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**Goriva za motorna vozila - Področja trga dizelskih goriv - Poročilo o raziskavi  
abrazivnih delcev**

Automotive fuels - Diesel fuel market issues - Abrasive particles investigation report

Kraftstoffe - Aspekte des Marktes für Deiseselkraftstoff - Untersuchungsbericht zu  
abrasiven Partikeln

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TECHNICAL REPORT  
RAPPORT TECHNIQUE  
TECHNISCHER BERICHT

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ICS 75.160.20

English Version

Automotive fuels - Diesel fuel market issues - Abrasive  
particles investigation report

Kraftstoffe - Aspekte des Marktes für Deiseselkraftstoff  
- Untersuchungsbericht zu abrasiven Partikeln

This draft Technical Report is submitted to CEN members for Vote. It has been drawn up by the Technical Committee CEN/TC 19.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## European foreword

This document (FprCEN/TR 17548:2020) 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.

This document is currently submitted to the Vote on TR.

This document primarily addresses quality issues that can be associated with abrasive particles in diesel fuel that can cause wear damage to high pressure common rail fuel injection systems.

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## Introduction

At the CEN/TC19/WG 24 meeting on 18 October, 2017 in Zurich, Switzerland there were technical presentations describing serious vehicle fuel injection system wear and damage problems in Northern Germany and the Southeast of the United Kingdom. A CEN task force was formed in January 2018 to investigate these abrasive wear issues in order to establish the root cause and make recommendations.

After a year of investigations of market fuels, refinery product streams and field issues, the task force produced a summary report detailing the findings of the fuel quality investigation and vehicle fuel injection system damage caused by this contamination with respect to the work on European (diesel fuel) standards. CEN/TC 19 requested to have this report published as a CEN/TR, parallel to implementing the advice and recommendations in standardization and the market.

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## 1 Scope

This document describes the investigation into diesel vehicle common rail fuel injection system damage and excessive wear problems in a number of countries across Europe since 2014 carried out by CEN/TC 19/WG 24 Abrasive Particles Task Force.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 590:2013+A1:2017, *Automotive fuels - Diesel - Requirements and test methods*

## 3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

## 4 Symbols and abbreviations

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

ARA	Antwerp Rotterdam Area
CONCAWE	Conservation of Clean Air and Water in Europe
DFA	Downstream Fuels Association
DLC	Diamond Like Carbon
DMV	
DPF	Diesel Particulate Filter
EU	European Union
FAME	Fatty Acid Methyl Ester
FBT	Filter Blocking Tendency
FIE	Fuel Injection Equipment
HD	Heavy Duty
HDEP	Heavy Duty Engine Platform
ICP	Inductive Coupled Plasma
ICP- AES	Inductively coupled plasma-atomic emission spectrometry
ICP-MS	Inductively coupled plasma-mass spectrometry
IPTV	Incidents Per Thousand Vehicles
LD	Light Duty
MDEG	Medium Duty Engine Generation
M+H	Mann and Hummel

**FprCEN/TR 17548:2020 (E)**

MIS	Months In Service
MS	Mass spectrometer
MWV	Mineralölwirtschaftsverband e.V.
NCV	Needle Control Valve
NOK	Not OK
OEM	Original Equipment Manufacturer.
PKW	Passenger Car
PRV	Pressure Regulating Valve
Rail	Fuel Rail
SEM	Scanning Electron Microscope
Van	Light Duty van
UKPIA	UK Petroleum Industry Association

**5 Description of fuel injection equipment problems**

An increasing number of fuel injector warranty claims have been reported by a number of vehicle manufacturers (Daimler, DAF, CNH Industrial, PSA and Volvo) and Fuel injection equipment manufacturers (Bosch and Delphi). Both heavy duty and light duty vehicles are affected with modern high pressure common rail diesel fuel injection systems of various vehicle configurations.

