types of buildings and equipment for rail traffic and the types of railway vehicles (Journal of Laws No. 212, item 1771, with subsequent amendments)
- Regulation of the Minister of Infrastructure of 29 February 2008 on the activities performed by the President of Railway Transport Office, for which fees are collected, and the height of the charges and the mode of their collection (Journal of Laws No. 47, item 276, with subsequent amendments).

In order to receive the operation admission certificate a number of activities must be taken up, mainly one must put forward an application for certification issuing to the President of The Office of Rail Transportation (UTK), which includes test results conducted by an authorised body.

One must also include the technical documentation (in paper and electronic version – i.e. CD-ROM) with the application, including:

- technical conditions of performance and acceptance,
- technical and traffic documentation,

- for train traffic control equipment – safety evidence or verification of such evidence,
- for new types of train traffic control equipment or in case of necessary operation tests – an agreement for operation tests including test programme,
- for types of train traffic control equipment after operation tests – a technical opinion issued by railway IM (Infrastructure Manager),
- opinion from an authorised body,
- technical description and figures (in case the electronic version of the documents includes colour diagrams, figures or photographs the paper documentation must be delivered printed in colour version),
- technical opinions issued by other IMs, RUs (Railway Undertakings) or shunt users – in case of building typed, equipment of rail vehicles already in operation.

All the documents and information must be put forward in the national language – Polish. This record can be sometimes hard to realise – it needs a translation of multi-page documents (i.e. safety evidence or test results) – it seems possible to be submitted by an authorised body of proper overviews (i.e. few sentences or few pages) of the above mentioned documents.

The President of the UTK issues a certificate of placing in service for indefinite time, and in case of new types or the necessity to conduct operating tests for fixed/definite time, anticipated for conducting the tests. The operational tests are conducted according to their programme, developed by the authorised body in agreement with UTK, and i.e. infrastructure owner (or traction vehicle owner – in case of traction vehicle certification) on whose land/ premises/ grounds the tests will be conducted.

### 2.2. CERTIFICATION OF EQUIPMENT UNDER THE EUROPEAN COMMUNITY LEGISLATION

The basic documents establishing the certification process of train traffic control are:

- New approach Directives,
- The Act of 30 August 2002 on conformity assessment system (Journal of Laws of 2002 No. 166, item 1360 with subsequent amendments)
- The Act of 28 March 2003 on rail transport (unified text: Journal of Laws of 2007 No. 16, item 94, with subsequent amendments)

- Regulation of the Minister of Infrastructure of 29 September 2008 on the basic requirements concerning railway interoperability and conformity assessment procedures for the trans-European conventional rail system,
- Regulation of the Minister of Infrastructure of 29 September 2008 on the basic requirements concerning railway interoperability and conformity assessment procedures for the trans-European high speed rail system.

The basic new approach directives used in the equipment certification process are::

- Directive 2004/49/EC of the European Parliament and the Council of 29 April 2004 on safety on the Community's railways and amending Council Directive 95/18/EC on the licensing of railway undertakings and Directive 2001/14/EC on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification (Railway Safety Directive),
- Directive 2008/57/EC of the European Parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community (Recast) (Text with EEA relevance),
- documents relating to the mentioned above Directives:
- Technical Specifications for Interoperability (TSIs) and cited documents within (European technical specifications and Standards)
- New approach Directives: machinery, electromagnetic compatibility, low voltage, safety and others.

The mentioned above documents are necessary to create certificates of conformity of interoperability constituents (elements/equipment/units for which the EU specifies 100% of requirements including methods of meeting requirement) and certificate of conformity of sub-system (verification of conformity before authorisation for placing in use).

### 2.3. *CERTIFICATION PROCESS OF TRAIN TRAFFIC CONTROL EQUIPMENT UNDER THE EUROPEAN COMMUNITY LEGISLATION*

According to European laws (partially transposed to national legislation and therefore the same for national law):

- interoperability constituents must receive EC conformity/compliance declarations, ,
- systems and equipment according to national requirements must receive type admission certificates,
- interoperable sub-system must receive EC declaration of conformity/compliance.

Assessment of compliance – (according to the EU Directive) is an action which the manufacturer is obliged to carry out, which aim is to submit the product, before it is admitted to the market, to the compliance assessment procedure in accordance with the relevant directive (or directives) and application of CE markings (according to the dedicated directive).

