

Restoration of Obliterated Chassis Number of Stolen Truck by Chemical Etching Method: A Case Study

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Abstract

Vehicle and truck robberies are a significant and growing crime in India. Many stolen vehicles are disguised by altering their identification numbers, known as the Vehicle Identification Number (VIN). Criminals often tamper with the VIN by casting a new number, engraving markings, or punching a different number with similar digits. Several forensic techniques have been developed to detect such tampering and restore the original chassis or engine number. This case study presents a classic example of VIN restoration from a stolen truck used for transporting goods. In this investigation, a simple and effective method has been used to recover the original chassis number. First, acetone was applied to clean and remove grease and paint from the target area. Fry's reagent has been successfully applied to the stamped VIN area. Within 30 minutes, the original number began to appear, and complete restoration was achieved in 40 minutes.

KEY WORDS: Vehicle Identification Number(VIN), Obliteration, Restoration, Chassis Number, Fry's reagent.

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I. Introduction

The Vehicle Identification Number (VIN) is a 17 Digit unique number for every vehicle. Identification of the vehicle, tracing, and regulation are carried out using this VIN. This number plays a very crucial role in ownership verification and in law enforcement to find out the vehicle used in a crime [1]. This unique number is encoded with decisive information regarding manufacturer details, Engine details, production details, and is generally located on the dashboard opposite to driver side near the tyre [2]. In many criminal cases, it is observed that the VIN of a vehicle or truck is tampered with or altered to disguise the identity of the vehicle. This obligation can be done by using physical procedures like welding, grinding or punching over the original VIN marking with a forged number on the same location [3]. It is one of the significant challenges for a forensic expert to restore obliterated serial numbers in investigating a case. Stamping or punching the forged VIN over the original number is a commonly used method. The stamped area undergoes plastic deformation, known as cold working. This deformation alters the metal's quality in terms of hardness, ductility, and malleability [4]. In such obligated VIN cases, there are three types of identification marks found on metal surfaces, such as cast marks, stamped or punched marks and engraved marks. However, only engraved or punched marks can be restored by applying chemical methods [5]. Several chemical procedures for restoring the stamped serial number from different metal surfaces have been reported. For the restoration from iron surface, Fry's reagent is used [6], for a copper surface, ferric chloride[7], for a titanium surface, Kroll's reagent is used [8], and for the aluminium and titanium alloys, Keller's reagent is used.[9] Here, we have carried out a successful restoration of VIN by using Fry's reagent, which contain aqueous solution of Cupric Chloride (CuCl₂) and Hydrochloric acid (HCl). Even though this method is destructive, we have used this method with great results by taking photographs in 5 minutes of interval. In this work, we have identified the forged or obligated VIN on the stolen truck by looking at the deformation near the suspected place. Then we have washed with a solvent like acetone, and then the fry's reagent is abraded using cotton for 30 minutes. After 30 minutes, we found that the obliterated serial numbers started disappearing and the original VIN appeared after 40 minutes with good visibility. The main finding of this study is that we have found the original 17-digit VIN, and this can help in case investigation and also, we have got more details about the vehicle owner, area of registration.

II. Case History

A truck loaded with approximately 25 tons of gram Dal was dispatched from Amravati to Bengaluru. The truck driver remained in contact for the first two days, but afterwards his mobile phone was switched off. Suspecting something was wrong, the businessman immediately went to the police station and filed a complaint. Within a few days, the police located the truck in Madhya Pradesh and brought it to the police station for verification. During inspection, the chassis number on the recovered truck was checked, and the police discovered that another truck existed with the same chassis number. Since two vehicles cannot have an identical chassis number, suspicion arose regarding the authenticity of the seized truck. When the second truck was examined, it was found to possess the original documents, which further increased doubt about the seized vehicle. To resolve the issue, the police asked for the assistance from forensic experts of Regional forensic laboratory, Amravati. Through chemical processing, the experts were able to reveal the original chassis number of the seized truck, helping the investigation move forward.

