

# Introductory Remarks:



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MARYANNE KAMAU advises governments, private entities and trade associations on international trade matters, with a particular focus on the World Trade Organization (WTO) and European trade law and policy. In addition, Maryanne focuses on trade issues relating to the digital economy. Most recently, Maryanne has been advising clients on various aspects of the legal and policy implications of Brexit and on the European Green Deal.

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# Speakers:



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BARTOSZ MROZEK is a Type Approval Engineer within TÜV Rheinland AG working in the field of cars, trucks and buses. Together with his colleagues, he helps his clients to better understand the requirements and procedures to obtain type approvals for the European market. He is focused on whole vehicle type approvals, emissions-related requirements for on-road light and heavy-duty vehicles and vehicle dynamics.



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DAVE GARRETT is an independent consultant and has been helping clients to better understand and successfully manage vehicle and mobile source emission and fuel economy regulations, certification, and compliance issues since 2016. His consulting business is built on his 32-year career at General Motors which included a series of technical and leadership positions, all of which were related to emission regulations and engine-emission control systems. A capstone of Dave's career at GM was to establish and lead a comprehensive, global governance program to guide compliance with all applicable emissions, diagnostics, and fuel economy regulations in all markets around the world.

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# Emissions Compliance in the EU: Understanding the Fundamentals

Information Event on European Type Approval Systematic,  
Emissions and Fuel Consumption of Light- and Heavy-Duty  
Vehicle within the EU  
(high-level overview)

Bartosz Mrozek, Type Approval Engineer / Auditor ISO 9001

2021-02-04

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# Emissions Compliance in the EU: Understanding the Fundamentals

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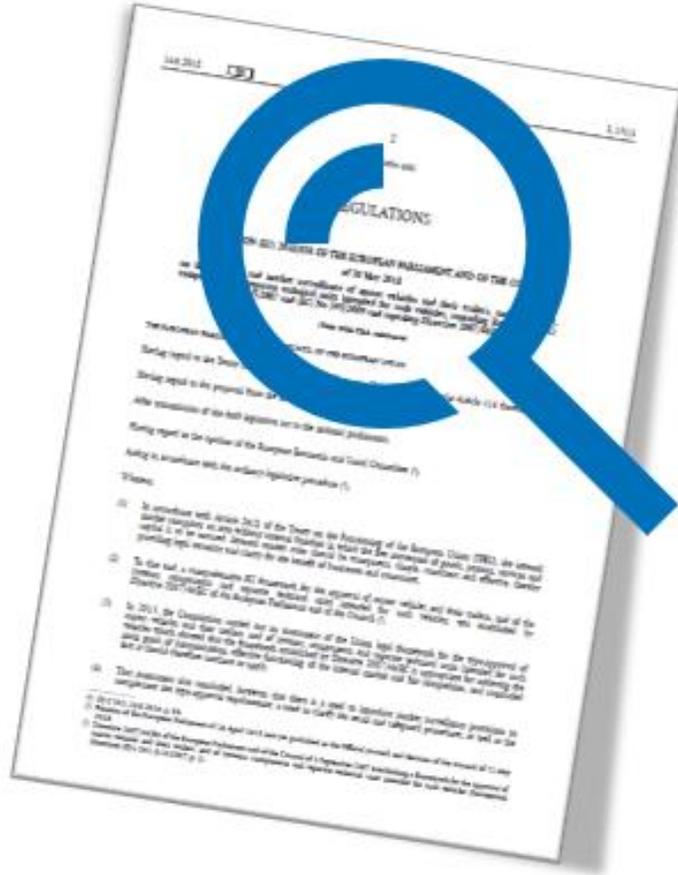
#### II. Emissions of Light Passenger and Commercial Vehicles

#### III. Emissions of Heavy Duty Vehicles

#### IV. CO<sub>2</sub> Emissions and Fuel Consumption of Heavy Duty Vehicles

# I. European Type Approval Systematic

## Guiding Questions



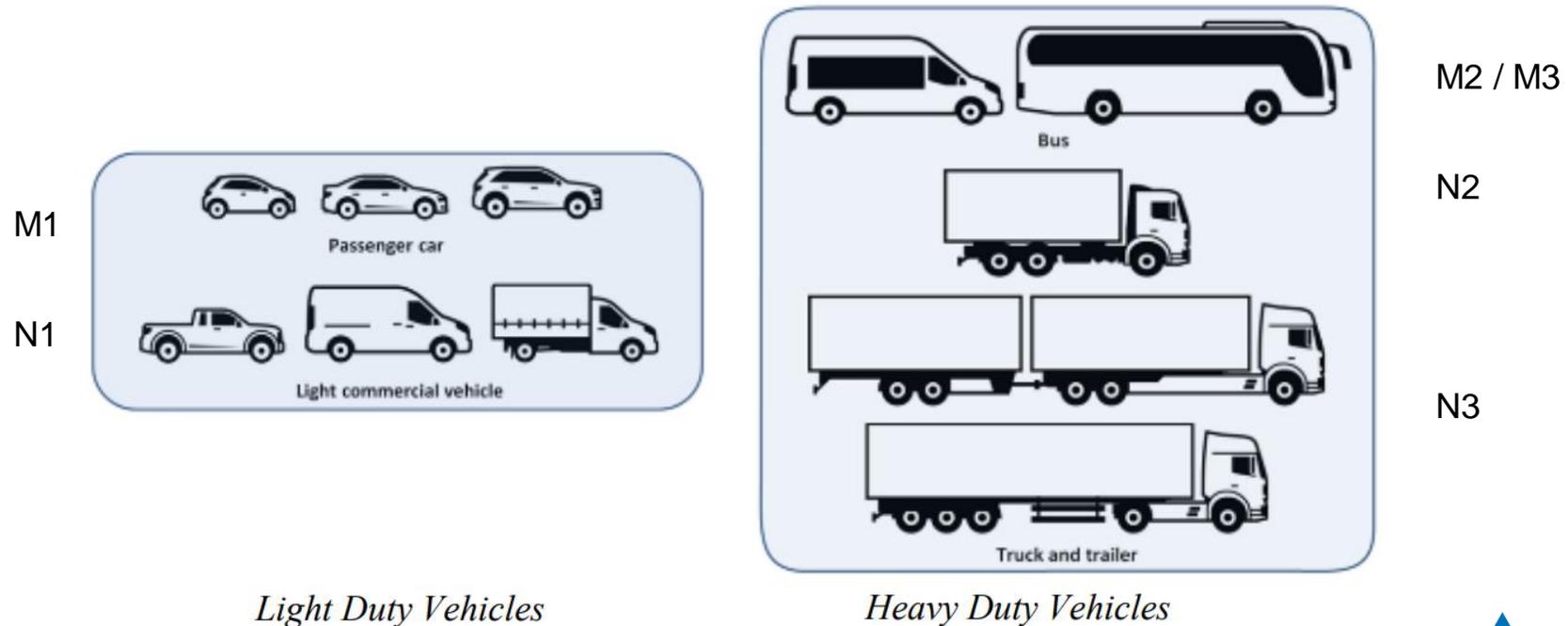
- a. How to get an approval according to the new framework regulation?
- b. What is the information folder?
- c. Who are the actors and participants involved in the process of getting an approval?
- d. What kinds of approval do exist?
- e. Which kind of legal requirement are part of the framework regulation?
- f. What are Conformity of Production arrangements?
- g. What are the obligations for approved vehicles which are not in conformity or that present a serious risk?
- h. What is Market surveillance in the EU?
- i. What is the compliance verification by the EU-Commission?
- j. Are there penalties in the EU?