The assessment of compliance can be carried out by a third party (notified body) and relates to the design phase, production phase or both of them.

From the date of Poland's accession to the European Union (1<sup>st</sup> May 2004) binding is the EU assessment of compliance system for industrial products.

This system allows a free flow of goods (SPT) (which fulfils the requirements of the EU legislation) on a Homogeneous EU Market.

The certification procedures based on the EC legislation are conducted using suitable modules, described in detail in EC laws.

The certification according to EC legislation can be carried out **only by notified bodies**, which take responsibility for all the tests, even if they do not conduct all of them themselves.

Certification of interoperable sub-systems is carried out in a similar manner to the interoperable constituents certification process. Obviously the certification process according to particular modules can be appropriately adapted to the needs and capabilities of the manufacturer and the user. This is achieved by selecting the appropriate modules.

### 3. ERTMS IN THE CERTIFICATION AND CONFORMITY ASSESSMENT PROCESS

The ERTMS system belongs to the harmonised area in the EC and therefore the following elements are obligatory for certification and placing in service:

- declaration of conformity issued by the manufacturer,
- participation of a Notified Body (NoBo) as a third party next to the manufacturer and user,
- conformity assessment procedures performed by the NoBo or with NoBo participation

The issued conformity assessment document for ERTMS as a structural sub-system is valid

case of manufacturer performing conformity assessment procedure on one's responsibility does not take place.

The ERTMS should possess the following certificates according to European legislation (partially transposed to national legislation and therefore according to national legislation):

- interoperability constituents must have the "EC" Declaration of conformity,
- systems and equipment are in compliance with national requirements and have type admission certificates
- the interoperable sub-system must have the "EC" Declaration of conformity verification

The course of the conformity assessment of the ERTMS structural sub-system, according to the 2008/57/EC Directive requirements is shown in fig.1.