III. Material and Method

3.1. Initial Examination and Cleaning of Surface

As considering restoration of obligated chassis number initially we decided to examine location, position of suspected area. We have found the chassis number located on the dashboard opposite to driver side near the tyre. Surface were cleaned by using clean and Dust free cloth followed by acetone and benzene to remove oils, paints and grease accumulated over working area. A soft-bristled brush was used during this cleaning process. After cleaning chassis number was clearly visible to naked eye and photographed by using a camera.[Fig.1]

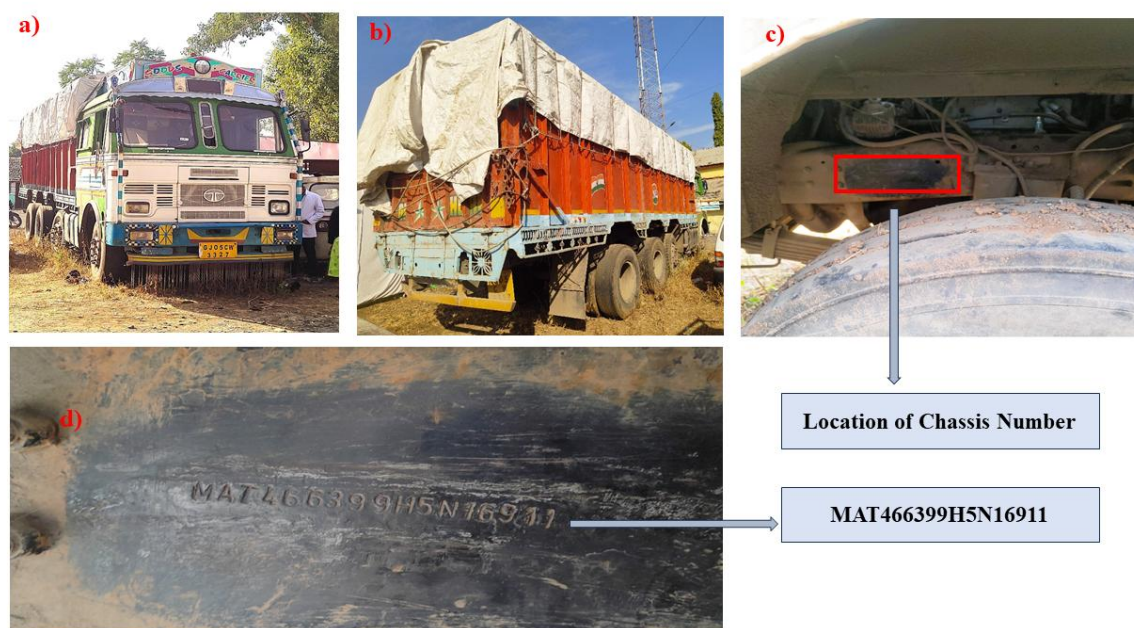


Fig.1. Photographs of a stolen truck showing a) Front View, b) Rear view showing the cargo body covered with a tarpaulin, c) Location of Chassis Number, and d) 16 Digit Chassis number (Obliterated).

IV. Chemicals and Reagents

All reagents used are of analytical grade, Cupric Chloride (CuCl_2) and Hydrochloric Acid was purchased from Loba Chemie. Pvt IND. Ltd.

4.1. Fry's Reagent (Green Variant) Preparation

Cupric Chloride (90 grams) added to Conc. Hydrochloric acid (120 ml) mixed well to dissolve then dilute this mixture with 100 ml Distilled water.

V. Results and Discussion

The chemical etching process successfully restored the original chassis number, obliterated on the seized truck's mild-steel frame. Initial surface cleaning with acetone and polishing revealed deformation pattern on the area where the chassis number located, which indicate the punching over the original stamps, but no digits were

visible. Application of Fry's reagent initiated preferential etching at 5-10 minutes, with ghostly outlines of the original digits appearing due to higher strain hardening from the primary stamping compared to the overlay.

