SAE International™

SURFACE VEHICLE RECOMMENDED PRACTICE

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Tamper Resistance for Adjustable Parameters on Diesel Fuel Injection Pumps

Foreword—Engine exhaust emission standards and test procedures enforced by various regulatory agencies has resulted in in-use emissions testing of certain vehicles or engines. Such testing has revealed that some diesel vehicles failing the smoke opacity test had adjustable parameters tampered with by the owner or an agent of the owner. To avoid non-compliance of an engine's exhaust emissions due to tampering, there have been various regulations developed designed to assure that the adjustable parameters which affect exhaust emissions will remain in-use within the original equipment manufacturer's intended settings.

It has been recognized that the impetus for developing designs that offer adequate tamper-resistance is with the manufacturer of the fuel injection pump (FIP). This SAE Recommended Practice is developed by the standards committee representing the interests of diesel fuel injection equipment (FIE) manufacturers, engine manufacturers, and the FIE service industry. The purpose of this document is to offer some design proposals which can be standardized in the FIE industry, are cost effective, and allow for servicing to be accomplished with a minimum of obstruction. The design proposals contained herein are designed in anticipation of approval by, specifically, the U.S. Environmental Protection Agency and the California Air Resources Board as to their being effective in discouraging tampering attempts and that the listing of applicable adjustable parameters is appropriate.

Described herein are designs which may be proprietary to the manufacturer and protected by patents. Information on the sources of fasteners shown can be obtained from SAE.

1. Scope—This SAE Recommended Practice defines a guideline for the fuel injection pump designer to select appropriate fastener designs which are considered to be tamper-resistant. It applies to fuel injection pumps used on diesel engines.

2. References

2.1 Applicable Publication—The following publication forms a part of this specification to the extent specified herein.

2.1.1 FEDERAL REGULATION—Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

Code of Federal Regulations, 40 CFR 86-090-22e

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3. Definitions

3.1 Tamper-Resistance—The definition of this term is found in 40 CFR 86-090-22e.

4. Applicable Features—The following lists the features of an injection pump which may require tamper-resistance. Excluded from the list is low idle and high idle adjustments. These features are excluded because (a) it is unlikely that an owner would knowingly tamper with these settings beyond that which may be necessary for the normal resettings in use, (b) the changing of these settings from the factory settings do not generally result in significant exhaust emissions non-compliance, and (c) after sale in-use resetting of these features is often required for application adaptability and considered part of normal use.

4.1 Fuel Setting—An adjustment which can alter the fuel setting considered to be the basic setting of the FIP may need to be tamper-resistant.

4.2 Fuel Trimming—An adjustment which alters the fuel curve which results in modifying the engine torque curve may need to be tamper-resistant.

4.3 Advance Setting—An adjustment which can alter the FIP timing device (i.e., speed advance or load advance) may need to be tamper-resistant.

4.4 Aneroid or Aneroid Setting—An adjustment which can alter the FIP aneroid or any mechanism which can alter the aneroid operation may need to be tamper-resistant.

5. Adjustment Type—There are two types of adjustment which can employ tamper-resistant designs. One type is a design in which the adjustable feature is housed under a cover and the cover fastener is the item which is required to be tamper-resistant. The second design is an adjusting screw which is externally accessible. Adjusting screws are often secured from further movement with a lock nut.

5.1 Cover Screw—Cover screws may be considered tamper-resistant by the design of the head configuration. The preferred design is shown in Figure 1. The features of the design make use of a special keyed tool which is available only to authorized servicing facilities and not to the general public. The design shown uses a special design socket shape with a pin protruding from its center. The pin disables the engagement of a commercially available socket key. An alternate design which requires the use of a special socket wrench to be used is shown in Figure 2.

Additionally, an alternate cover screw design employs the use of a breakaway capscrew. This design utilizes an external drive that breaks away at a specified torque, thus preventing the use of wrenches or drivers for removal. Removal of the capscrew requires the use of a drill and screw extractor.