# I. European Type Approval Systematic

## General Information on the Framework Regulation

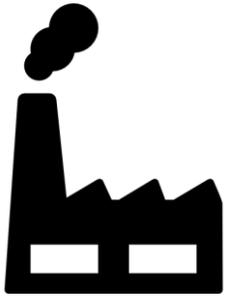
What are we able to get approved within the requirements of the Regulation (EU) 2018/858?

- Motor vehicles (category M1, M2, M3, N1, N2, N3)
- Trailers (O1, O2, O3, O4)
- Systems, components and separate technical units intended for such vehicles



# I. European Type Approval Systematic

General Information on the Framework Regulation - What is the Regulation (EU) 2018/858 about?



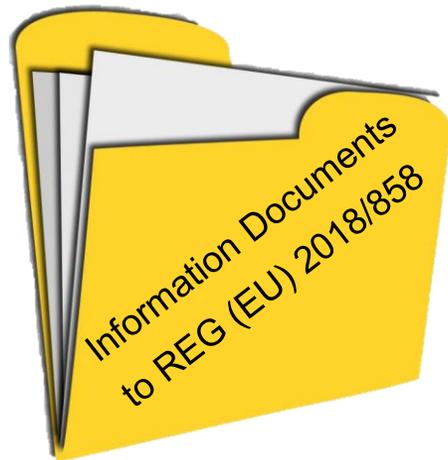
Manufacturer



Technical Service



Type Approval Authority / Market Surveillance Authority

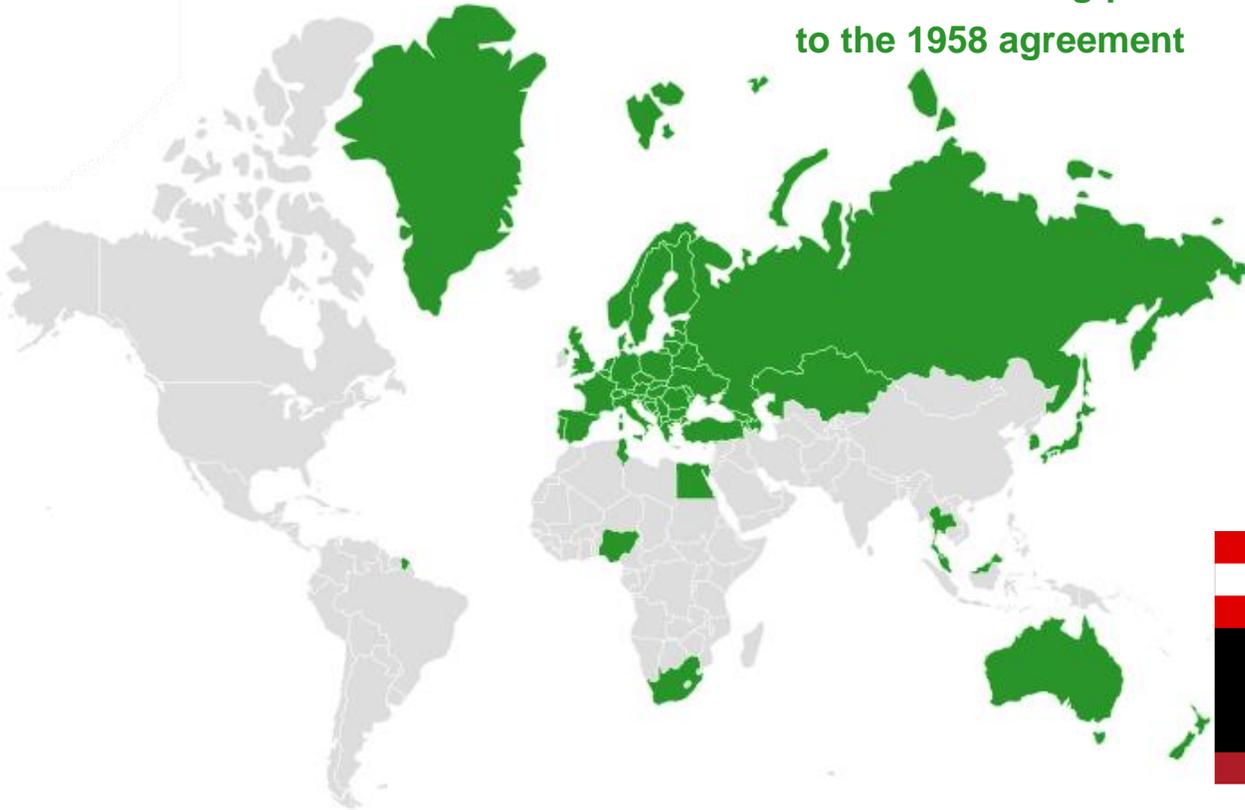


Item	Subject	Regulatory act reference	Applicability										STU or component	
			M <sub>1</sub>	M <sub>2</sub>	M <sub>3</sub>	N <sub>1</sub>	N <sub>2</sub>	N <sub>3</sub>	O <sub>1</sub>	O <sub>2</sub>	O <sub>3</sub>	O <sub>4</sub>		
1A	Sound level	Regulation (EU) No 540/2014 of the European Parliament and of the Council (*)	X	X	X	X	X	X						X
2A	Emissions (Euro 5 and Euro 6) light duty vehicles/access to information	Regulation (EC) No 715/2007	X <sup>(1)</sup>	X <sup>(1)</sup>		X <sup>(1)</sup>	X <sup>(1)</sup>							X
3A	Prevention of fire risks (liquid fuel tanks)	Regulation (EC) No 661/2009 UN Regulation No 34	X	X	X	X	X	X	X	X	X	X	X	
3B	Rear underrun protective devices (RUPDs) and their installation; rear underrun protection (RUP)	Regulation (EC) No 661/2009 UN Regulation No 58	X	X	X	X	X	X	X	X	X	X	X	X

# I. European Type Approval Systematic

Which kinds of legal requirement are part of the framework regulation?

