



# **Particle Number Measurement in Switzerland - within the Framework of Periodical Technical Inspection (PTI)**

GRPE, May/June 2022

Federal Office for the Environment FOEN



# From Inspiration to Introduction



Inspired by the laboratory measurements within the framework of the Particle Measurement Programme ([PMP](#)) of the UNECE.

## PN measurement in Switzerland



2013: Requirements for measuring equipment ([SR 941.242](#))

2016: Measurement method and threshold value ([Construction Guideline Air](#))

→ Recognized as part of the exhaust gas maintenance of construction machinery (2016)

→ Mandatory for the exhaust gas maintenance of passenger ships (2016) [SR 747.201.3](#)

→ **NEW:** *PN measurement as part of the exhaust gas follow-up checks by licensing authorities and the police (1.1.2023)*



# DETEC Exhaust Gas Maintenance Ordinance

Ordinance on the Maintenance and Re-inspection of Motor Vehicles concerning Exhaust and Smoke Emissions ([SR 741.437](#))



Supplement with the PN measurement :  
→ see press release of FEDRO from 28.2.2022

- Exhaust gas follow-up checks by licensing authorities and the police
- For all **diesel vehicles with mandatory diesel particulate filter** (explanation see next slide) (cars, vans, trucks, buses, NRMM)
- Measuring equipment according to METAS requirements ([SR 941.242](#))  
Threshold value : 250'000 particles/cm<sup>3</sup>  
Simplified procedure: 100'000 particles/cm<sup>3</sup>

per 1.1.2023



# Diesel Vehicles with Mandatory Diesel Particulate Filter

	PN limit value in exhaust gas regulation (first registration): Emission code on vehicle registration document	Other:
Passenger cars	from Euro 5b (2013): B5b	Special classification as of Euro VI (2014): A08
Vans	from Euro 5b (2013): B5b	Special classification as of Euro VI (2014): A08
Trucks	from Euro VI (2014): E06	Special classification as of Euro 5b (2013): A16 – A19 and A28 until A37
Buses	from Euro VI (2014): E06	Special classification as of Euro 5b (2013): A16 – A19 and A28 until A37  Entry 924 (DPF retrofitted or OEM, e.g. due to action plan fine dust 2008, refund of mineral oil tax)
Trucks and vans, buses, cars, motorbikes (45km/h, 12t GVW) Work vehicles Tractors and motor carts Motorised sledges, single-axle vehicles and hand trucks > 19 kW (NRMM regulation)	from stage V (2019/2020): A50, A51, A52, A53, D05, F05	Entry 924 (DPF retrofitted or OEM, e.g. due to Swiss Ordinance on Air Pollution Control 2009)



# Measurement Procedure, Implementation

## *Measurement procedure:*

Total 40s (carried out by the instrument itself: 15 s waiting time, 3 x 5 s measurement, 2 x 5 s pause in between)



## *Vehicle:*

Engine running, stationary vehicle, operating temperature

## *Official measurement:*

Vehicles of categories M and N:

2'000 revolutions/min

Threshold value: 250'000 particles/cm<sup>3</sup>

All others (e.g. NRMM):

High idle

Threshold value: 250'000 particles/cm<sup>3</sup>

## *Simplified procedure:*

Low idle

Threshold value: 100'000 particles/cm<sup>3</sup> (only pass criteria)



# Metrological Requirements

## *Measuring range:*

between  $5 \times 10^4 \text{ cm}^{-3}$  and  $5 \times 10^6 \text{ cm}^{-3}$

## *Nominal operating conditions:*

- Range for ambient pressure from 860 hPa to 1060 hPa;
- Mechanical environment class M2;
- Electromagnetic environment class E2.

## *Error limits:*

<u>Geometric mean mobility diameter</u>	<u>Limits of efficiency <math>E</math></u>
23 nm nanoparticles	$E < 50 \%$
41 nm nanoparticles	$E > 40 \%$
80 nm nanoparticles	$70 \% < E < 130 \%$
200 nm nanoparticles	$E < 300 \%$
30 nm droplets of tetracontane (number concentration up to $10^5 \text{ cm}^{-3}$ )	$E < 5 \%$



# PN Measuring Instruments, METAS-approved



- 2016



[NPET](#) from TSI

- 2020



[HEPaC](#) from FHNW

- 2021



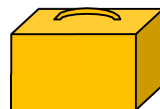
[CAP3070](#) from Capelec

- 2022



[DiTest Counter](#) from AVL

Status as of 20.5.2022



[List of approved instruments \(metas.ch\)](#)

In the form field «Geräteart», please choose «Partikelmessgeräte»





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