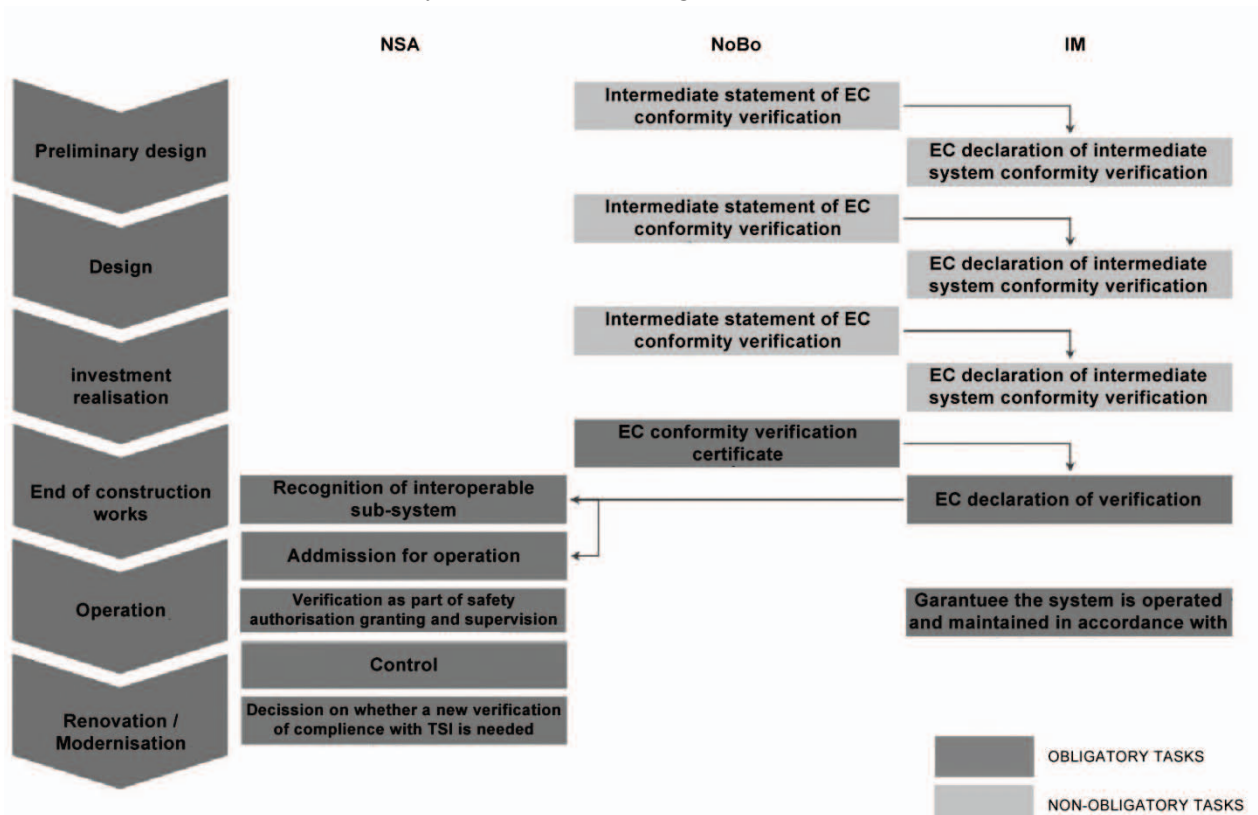


Fig. 1. Certification process Scheme for a structural sub-system

throughout the whole European Union, which is also necessary for domestic trade.

The interoperability constituents must be accepted first (both on-board sets and track-side sets) according to CCS TSI the then ERTMS as a whole infrastructural sub-system is accepted. Because the participation of a NoBo is listed in CCS TSI requirements for the ERTMS certification and placing in service process, the

The ERTMS sub-system conformity assessment must be performed by the NoBo at the stage of:

- design
- development
- final sub-system tests
- before the system is admitted for operation

After a positive subsystem or interoperability constituent conformity assessment with the railway

interoperability basic requirements, the Notified Certification Body issues the manufacturer or its authorised representative or IM, accordingly:

- sub-system conformity certificate
- interoperability constituent conformity certificate

#### 4. PROPOSALS FOR ERTMS/ETCS CERTIFICATION ON TRACTION VEHICLES

On the basis of the above described document analysis one can propose the ERTMS/ETCS on traction vehicles certification method in two following cases:

- entry into service of a traction vehicle with disabled ERTMS/ETCS (switched off)
- certification of ERTMS/ETCS on-board equipment on the traction vehicle (up to obtaining the sub-system certificate)

##### 4.1. ADMISSION FOR OPERATION OF THE TRACTION VEHICLE WITH DISABLED ERTMS/ETCS (SWITCHED OFF)

In this case the following actions must be performed:

- obtaining on-board ERTMS/ETCS equipment certificate on traction vehicle at the design stage,
- obtaining on-board ERTMS/ETCS equipment certificate on traction vehicle at the development stage,
- obtaining NoBo assessment regarding unchanged traction vehicle type in the aspect of ERTMS/ETCS on-board equipment installation, with a particular emphasis on drives with disabled (switched off) equipment,
- agreement with traction vehicle owner (or operator) that the vehicle can be further operated with disabled ERTMS/ETCS on-board equipment (switched off).

The fourth mentioned action may also require a consent with the Office of Rail Transportation (UTK). Such a consent doesn't necessarily lead to the UTK issuing an appropriate authorisation for further drives, it can simply be an agreement for further operation of the vehicle on the basis of previously acquired release for service Certificate.

The procedure must be repeated for each traction vehicle type.

Required documents:

- on-board ERTMS/ETCS equipment certificate on traction vehicle at the design stage,
- on-board ERTMS/ETCS equipment certificate on traction vehicle at the development stage,
- NoBo assessment regarding unchanged traction vehicle type in the aspect of ERTMS/ETCS on-board equipment installation, with a particular emphasis on drives with disabled (switched off) equipment,
- agreement with traction vehicle owner (or operator) that the vehicle can be further operated with disabled ERTMS/ETCS on-board equipment (switched off)
- possible consent of the Office of Rail Transportation (UTK) for further operation of the vehicle on the basis of actual acquired release for service Certificate

##### 4.2. CERTIFICATION OF ON-BOARD ERTMS/ETCS EQUIPMENT ON TRACTION VEHICLE

According to the ERTMS/ETCS equipment certification process described in the previous chapters, the certification should be carried out in two paths:

- Certification according to national legislation,
- Certification according to EC legislation,

###### 4.2.1 Certification according to national legislation

The certification according to national legislation concerns system elements, which are not interoperability constituents. It concerns all interfaces between ERTMS/ETCS system and traction vehicle. This is primarily the on-board ERTMS/ETCS interface – traction vehicle braking system and STM (specific transmission module), unless it is a interoperability constituent.