UNECE contracting parties  
to the 1958 agreement



# I. European Type Approval Systematic

The European (EU) type approval systematic allows different kinds of approvals based on European or national requirements:

- EU Whole Vehicle Type Approval (WVTA) in different approaches like single-step, step-by-step or mixed type approval, and multi-stage approval for incomplete or completed vehicles
- EU type-approval of vehicles produced in small series
- EU individual vehicle approvals
- National type-approval of vehicles produced in small series
- National individual vehicle approvals

e24\*2018/858\*00004\*02

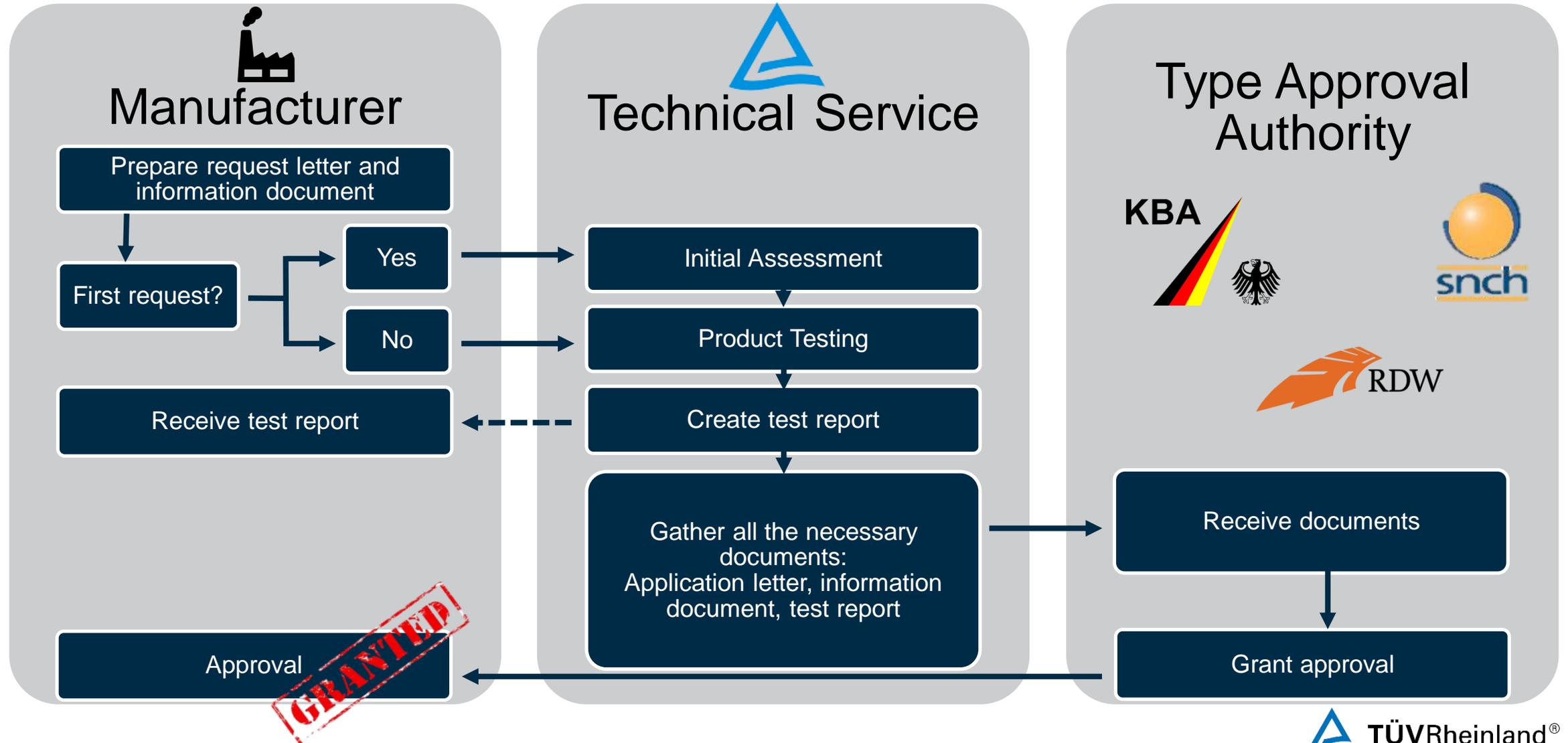
e12\*IV18/858\*ST0001

e12\*NIV18/858\*W00001

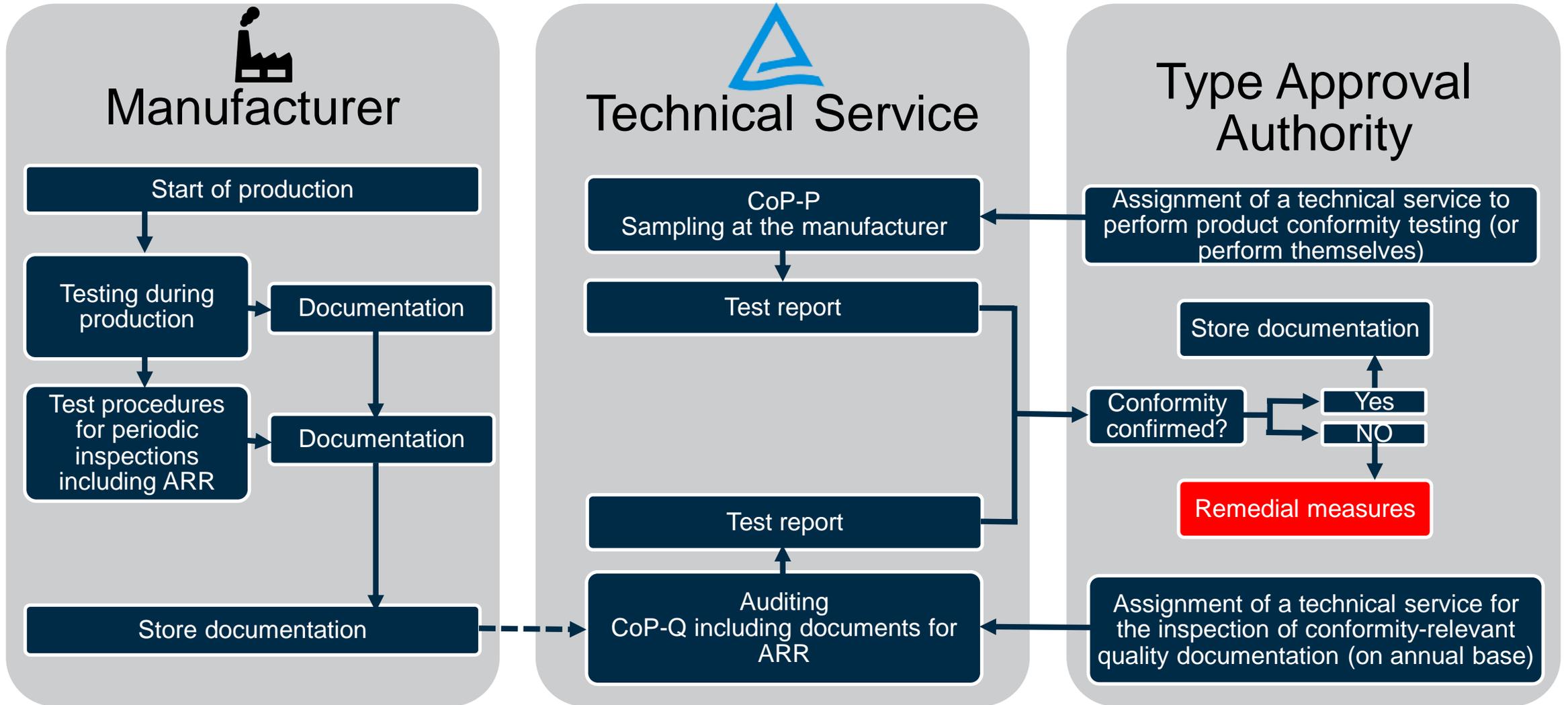
e13\*KS18/858\*00001\*00

e4\*NKS18/858\*00001\*00

# I. European Type Approval Systematic – Getting an Approval

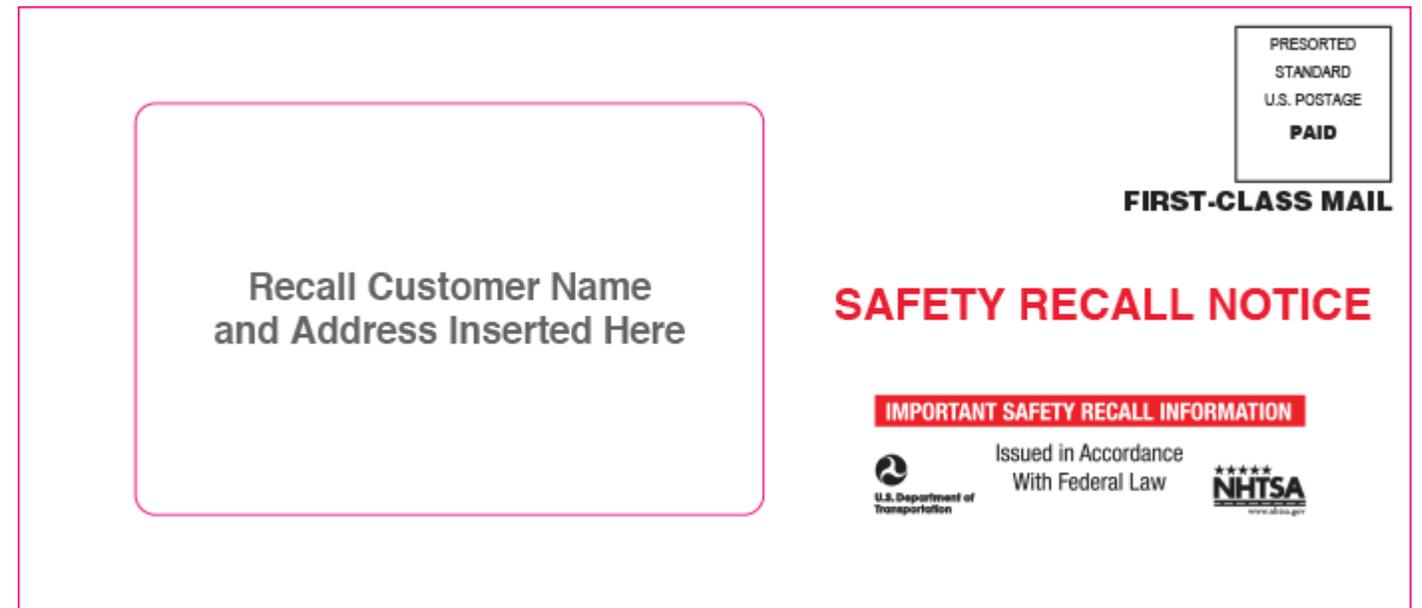


# I. European Type Approval Systematic – Having an Approval



# I. European Type Approval Systematic

- Not in conformity:
  - Manufacturer shall immediately take the **corrective measures** necessary to bring that vehicle [...] into conformity, to **withdraw it from the market or to recall it**, as appropriate
  - The manufacturer shall immediately **inform the approval authority** that granted the type-approval in detail of the non-conformity and of any measures taken



# I. European Type Approval Systematic

**NEW!**

Market surveillance in the EU

Activities carried out and measures taken by the new Market Surveillance Authorities independently and impartially