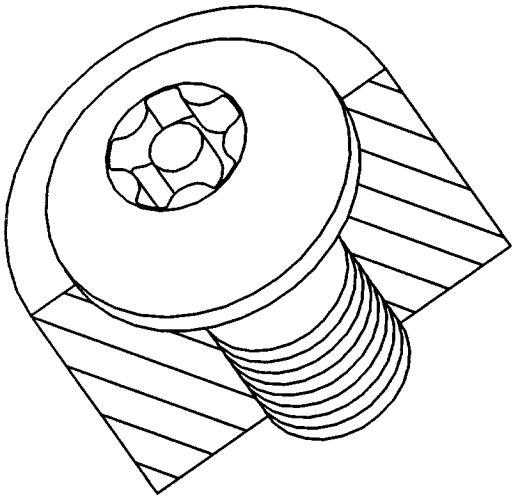

FIGURE 1—KEYED CAPSCREW

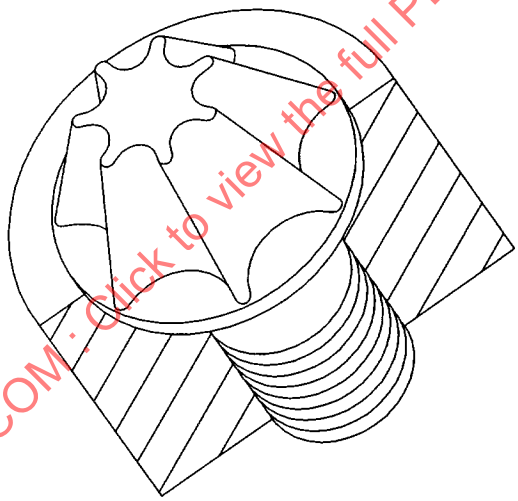

FIGURE 2—SPECIAL SOCKET CAPSCREW

5.2 Cover Screw for Seal Wire—This design, as shown in Figure 3, utilizes a breakaway hex and a ring that prevents the use of standard wrenches. It can further be used by the manufacturer and manufacturer's service representative to place their seal on a tag and wire.

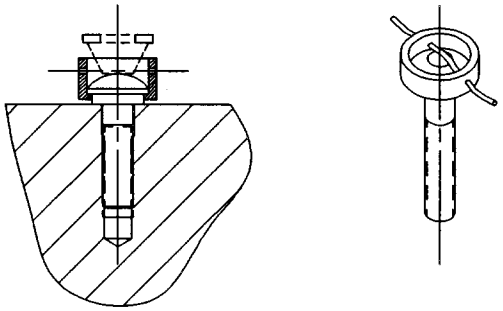

FIGURE 3—BREAKAWAY CAPSCREW

5.3 Adjusting Screw with Lock Nut—An adjusting screw with its lock nut can be made tamper-resistant by one of two designs. The "special nut design" as shown in Figure 4 has the nut recessed in an area such that its outside surface is inaccessible. The nut incorporates a design feature requiring the use of a special tool which is only available to authorized servicing dealers.

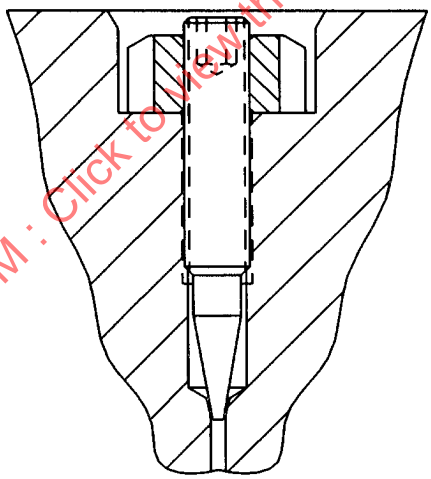

FIGURE 4—SPECIAL NUT AND ADJUSTING SCREW

The “covered access design” also contains the screw and nut in a recess. Access is denied by placing a cover over the adjustment making the recessed area inaccessible as shown in Figure 5.

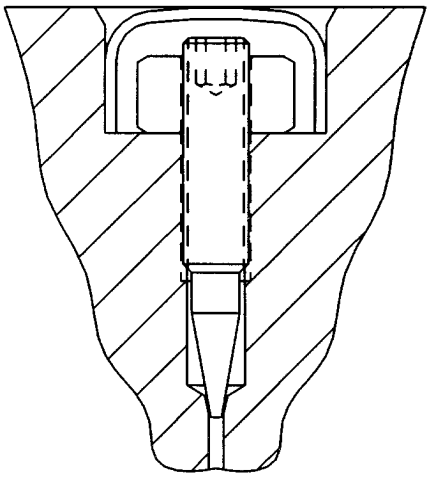

FIGURE 5—COVERED ACCESS

The “covered access design” can be employed on an adjustment which may not be recessed. Access is denied by virtue of the cover design itself. Such designs are shown in Figures 6 and 7.

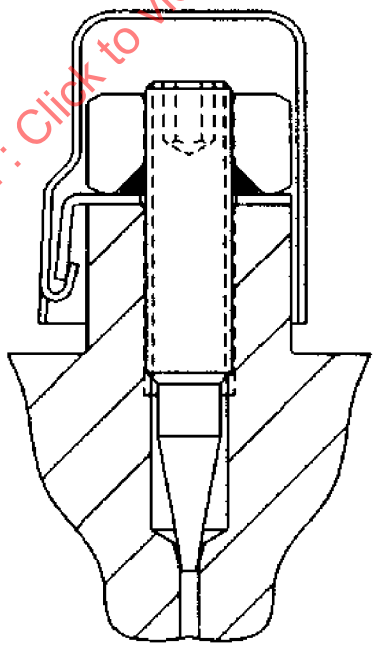

FIGURE 6—IRREVERSIBLE CAP