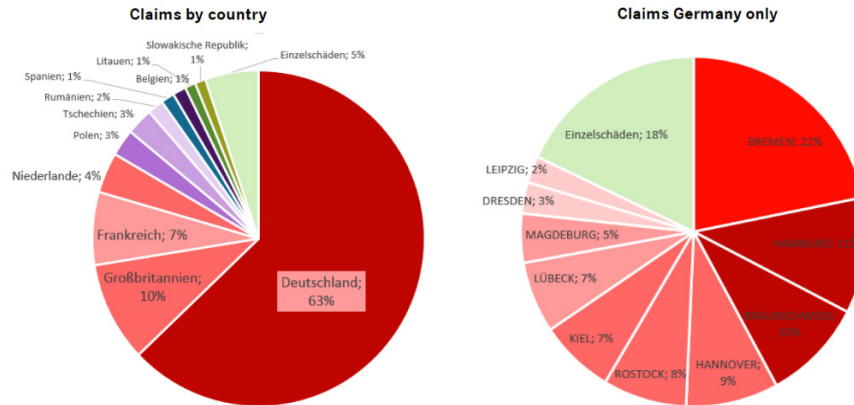
Investigation clearly shows internal damage to fuel injector moving parts, internal valves and pressure relief valves causing internal injector leakage, engine malfunction indicator light illumination, engine power loss, poor idle stability and in some cases complete engine shutdown.

PSA have reported the following vehicle field experience:

- 71 % of cases: on board light and engine power loss
- 21 % of cases: engine shut down during the driving
- 8 % of cases: idle instability
- vehicle minimum mileage: 4,451 km
- vehicle maximum mileage: 130,970 km

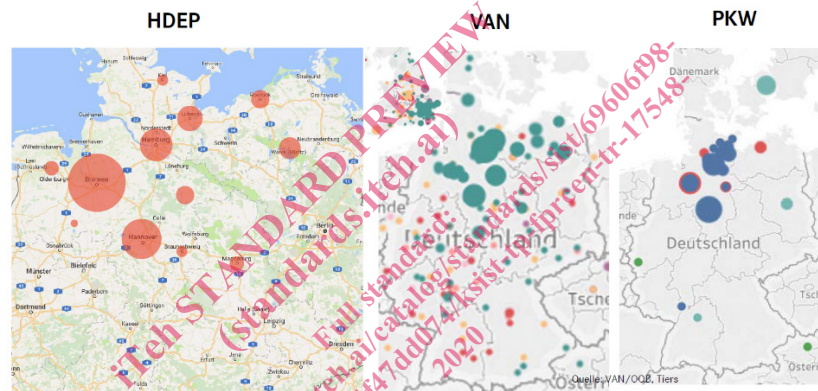
Only certain areas of Europe are affected with the highest numbers of vehicle incidents reported in Northern Germany, the Southeast of the UK followed by Northern France and a small number in Spain. See Figures 1 through 15 for the reports on the incidents. The vehicle manufacturers have reported a small number of failures elsewhere in Europe but these are deemed as isolated incidents. Failures are more common during the winter in the January/March timeframe (see Figure 7 and 10).