- Minimum check of one for every 40.000 new motor vehicles registered in that Member State (preceding year)
- Minimum 20 % emission related tests
- Control/supervision of national authorities by the EU-Commission

On the basis of the reports submitted by Member States, the Commission shall make a summary report on market surveillance activities publicly available on a two-yearly basis.

# I. European Type Approval Systematic

**NEW!**

What is Market surveillance in the EU?



2019: 4.23 million new vehicles and trailers registered in Germany  
→ at least 106 checks need to be performed by the German Market Surveillance Authority



2019: 17.81 million new vehicles registered in the EU-Member States  
→ at least 446 checks need to be performed by all MSA together

# I. European Type Approval Systematic

## Market Surveillance Activities in Germany

### Fundamental Affairs

24,156 inquiries +  
385 inquiries related to  
freedom of information  
rights

### Field Monitoring

85 tests on vehicles and  
vehicle applications  
(~ 58 % on diesel  
engines)

57 as field tests

16 tests on  
software  
upgrades  
verification

### CoP

349 CoP-P  
checks  
completed

Emissions  
(pollutants,  
noise and  
CO<sub>2</sub>)

Safety  
(brakes and  
steering)

Parts and  
components

### Product Safety and Recalls

1065  
investigations  
carried out in  
2019

59 % tests  
led to recalls

### Offences and Sanctions

1211 control  
reports  
issued

# I. European Type Approval Systematic

## Penalties in the EU

Member States shall lay down the rules on penalties applicable to infringements.