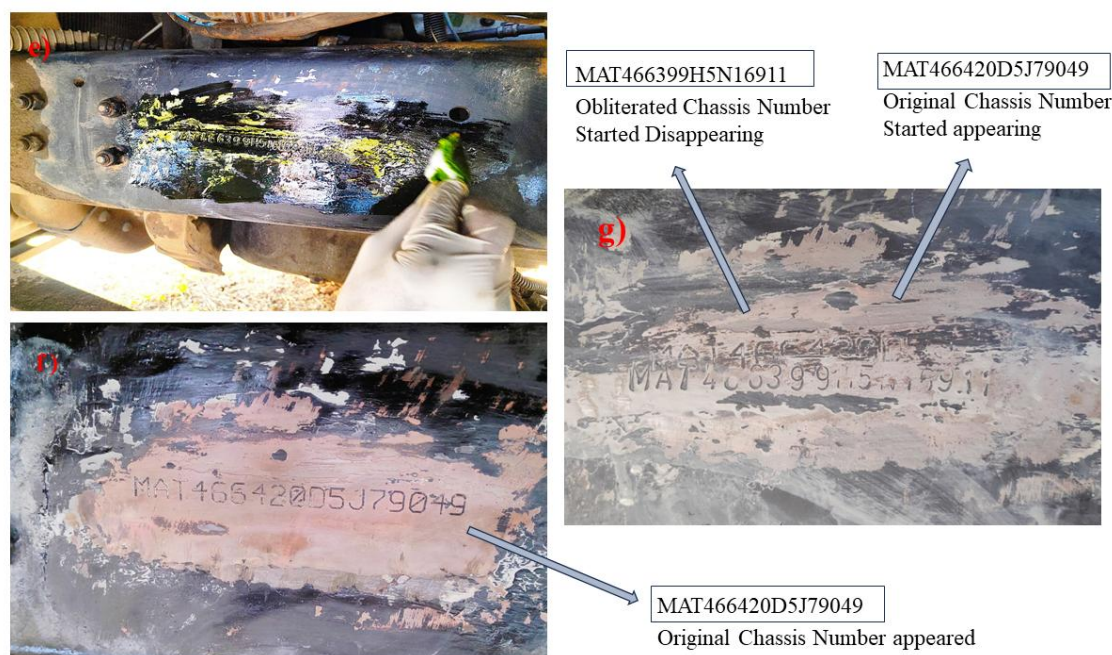


Fig.2. Photographs of restoration of Chassis number e) surface before application of fry's reagent , g) image representing the appearance of original chassis number and at the same time, disappearance of obliterated chassis number f) original chassis number.

By 30 minutes, the forged 17-digit number had largely dissolved, exposing the full 17-digit original VIN. Complete legibility was achieved at 40 minutes, confirmed by high-resolution photography under oblique lighting [Fig.2]. The restored number linked the truck to a legitimate registration in Maharashtra, distinct from the forged one tied to a duplicate vehicle, resolving the duplication anomaly and advancing the theft investigation. This outcome aligns with metallographic principles where cold-worked zones etch faster in $\text{CuCl}_2\text{-HCl}$ solutions, as the deformed lattice increases reactivity. Similar success rates (80-95%) are reported for iron surfaces using Fry's reagent on obliterated marks, outperforming milder etchants on heavily punched sites. The method's simplicity and cost-effectiveness make it ideal for regional forensic labs handling India's rising vehicle thefts. Future enhancements could integrate digital image analysis for automated digit recognition post-etching.

VI. Conclusion:

This case study demonstrates the efficacy of Fry's reagent in restoring an obliterated chassis number on a mild steel truck frame within 40 minutes, revealing the original 17-digit VIN and confirming vehicle tampering in a theft investigation. The method leverages strain-induced metallurgical differences from stamping, offering a simple, low-cost solution for forensic labs combating India's vehicle robbery epidemic. Despite its destructive nature, serial photography ensures evidentiary integrity, with high success on punched ferrous marks.

VII. Conflict of Interest

Authors declares that there is no conflict of interest

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