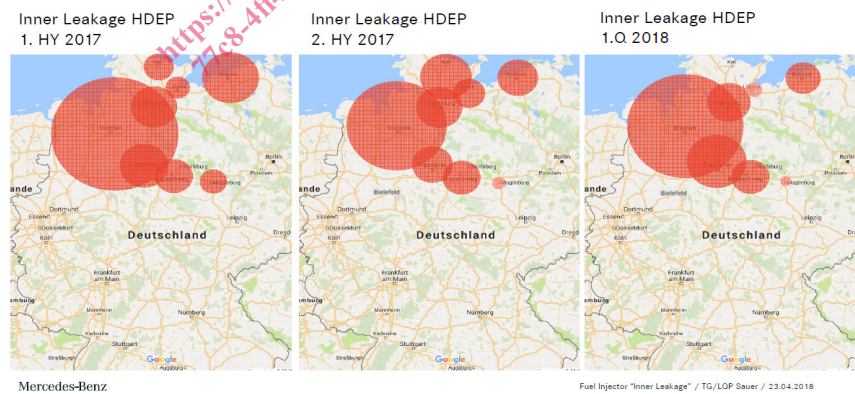


Build year 2016, repair year 2017, status 08/2017

**Figure 1 — Injector complaints inner leakage OM 47x (Courtesy Daimler)**



**Figure 2 — Daimler reported incidents (Courtesy Daimler)**



**Figure 3 — Distribution of injector failures HDEP in Germany (Courtesy Daimler)**

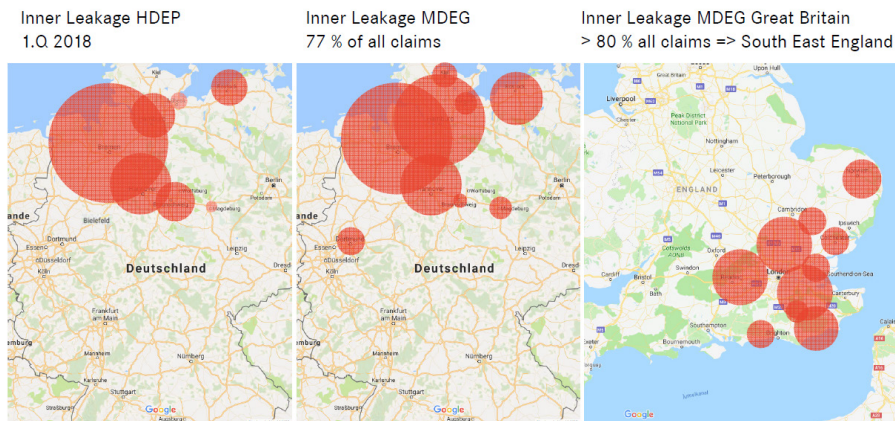


Figure 4 — Distribution of injector failures HDEP/MDEG (Courtesy Daimler)



NOTE The claim rate in the marked areas is 13 times higher than in other parts of Great Britain.

Figure 5 — Injector claims “inner leakage” Great-Britain 2017/2018 (Courtesy Daimler)

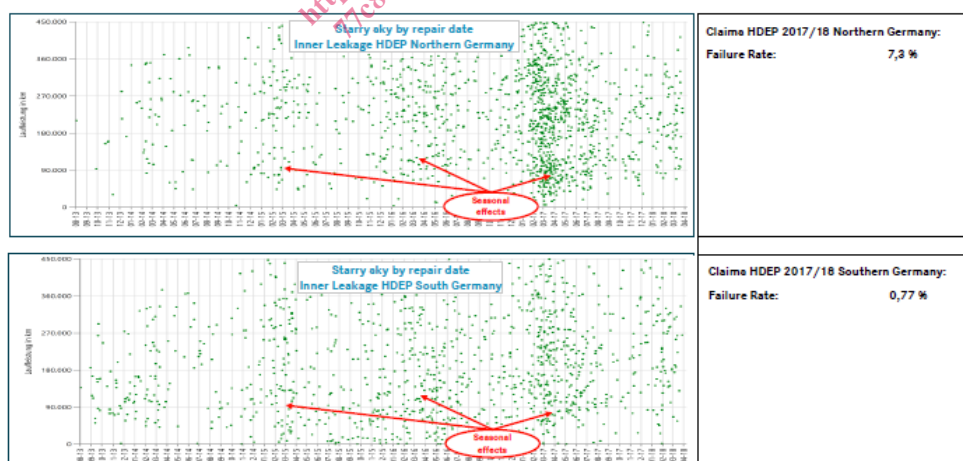
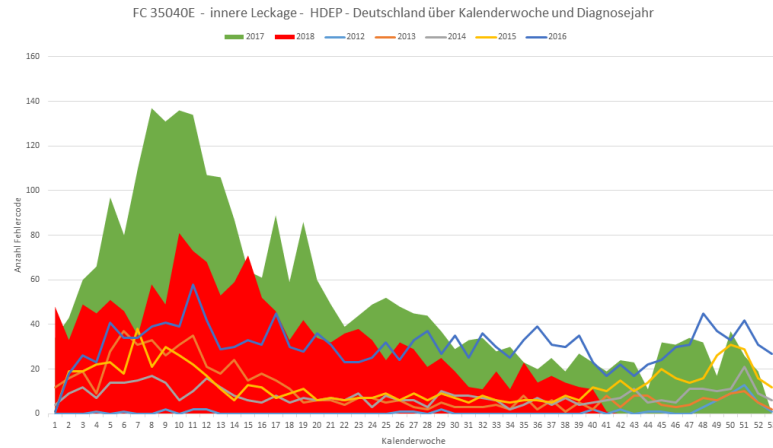
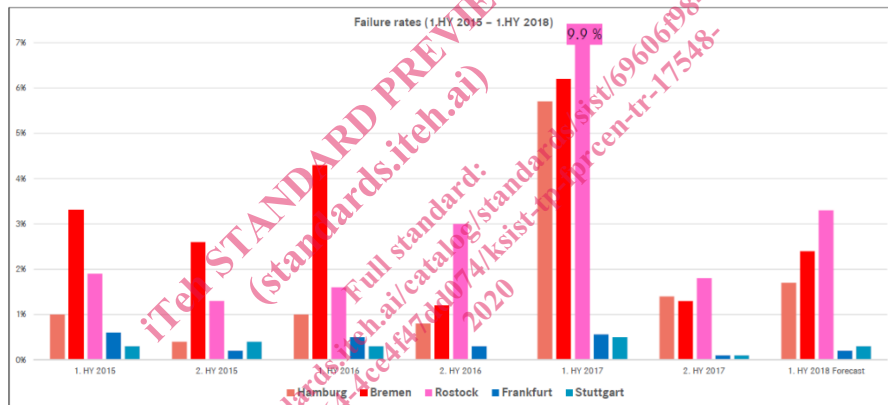


