

# Verification of the authenticity of identification numbers

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## Abstract

This article provides basic definitions of terms, such as „VIN number” and „nameplate”. Also described are methods of vehicle identification, methods of revealing non-factory tampering with identification markings. The examples show how to rework identification markings and replace a body part with a VIN number with another body part with a different VIN number in order to legalise vehicles derived from criminal acts.

**Keywords:** identification marking, VIN number, markings disclosure, vehicle, nameplate, number field, automotive components, forensics

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In fighting car crime, one of the key elements is to determine the original vehicle identification number – VIN. The vehicle identification number is assigned and placed in specific areas of the vehicle by the manufacturer. Before 1981, there was no accepted standard defining this number, and manufacturers used different formats for it. The modern VIN number consists of 17 characters – numbers and letters, excluding the letters I, O and Q. In the European Union, the VIN number is assigned according to the ISO-3779 standard, while in North America the format includes an additional check digit, but is compatible with the European one. In Polish legislation, vehicle identification numbers are included in the „Traffic Law” Act. Identification numbers should be understood to mean the identification features listed in the aforementioned law, thus the VIN body number, chassis number, and frame number. Until recently, another identification feature was also the engine number, but on October 21, 2005, the Act of July 29, 2005 amending the Act on Road Transportation and certain other acts came into force (Journal of Laws No. 180, item 1497), which amended, among other things, the requirements of the Act of June 20, 1997 – „Traffic Law”, repealing the provisions on the engine number as an identifying feature of a vehicle.

Police officers investigating a case related to car crime are primarily looking for answers:

- Is there an original VIN number on the car?
- If the VIN number is original, does it identify the vehicle? This is because it happens that criminals insert the original VIN number, but cut out along

with the substrate from another vehicle, which is destroyed, for example, as a result of an accident,

- Can the markings found on automotive components be used to identify the component individually and thus obtain the VIN number of the vehicle in which the component was factory-installed?

Each vehicle is made up of thousands of components, and only some of them are used to identify the vehicle indirectly. The VIN number is a marking permanently affixed to a structural element of vehicles. The structural element on which the marking in question is located must be permanently connected to the rest of the body. Access to the location of the identification marking should be easy and not require the removal of vehicle components. Vehicle manufacturers apply the VIN designation to the body or frame in various places, depending on the make and model of the vehicles. The VIN number can be located in the engine compartment (in the front of the vehicle), passenger compartment or luggage compartment. The place where the VIN marking is applied is described in the approval card – the documentation of the vehicle’s admission to a particular market, such as the European Union. The VIN is a seventeen-character combination assigned by the manufacturer to identify the factory, make, type of vehicle, individual production number. In addition, some manufacturers encode in this number the year of production of the vehicle and the factory where the vehicle was manufactured. In general, the entire code (VIN number) is divided into three sections:

- a) **WMI PART** WMI, or World Manufacturers Identification, stands for the so-called world manufacturer's mark, which is formed by the three characters of the VIN number. WMI codes are assigned by a National Organisation (in Poland by the Industrial Automotive Institute), and registered and verified by an organisation acting under the authority of ISO, such as: S.A.E. Society of Automotive Engineers, Inc. The first character of WMI is the coded designation of the country in which the vehicle was manufactured, e.g., vehicles manufactured in the U.S. first have the digits „1” or „4”, in Canada the digit „2”, in Japan the letter „J” and in France the letter „V”. The second WMI mark identifies a specific vehicle manufacturer (company, concern), such as Audi (A), BMW (B), Ford (F), General Motors (G), Honda (H), Mercedes Benz (D), Nissan (N), Toyota (T), Volvo (V). The third WMI mark identifies the type of vehicle produced, e.g., for Volkswagen, the „WVW” designation is used for passenger cars (Fig. 2.), while „WV2” is appropriate for commercial vehicles. However, if a company produces less than 500 vehicles per year, the third character of the VIN number is always the number „9”.
- b) **VDS PART** The VDS, or Vehicle Description Section, is the second six-character part of the ID number for describing the vehicle. The marks and their sequence and meaning are determined by the manufacturer and should characterize the vehicle design, body type, engine type or other relevant features. There is absolute freedom in this area. Even the same manufacturer often uses different vehicle markings depending on the model, year of manufacture or country of the customer. Relatively clear criteria and consistent labeling are implemented by Mercedes and BMW, for example.
- c) **VIS PART** The VIS, or Vehicle Identification Number, is the so-called vehicle identification section, consisting of eight characters, the last four of which must be numbers. The first character specifies the year of production of the vehicle, encoded by the

digits „0” to „9” and letters from the Latin alphabet excluding letters such as „I”, „O”, „Q”, „U”. The second symbol is the designation of the factory or assembly plant where the vehicle was built. However, there are deviations from the aforementioned designations, as some manufacturers do not include the model year of the vehicle and the assembly plant in the VIN number. The remaining spaces are at the manufacturer's disposal, provided, of course, that it produces at least 500 units per year, otherwise it must put an additional individual manufacturer code in the third, fourth and fifth spaces. More often than not, however, these last six VIN characters represent the vehicle's consecutive production number, which is assigned to a single unit.