The EU-Commission may impose administrative fines. These fines shall not be in addition to the penalties imposed by the Member States.

The administrative fines imposed by the Commission shall not exceed:

**EUR 30 000**

per non-compliant vehicle, system, component or separate technical unit.

**effective - proportionate - dissuasive**

# Emissions Compliance in the EU: Understanding the Fundamentals

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I. European Type Approval Systematic

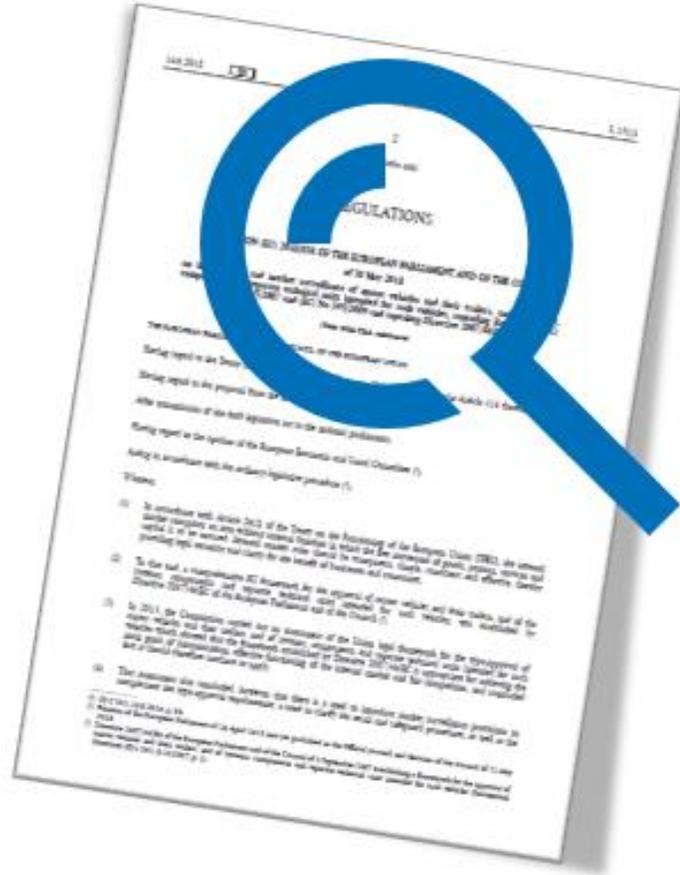
**II. Emissions of Light Passenger and Commercial Vehicles**

III. Emissions of Heavy Duty Vehicles

IV. CO<sub>2</sub> Emissions and Fuel Consumption of Heavy Duty Vehicles

## II. Emissions of Light Passenger and Commercial Vehicles

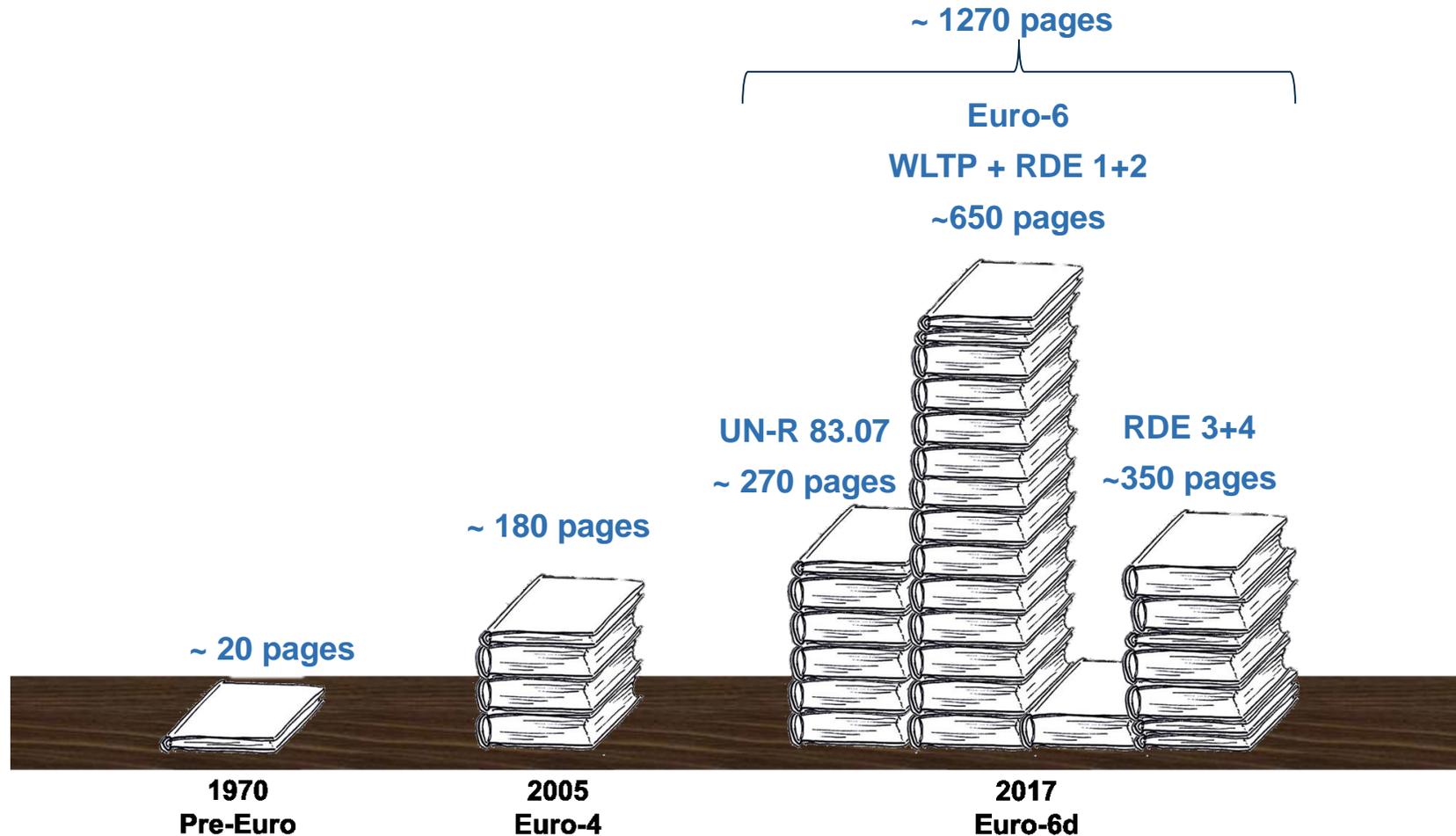
### Technical Requirements for Type-Approval and Requirements after Bringing into Market