The following actions are necessary to perform for the above mentioned equipment certification:

- obtain an opinion of the interface from an authorised body
- obtain the UTK term certificate of release to service
- perform operation tests,
- obtain the UTK unlimited certificate of release to service.

The minimum of following documents are required to perform the mentioned above actions:

- interface documentation (manuals, technical requirements of realization and receipt, proof of safety, proof of safety verification, development plan, etc.)
- opinion of the interface from a notified (authorised) body,
- field test framework program,
- agreement (manufacturer [assembler] – NoBo [authorised body] – vehicle user [owner or vehicle operator]) on interface field test framework program execution, agreed with UTK,
- UTK term certificate of release to service,
- field test program,
- report on field tests,
- complements on proof of safety and its verification after field testing,
- final opinion of the interface from a notified (authorised) body,

UTK unlimited certificate of release to service of the interface.

#### 4.2.2 Certification according to the EU legislation

The certificates according to the EU legislation refer to interoperability constituents. It concerns all interoperability constituents installed on the traction vehicle. Primarily: the on-board computer along with software platform, odometer, DMI (interface driver, ETCS/ERTMS equipment installed on the vehicle, STM). According to the community law, the 'control' sub-system on the traction vehicle must also be certified.

The following actions must be performed in order to perform certification of the mentioned above equipment:

- obtain the certificate from the NoBo at the design stage,
- perform field tests after sub-system development/installation on the traction vehicle,
- obtain the certificate from the NoBo at the development stage
- perform field tests,
- obtain the certificate of installed sub-system on the traction vehicle from the NoBo
- obtain the UTK acceptance of release to service

In order to perform the above mentioned actions, the minimum of the following documents are required:

- sub-system documentation (manuals, technical requirements of realization and receipt, proof of safety , proof of safety verification, development plan, etc.)
- certificates of conformity (or Declaration of conformity) for interoperability constituents (for each constituent separately),
- certificate of sub-system conformity at the design stage
- manufacturer's declaration of conformity for the sub-system at the design stage
- sub-system (with interfaces) field test program on a specified vehicle type before putting into supervised operation,
- report on sub-system tests on traction vehicle before putting into operation,
- certificate of sub-system conformity at the development stage
- manufacturer's declaration of conformity for the sub-system installed on a particular type of traction vehicle at the development stage,
- sub-system installed on a particular vehicle type field test program,
- agreement (manufacturer [assembler] – NoBo [authorised body] – vehicle user [owner or vehicle operator]) on sub-system testing and sub-system field testing, agreed with UTK,
- field testing program,
- certificate of conformity for the installed sub-system on a particular vehicle type issued by NoBo,
- manufacturer's declaration of conformity for the sub-system installed on a particular vehicle type
- UTK acceptance for putting into service of the sub-system installed on a particular traction vehicle type.