Fig. 1. Example of the VIN number identification of a Mercedes vehicle

An additional identification mark is the nameplate. Current laws in Poland require that each vehicle be properly marked. The identifier of each car or machine is, in addition to the VIN number, the nameplate, which contains basic technical data. The absence of a placard will prevent a passing of mandatory technical tests.

Nameplates are made in various shapes (rectangular or square) and can be a sticker, a metal plate, a plate made of plastic. Vehicle manufacturers protect the nameplate from environmental conditions and from attempts at secondary assembly. Various types of protection are used, including: stickers containing pigments in their structure that emit, for example, the manufacturer's logo visible under ultraviolet light, multilayer films, notches that prevent peeling and holograms. Plates made of metals or plastics can be glued or riveted using rivets or disposable mounting pins. The markings found on nameplates are made by various



Figures 2-3. Examples of nameplates the form of metal sheets and stickers

methods: laser engraving, laser printing, screen printing, fixed numbering machines or spot marking machines.

We can divide vehicle examinations into two groups: non-destructive examinations that do not affect the paint finish, and destructive examinations that affect both the paint finish and the metal structure.

Nondestructive testing is an evaluation and selection test. Among other things, magnifying devices, ultraviolet light, permanent magnet defectoscope, paint thickness gauges are used in the course of operations. When conducting these tests, the expert visually and using the above-mentioned equipment evaluates the appearance, the technology of making the marking and the quality of the paint coatings applied to the number field.

Destructive testing – affecting the structure of the paint film and the structure of metals – uses paint strippers and chemical reagents to reveal damaged markings. The removed paint coating reveals the structure of the metal. If inhomogeneous structure, discolouration, metal continuity and deformation of VIN marks are found, recrystallisation tests are undertaken to reveal the removed marks and the method of interference in the number field.

When performing tests, the expert evaluator of identification markings also conducts an evaluation of the connection of the body component, which bears the VIN number and nameplate, to the rest of the body or

frame. The tests are designed to determine whether the VIN component is an integral whole and whether the welded, riveted or glued joints were made during the manufacturing process or body and paint repairs.

**Methods for revealing forged identification markings on metal substrates**

Disclosure of removed and illegible company markings from vehicles and other metal products usually takes place when there is a need to determine the origin of a car or object, or the fact of attempted alteration of original markings on products suspected of being stolen. The most common falsification is of numbers found on cars, weapons, measuring devices and various types of tools. Criminals, in order to make it more difficult to identify a stolen car or object, try to remove all signs that characterize such a car or object, and in doing so usually apply new number markings on the number field. One of the most common methods of removing „VIN“ identification numbers from vehicles is to remove a layer of metal from the surface of the number field to such a depth that the number becomes invisible. The second step, after completely removing or covering up the original markings and preparing the number field, is to apply a new number with different content. Activities to remove identification markings can be carried out by mechanical methods, such as grinding, cutting, caulking, milling, or by thermal methods (heating, surfacing). Markings can also be removed by replacing



Fig. 4-5. Vehicle number field test using a permanent magnet defectoscope



Fig. 6. Destructive testing using the recrystallisation phenomenon

Fig. 7. Destructive testing – removal of paint to assess the connections of the element containing the VIN number to the rest of the bodywork



entire components with identification markings or by covering them with other material. After such treatment, the field is left unmarked and, most often, new marks are applied in its place. This method of removing marks does not cause major changes in the structure of the substrate. The most common methods of removal, falsification of identification markings include:

- rearrangement of some digits or letters into other ones with preservation of graphic fragments of the original writing, e.g. „3” to „8”. The most common methods of altering/falsifying identification markings on motor vehicles include: changing the content of individual digits or letters, punching through individual characters or members, covering up parts of the original marking, changing the order of the characters that make up the identification number, or adding digits or letters at the beginning or end of the number;
- cutting out the entire number field or a portion of it and filling in the cavity by welding another piece with the number of the cut-out car of the same make and model in its place. The pieces that are cut out and then welded in are usually from wrecked or burned vehicles that are no longer repairable;
- taping the marks with a hammer, punch or chisel. This causes significant deformations in the structure of the substrate, which often makes it impossible to reveal the number marking;
- removal of the content of numerical markings by thermal method, which involves heating the metal with a torch or using an electrode to such a state that changes in its structure occur. Thermal changes will cause the so-called blurring of minted marks. The metal undergoes melting in the welding process, resulting in a complete remodeling of the crystal lattice. The welded metal fuses with the metal of the substrate so that it is not possible to detach or separate the weld from the substrate;
- grinding off all the content of the original markings and hot-stamping the field, and then using selected

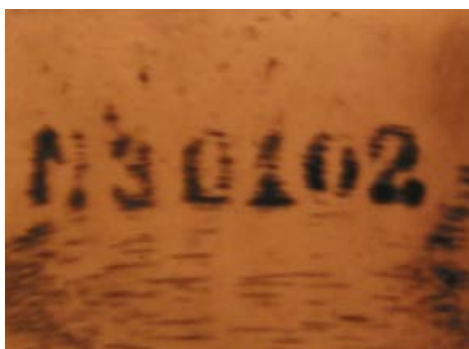
numerical markers similar in shape and size to apply the new number.