Figure 6 — Fuel injector HDEP “inner leakage” Germany (Courtesy Daimler)



**Figure 7 — Daimler vehicle complaints in Germany (Courtesy Daimler)**

Figure 8 illustrates the difference in injector failure rates between Northern and Southern Germany.



Key

Redish bars Northern Germany

Blueish

Southern Germany

**Figure 8 — Injector failure rates HDEP in Germany (Courtesy Daimler)**

DAF reported incidents are consistent with Daimler reported incidents in both Germany and the UK (Figure 9). It should be noted that 78,7 % of the failures in Germany occurred in Northern Germany. Their yearly trend since the start of the incidents is shown in Figure 11.

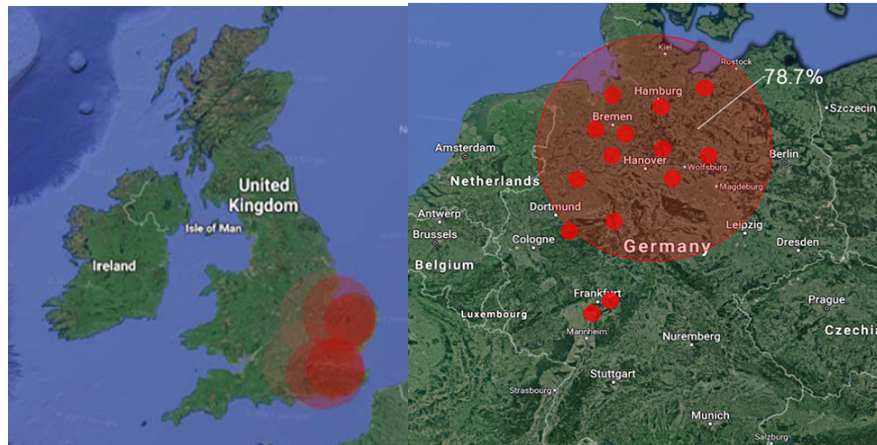


Figure 9 — DAF reported incidents (Courtesy DAF UK)

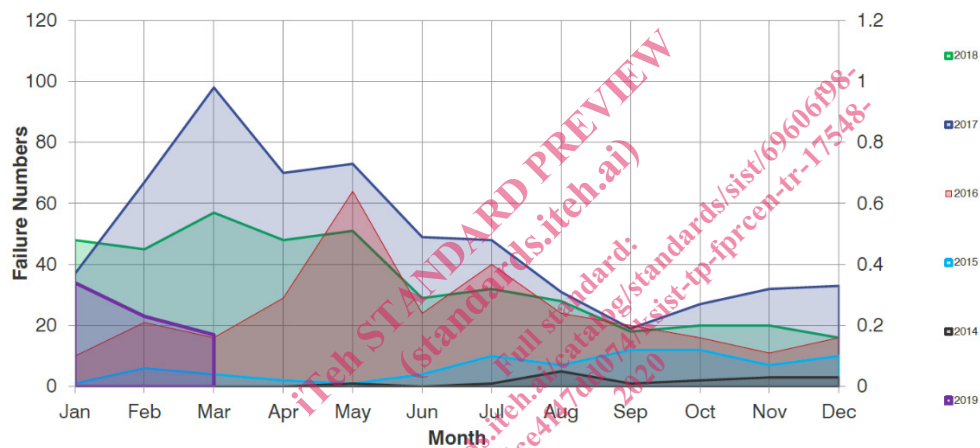


Figure 10 — Year comparison of failures per month for trucks over 16 ton (Courtesy DAF UK)

Figure 11 shows DAF (UK) comparative warranty rates for injectors and highlights the Southeast of the UK area with the highest number of returns. Note that actual numbers are not reported for Figures 11 and 12 due to commercial confidentiality requirements.