- a. Timeframe of latest changes from NEDC to WLTC / WLTP
- b. New test cycle WLTC and the European procedure WLTP
- c. Conformity of Production
- d. In service conformity

## II. Emissions of Light Passenger and Commercial Vehicles

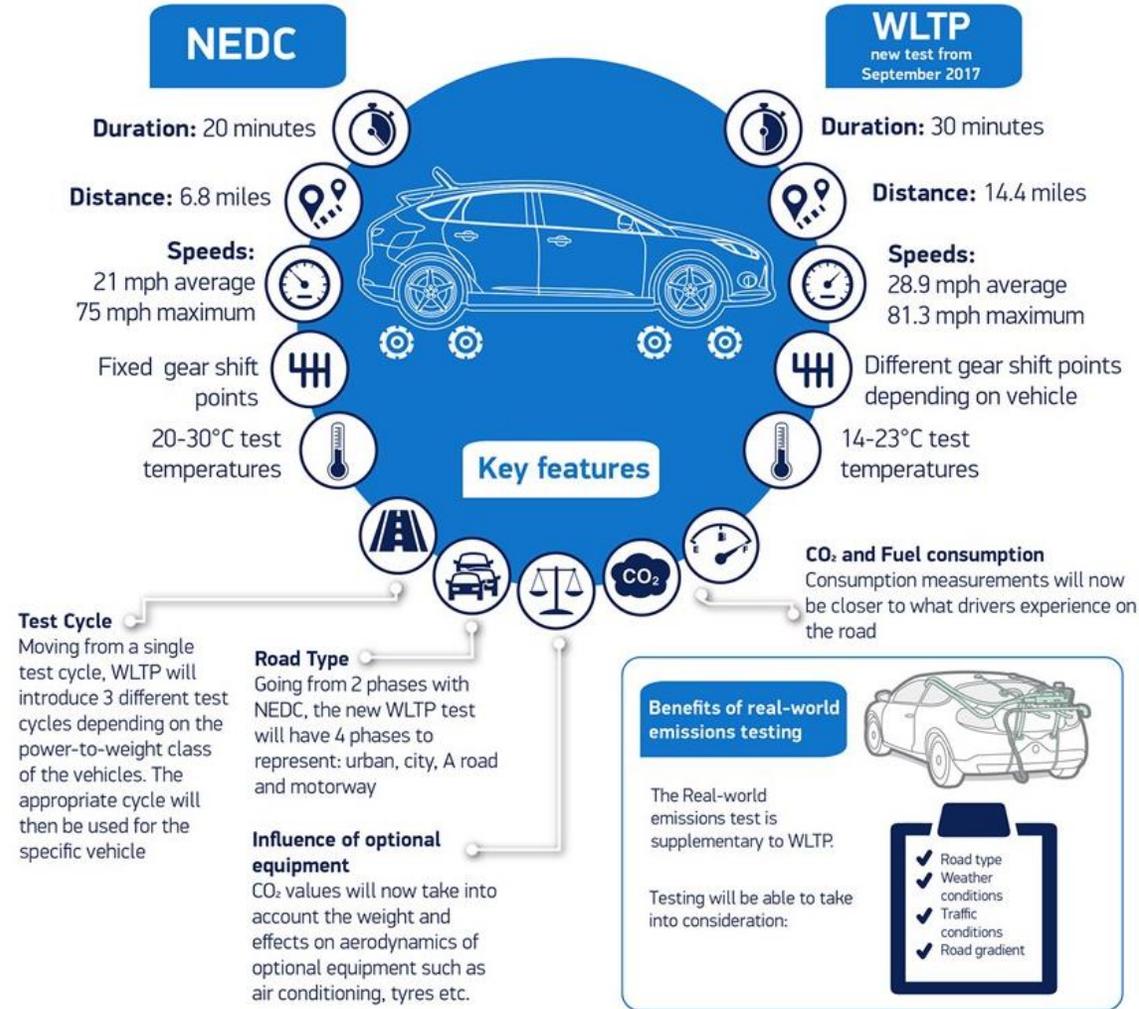
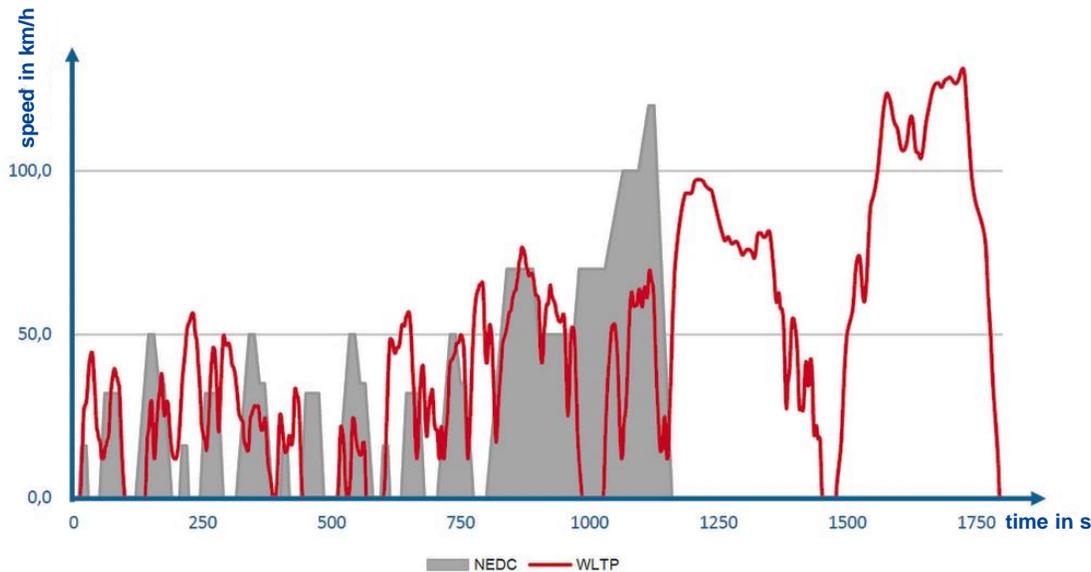
### Emissions Regulations Overview - Change in Regulatory Complexity



# II. Emissions of Light Passenger and Commercial Vehicles

## Emissions Regulations Overview – Changes from NEDC to WLTC

New European Drive Cycle (NEDC) versus Worldwide Harmonized Light Vehicle Test Cycle (WLTC)



## II. Emissions of Light Passenger and Commercial Vehicles

### Emissions Regulations Overview

Tests required to obtain an emission approval:

- Type 1 Test - Gaseous pollutants, PM, PN, CO<sub>2</sub> emissions, electrical energy consumption, electrical range
- ATCT - ambient temperature correction test (at 14°C)
- RDE - gaseous pollutants and particle number in real driving conditions
- Type 2 test - idling emissions
- Exhaust opacity (CI engines only)
- Type 3 Test - Crankcase emissions
- Type 4 Test - Evaporative emissions
- Type 5 Test - Durability
- Type 6 Test - Low temperature emissions
- On-board diagnostic systems (OBD)
- Engine power

## II. Emissions of Light Passenger and Commercial Vehicles

### Emissions Regulations Overview – CoP vs. ISC

#### Conformity of Production

- approval authority shall verify and agree with arrangements and control plans and perform audits and conduct emission and OBD tests

#### In-service conformity (ISC)

- Vehicles to be properly maintained and used
- 15.000 km or 6 month – 100.000 km or 5 years, whichever occurs sooner for tailpipe emissions
- 30.000 km or 12 month – 100.000 km or 5 years, whichever occurs sooner for evaporative emissions

#### Tests to be performed:

Type 1 Test - Gaseous pollutants  
emission of CO<sub>2</sub> (or electric energy consumption)

Type 3 Test - Crankcase emissions

Type 4 Test - Evaporative emissions

On-board diagnostic systems (OBD)

Type 1 Test - Gaseous pollutants (incl. low temperature)

Type 4 Test - Evaporative emissions

## II. Emissions of Light Passenger and Commercial Vehicles

### Emissions Regulations Overview – CoP by the Manufacturer

- Frequency based on a risk assessment methodology (consistent with ISO 31000:2018)
- For type 1 tests a minimum of one verification per 5.000 vehicles produced or once per year, whichever comes first
  - In Europe the VW Golf was the best selling car in 2019 with roughly 460.000 units
  - ~ 92 verifications needed (depending on the structure of the CoP families)
- A sample of three vehicles shall be selected



## II. Emissions of Light Passenger and Commercial Vehicles

### Emissions Regulations Overview – CoP by the Granting Type Approval Authority (GTAA)

- **has to** verify the manufacturers arrangements and documented control plans with a **minimum** frequency of **one audit per year**
- **may** at any time verify the conformity control methods (in each production facility)
- not satisfied → physical test shall be carried out directly
- normal frequency of physical test verifications is based on the results of the auditing, but **minimum one verification per three years**

#### Surveillance of the production process

The RDW supervises approvals granted by it by means of:

- › document assessment,
- › audits and
- › a product assessment if necessary.



How often supervision takes place (frequency) depends on any provisions in respect thereof in the legislation as well as a risk analysis carried out by the RDW.

The risk factors may consist, among other things, of the following:

- › the absence of an ISO certificate,
- › results from previous assessments,
- › the nature of the product,
- › the moment of the most recent audit,
- › complaints and
- › information concerning product deviations known to the RDW.

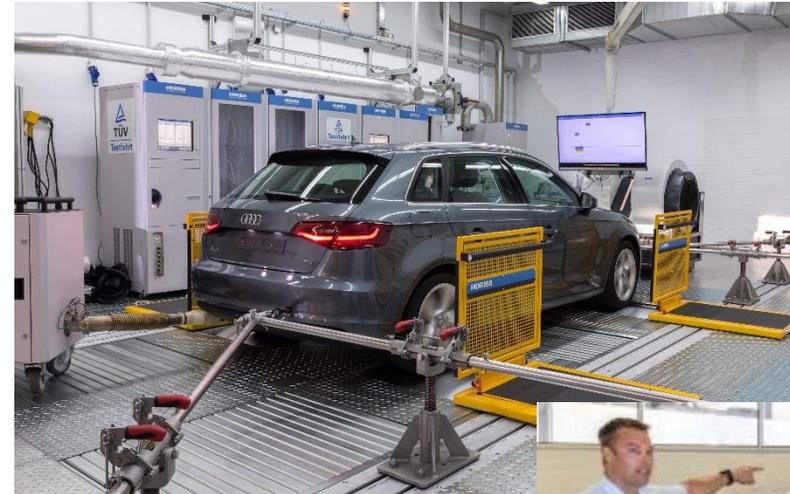
The RDW carries out the audits itself, but also has these carried out by RDW partners or technical services (category C) designated for this purpose by the RDW. This means that manufacturers may also be visited by these organisations instead of the RDW.

## II. Emissions of Light Passenger and Commercial Vehicles

### Emissions Regulations Overview – ISC by the Manufacturer

- **Shall** perform ISC testing in form of at least Type 1 tests
- **May** perform RDE, Type 4 and Type 6 test
- Shall report all results (using the Electronic Platform)
- Period between starting two ISC checks for a given family shall not exceed 24 month
- Number of sample lots for ISC testing with Type 1 tests
- Sample size: minimum 3 – maximum 10

EU Registrations per calendar year of vehicles in the sampling period	Number of sample lots (for Type 1 tests)
up to 100.000	1
100.001 to 200.000	2
above 200.000	3



## II. Emissions of Light Passenger and Commercial Vehicles

### Emissions Regulations Overview – ISC by the Granting Type Approval Authority

- Shall check an appropriate number each year
- Shall perform Type 1 and RDE tests on a minimum of 5% of the ISC families per manufacturer per year or at least two ISC families
- Type 4 or Type 6 ISC test have no minimum frequency requirements



## II. Emissions of Light Passenger and Commercial Vehicles

### Emissions Regulations Overview – Conformity Conclusion – Minimum Test Effort

#### Manufacturer

##### CoP

tailpipe emissions

emission of CO<sub>2</sub> (or electric energy consumption)

crankcase emissions

evaporative emissions

OBD

##### ISC

tailpipe emissions (including low temperature)

#### Authority

##### CoP

audit

physical test verification (at least ever three years)

##### ISC

tailpipe emissions (including low temperature)

RDE

## II. Emissions of Light Passenger and Commercial Vehicles

### Emissions Regulations Overview – Conformity Conclusion

- KBA list of vehicles including defeat devices (2020-08-11) – in the responsibility of KBA
  - 134 vehicle types (29 engine codes) + 285 VW group models (47 engine codes)
  - Production years 2008 – 2018
  - All vehicles are subject to recall
  
- KBA list of vehicles including defeat devices (2020-08-11) – **not** in the responsibility of KBA
  - 18 vehicle types (16 engine types)