The process of revealing marks removed from metal objects takes advantage of the differences in the structure of the places where each mark was applied, compared to the rest of the surface of the number field. Disclosure of removed number markings is possible when they have been applied in such a way that the structure of the metal has been compromised.

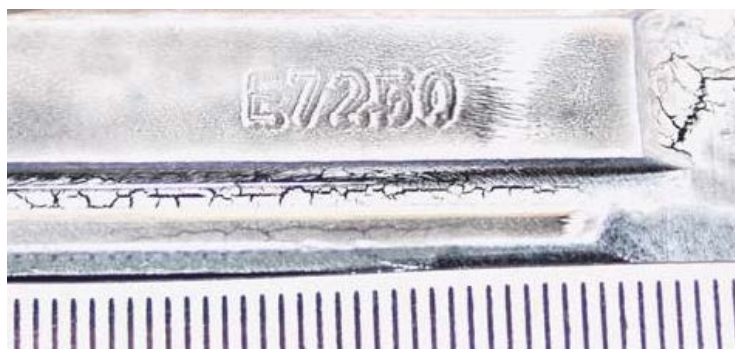
A magnetic (non-destructive) method is used to reveal removed marks on products with ferromagnetic properties (iron, nickel, cobalt and their alloys). Ferromagnetic metals have the ability to magnetize under the influence of a magnetic field, whereby the sites of plastic deformation (sites of removal of numerical markings) have, due to the dissolution of magnetic field lines of force, the ability to attract particles of iron powder. The revealed image of the removed object identification mark is not permanent, so it should be fixed with a camera.

To reveal the removed marks, the most common method is chemical (destructive) - it involves acting on the surface of the metal with appropriate chemical reagents. The areas where the mark was located (there are grains that are crushed, ground or of a different size than in the rest of the substrate) dissolve more quickly. After testing, the surface of the number field with the revealed marking should be protected and cleaned of chemicals, and subjected to corrosion protection.

Among other things, the article presents the markings used by vehicle manufacturers to identify them. With identification, vehicles can be distinguished and assigned to a particular owner. In addition, the study shows the ways of falsification, alteration of identification markings, as well as how to assess their originality and possible disclosure of the method of alteration/counterfeiting of the markings. Knowledge of the issues described will enable us to apply this knowledge, for example, when inspecting or buying a vehicle.



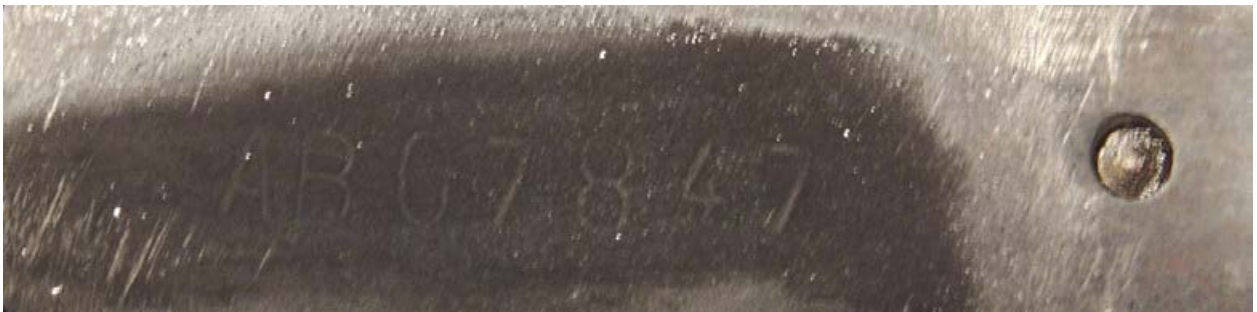
**Fig. 8.** Buss gun structure marking reproduced with a defectoscope



**Fig. 9.** The number was revealed using a defectoscope



**Fig. 10.** Mosin rifle bolt markings reproduced with chemical reagent



**Fig. 11.** Mosin rifle magazine marking reproduced with chemical reagent



**Fig. 12.** Surgical instruments made of stainless steel



**Fig. 13.** Marking of surgical instrument numbers reproduced with chemical reagent