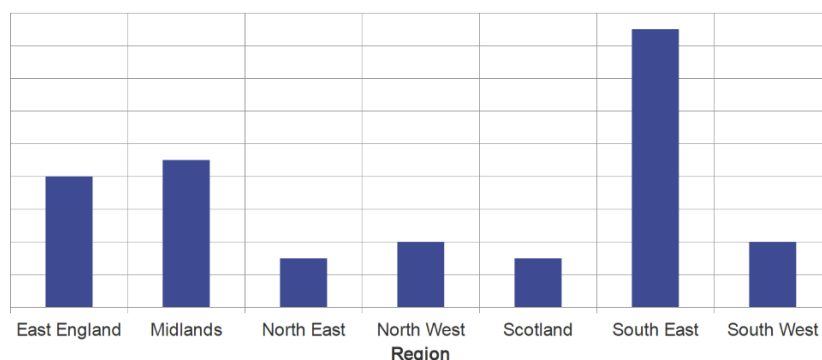
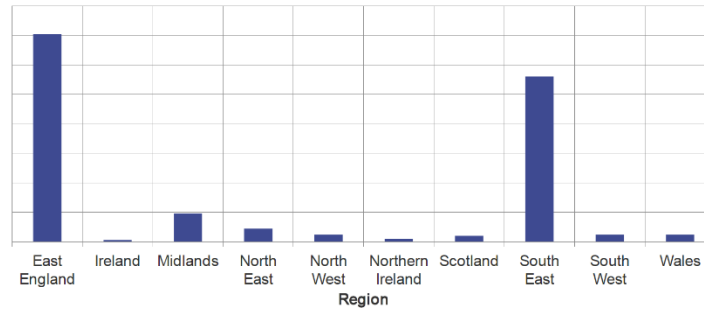


Figure 11 — UK warranty information - Injectors (Courtesy DAF UK)

Figure 12 shows comparative warranty information for the Fuel Rail Pressure Regulating Valve (PRV) and highlights that the highest number of failures are in the Southeast and East of England.





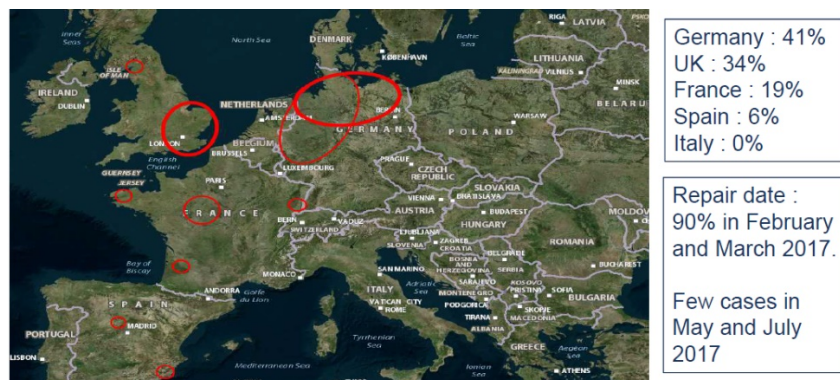
**Figure 12 — UK warranty information – Rail and PRV (Courtesy DAF UK)**

Reported incidents (2014-2017) by CNH Industrial are plotted in Figure 13 and these again are clustered in Northern Germany (at least 25 % of claims are located in that area).



**Figure 13 — CNH Industrial reported incidents (Courtesy CNH Industrial)**

PSA reported incidents (Figure 14) are primarily in Northern Germany and the UK and to a lesser extent in France and Spain, with none in Italy.



**Figure 14 — PSA reported incidents (Courtesy PSA)**

Delphi reported incidents (Figure 15) are clustered in Northern Germany and the Southeast of the UK.