



BSI Standards Publication

Liquid petroleum products — Investigation on internal diesel injector sticking deposits mechanisms and the impacts of corrosion inhibitors

National foreword

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English Version

**Liquid petroleum products - Investigation on internal diesel
injector sticking deposits mechanisms and the impacts of
corrosion inhibitors**

Flüssige Mineralölerzeugnisse - Untersuchung der
Mechanismen für die Bildung von Ablagerungen in
Dieselinjektionsvorrichtungen und der Auswirkung von
Korrosionsinhibitoren

This Technical Report was approved by CEN on 23 December 2013. It has been drawn up by the Technical Committee CEN/TC 19.

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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

page

Foreword.....	3
1 Scope	4
2 Normative references	4
3 Symbols and abbreviations	4
4 Summary.....	5
5 Description of injector sticking problems.....	5
6 FIEM/OEM experience	6
7 Changes influencing internal injector deposits	7
8 Deposit forming mechanism	7
9 Potential sources of sodium in diesel fuel.....	8
10 Corrosion inhibitors	9
11 Investigations in France.....	9
12 Investigations in Spain.....	12
13 Investigations in Denmark	14
14 Conclusions	15
15 Future work	16
Bibliography.....	17

Foreword

This document (CEN/TR 16680:2014) has been prepared by Technical Committee CEN/TC 19 “Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin”, the secretariat of which is held by NEN.

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1 Scope

This Technical Report describes the investigation into diesel vehicle common rail fuel injector sticking problems in a number of countries across Europe since 2005/2006, carried out by the CEN/TC 19/WG 24/IDID Task Force. It provides conclusions following this work that have been adopted by CEN.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 590, *Automotive fuels - Diesel - Requirements and test methods*

3 Symbols and abbreviations

For the purposes of this document, the following symbols and abbreviations apply.

Abbreviation	Meaning
AGQM	Arbeitsgemeinschaft Qualitätsmanagement Biodiesel
ACEA	Association des Constructeurs Européens d'Automobiles (European Automobile Manufacturers' Association)
BNPe	Bureau de Normalization au service des metiers du Petrole
B7	7 % (V/V) blend of biodiesel (FAME) with diesel fuel meeting the requirements of EN 590
B30	30 % (V/V) blend of biodiesel (FAME) with diesel fuel meeting the requirements of EN 590
CEC	Coordinating European Council
CEN	Comité Européen de Normalization (European Committee for Standardization)
CONCAWE	CONservation of Clean Air and Water in Europe
CRC	Coordinating Research Council
DDSA	Dodecenyls Succinic Acid
EN	European Norm
FAME	Fatty Acid Methyl Ester
FIEM	Fuel Injection Equipment Manufacturer
FTIR	Fourier Transform Infra-Red
HDSA	Hexadecenyl Succinic Acid
ICP-AES	Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP-OES	Inductively Coupled Plasma Optical Emission Spectroscopy
ICP-MS	Inductively Coupled Plasma Mass Spectroscopy
IDID	Internal Diesel Injector Deposits
MIL	Malfunction Indicator Light
Na	Sodium
OEM	Original Equipment Manufacturer
SPMR	Societe du Pipeline Mediterranee Rhone
TRAPIL	Societe Des Transports Petroliers Par Pipeline
UFIP	Union Francaise des Industries Petrolieres

Abbreviation	Meaning
WDXRF	Wavelength-Dispersive X-Ray Fluorescence
WG	Working Group

4 Summary

At the CEN/TC 19/WG 24, Distillate fuels, meeting on 24 May 2011 in Krakow, Poland there were strong technical representations from the Vehicle Manufacturers (ACEA) and Fuel Injection Equipment suppliers describing serious vehicle fuel injector sticking problems in a number of countries across Europe since 2005/2006. The worst affected country was France although sporadic problems had been reported in Denmark, Germany and Spain in recent years.

As a result of these diesel vehicle common rail injector sticking field problems WG 24 recommended and CEN/TC 19 endorsed the formation of an ad hoc task force under the leadership of the WG 24 convenor to urgently investigate the injector sticking issue and provide feedback to WG 24 on a monthly basis.

5 Description of injector sticking problems

Traditional external “coking” deposits form inside and around nozzle fuel flow holes on the outside tip of injector and are caused by combustion heat and gases, interacting with diesel fuel and engine lubricant components. These deposits can affect the fuel spray pattern and volume of fuel delivered to each cylinder.

In the injector sticking case, two new types of internal injector deposits have been reported by vehicle manufacturers and FIE manufacturers, these two new types of internal injector deposits can also be found together (salt crystals inside a polymeric matrix), see Figure 1:

- Carboxylate soaps and salt deposits - typically soft, white/tan crystalline deposit;
- Organic amide deposits - lacquer, polymeric in nature, typically hard, tan/orange/brown deposit.

Deposits form on inner component surfaces of the injector restricting fuel flow by reducing armature lift and affecting injection timing and fuel volume delivery by armature and injector needle sluggishness and sticking (see also Figure 2).

Both Solenoid and Piezo actuated injectors were affected. Smaller component clearances due to increasing injection pressure and highly sophisticated injection profiles required to meet increasingly challenging emission targets make injection technologies more sensitive to IDID formation than previous generations of direct injectors.

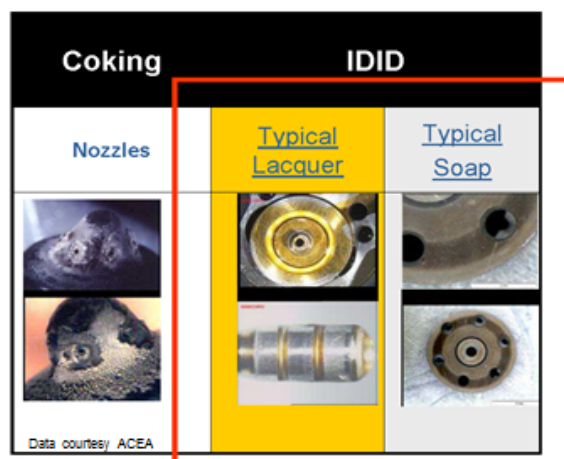


Figure 1 — Types of injector deposits (courtesy PSA)