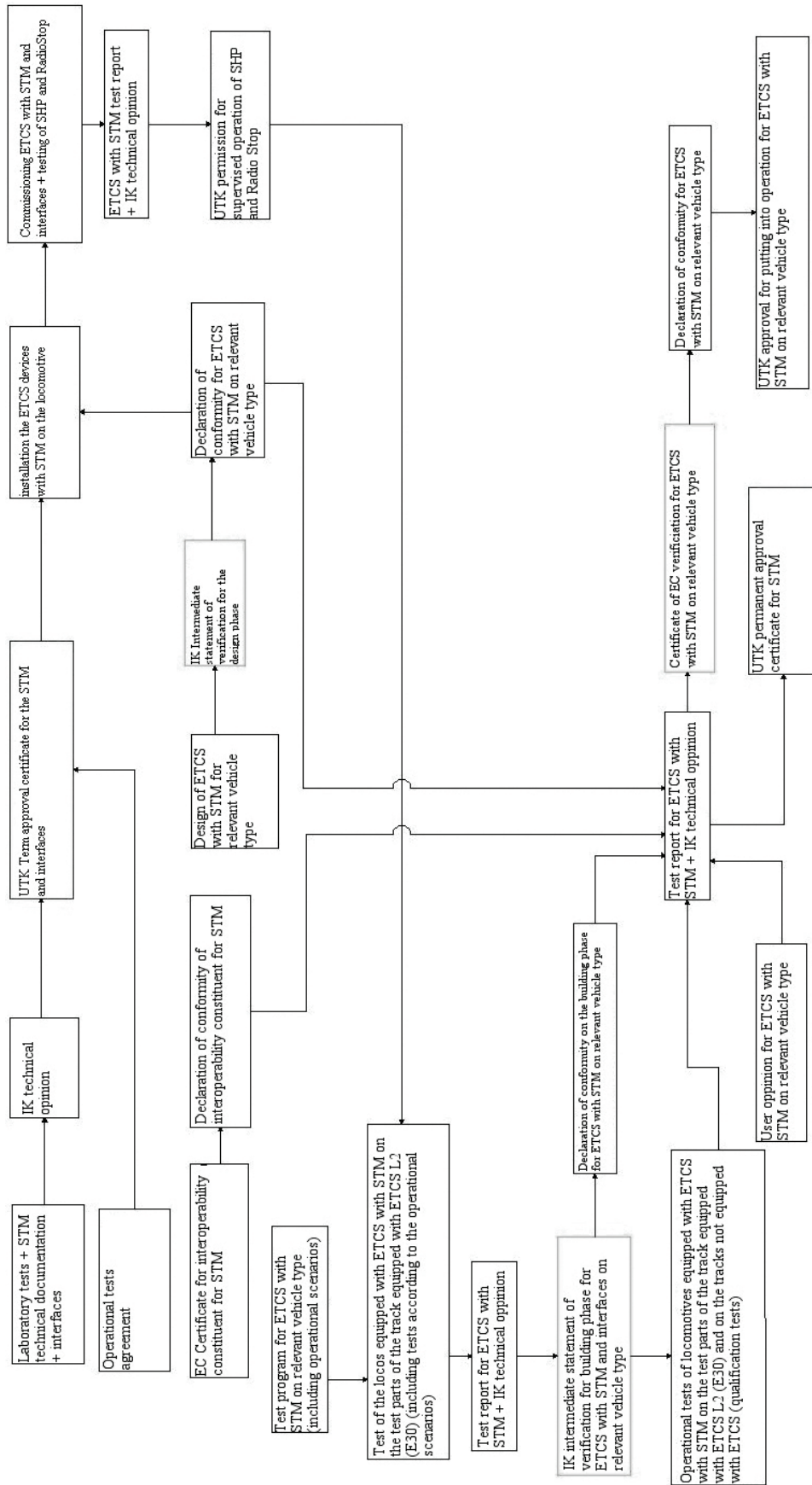


Fig. 2. ERTMS/ETSC on a traction vehicle certification process scheme

The fig. 2 shows the scheme of carrying out the ERTMS/ETCS on a traction vehicle certification process.

#### 4.2.3 Proposals for acceptance of the traction vehicle after installation of ERTMS/ETCS system

The process of acceptance for service of traction vehicle is suggested to be performed in three steps:

- acceptance of traction vehicle for further operation after installing ERTMS/ETCS equipment on traction vehicle (drives with disabled/swathed off equipment),
- acceptance of traction vehicle type for drives of installed on traction vehicle ERTMS/ETCS equipment during field testing,
- acceptance of traction vehicle type for service for field testing.

In order to perform the rest or the necessary actions the following documents are needed:

- agreement on performing tests of ERTMS/ETCS equipment installed on a specific type of traction vehicle (agreed with UTK),
- UTK acceptance for performing tests of ERTMS equipment installed on a specific traction vehicle type,
- verification of manuals and technical requirements of realization and receipt for a particular traction vehicle type, taking onto account vehicle with and without STM (as options),
- NoBo opinion on lack of changes in each vehicle type after installation of ERTMS/ETCS equipment on a particular traction vehicle type,
- delivering (by the traction vehicle certificate of placing into service owner) information on changes in manuals and technical requirements of realization and receipt to UTK,
- acceptance of information by the UTK.

## 5. SUMMARY

The certification process of ERTMS on a traction vehicle is carried out for the first time in Poland. All participants in this process do not have experience in this field, enabling unambiguous definition of the principles of such certification. Proposed in the article principles of such a process

can be tried out during the certification of the first traction vehicle equipped with the ERTMS system.

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