Liste der betroffenen Fahrzeugvarianten außerhalb des Zuständigkeitsbereiches des KBA											
Marke	Handelsbezeichnung	Hubraum	Leistung	Motorkennbuchstabe	Typ/ Variante / version	Emissionsstufe	Genehmigungsnummer Gesamtfahrzeug	zuständige Genehmigungsbehörde hinsichtlich der Emissionen	Feststellungsdatum	Emissionsstrategie	Keine hinreichende Begründung gemäß Artikel 5 Absatz 2 der VO (EG) Nr. 715/2007:
		[ccm]	[kW]								
Chevrolet	Cruze	1998	120	Z20D1	KL1J / JNF11 / FJ5	Euro 5	e4*2001/116*0140*09	RDW (NL)	April 2016 (UK-Bericht)	Reduzierung der Wirksamkeit des Systems zur Abgasrückführung (AGR)	Information der zuständigen Typgenehmigungsbehörde und der EU-Kommission
Dacia	Sandero	1769	66	K9K E6	SD / SDDCJ / SDDCJS	Euro 6	e2*2001/116*0314*76	CNRV (FR)	April 2016 (UK-Bericht)	Reduzierung der Wirksamkeit des Systems zur Abgasrückführung (AGR)	Information der zuständigen Typgenehmigungsbehörde und der EU-Kommission
Fiat	500X	1956	103	XB	334 / AXB22 / D1A	Euro 6	e3*2007/46*0318*02	MIT (IT)	April 2016	Reduzierung der Wirksamkeit des Systems zur Abgasrückführung (AGR)	Information der zuständigen Typgenehmigungsbehörde und der EU-Kommission
Fiat	Ducato	2999	130	F1CE3481E	250 / CPMFC / EY	Euro 5	e3*2007/46*0044*08	MIT (IT)	April 2016 (UK-Bericht)	Reduzierung der Wirksamkeit des NOx-Speicher-Katalysators (LNT - Lean NOx-Trap)	Information der zuständigen Typgenehmigungsbehörde und der EU-Kommission
Ford	C-Max	1499	88	XWDB	DXA / XWDB1V / SHA1NA	Euro 6	e13*2007/46*1103*15	VCA (UK)	April 2016 (UK-Bericht)	Reduzierung der Wirksamkeit des Systems zur Abgasrückführung (AGR)	Information der zuständigen Typgenehmigungsbehörde und der EU-Kommission
FCA (Jeep)	Cherokee	1956	125	unbekannt	KL / JETCT / FSHD1A	Euro 5	e4*2007/46*0783*04	MIT (IT)	April 2016 (UK-Bericht)	Reduzierung der Wirksamkeit des Systems zur Abgasrückführung (AGR)	Information der zuständigen Typgenehmigungsbehörde und der EU-Kommission
Hyundai	iX35	1995	100	D4HA	ELH / FSD24 / A63AZ1	Euro 5	e11*2007/46*0192*08	VCA (UK)	April 2016 (UK-Bericht)	Reduzierung der Wirksamkeit des Systems zur Abgasrückführung (AGR)	Information der zuständigen Typgenehmigungsbehörde und der EU-Kommission
Hyundai	i20	1120	55	D4HA	GB / BSD11 / M62BZ	Euro 6	e11*2007/46*1600*01	VCA (UK)	April 2016 (UK-Bericht)	Reduzierung der Wirksamkeit des Systems zur Abgasrückführung (AGR)	Information der zuständigen Typgenehmigungsbehörde und der EU-Kommission
Jaguar (Land Rover)	XE	1999	120	2040TD	JA / C / 504	Euro 6	e11*2007/46*2150*00	VCA (UK)	April 2016 (UK-Bericht)	Reduzierung der Wirksamkeit des Systems zur Abgasrückführung (AGR)	Information der zuständigen Typgenehmigungsbehörde und der EU-Kommission
Land Rover	Range Rover	2993	190	306DT	LG / SSKY2F / D5Z1	Euro 5	e11*2007/46*0649*05	VCA (UK)	April 2016 (UK-Bericht)	Reduzierung der Wirksamkeit des Systems zur Abgasrückführung (AGR)	Information der zuständigen Typgenehmigungsbehörde und der EU-Kommission

## II. Emissions of Light Passenger and Commercial Vehicles

### Emissions Regulations Overview – Emission Targets in the EU

- Introduce “post Euro 6” standards
  - Currently a high level concept
  - Stake holder discussion ongoing
  - Potential changes: increase of mileage for ISC and MSA, increase of durability, introduction on wide on-road testing (more than RDE) to cover conditions not controlled in Euro 6, technology and fuel-neutral lower limits
  - New technologies: pre-heated catalyst and full map lambda = 1
  
- Reduction of greenhouse gasses compared to 1990
  - Target changed from 40 % to 55 % reduction in 2030 (December 2020)
  
- Green Deal
  - Greenhouse gas neutral in 2050
  - EU-COM defined 50 measures required for this purpose

# Emissions Compliance in the EU: Understanding the Fundamentals

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**III. Emissions of Heavy Duty Vehicles**

IV. CO<sub>2</sub> Emissions and Fuel Consumption of Heavy Duty Vehicles

# III. Emissions of Heavy Duty Vehicles

## Emissions Regulations Overview

1. Regulation (EC) No. **595/2009**  
on **type-approval** of motor vehicles and engines with respect to emissions from heavy duty vehicles (Euro VI)...
2. Regulation (EU) No. **582/2011**  
**implementing** and amending Reg. (EC) No 595/2009 [...] with respect to emissions from heavy duty vehicles...
3. UN-Regulation **No. 49**  
[...] **gaseous and particulate pollutants** from CI engines and PI engines for use in vehicles
4. Vehicle Energy Consumption Calculation Tool (**VECTO**) & Regulation (EU) No. **2017/2400**  
implementing [...] as regards the determination of **the CO<sub>2</sub> emissions and fuel consumption** of HDV

# III. Emissions of Heavy Duty Vehicles

## Emissions Regulations Overview

- Technical requirements for type approval of:
  - Motor vehicles
  - Engines
  - Replacement parts
  - Durability of pollution control devices
  - OBD systems
- Definition of:
  - Emission Limits
  - Fuel consumption / CO<sub>2</sub>
  - Conformity of Production
  - In-service conformity



# III. Emissions of Heavy Duty Vehicles

## Emissions Regulations Overview

### Article 5

#### Requirements and tests

1. Manufacturers shall ensure compliance with the emission limits set out in Annex I.
2. Manufacturers shall equip vehicles and engines so that the components likely to affect emissions are designed, constructed and assembled so as to enable the vehicle or engine, in normal use, to comply with this Regulation and its implementing measures.
3. The use of defeat strategies that reduce the effectiveness of emission control equipment shall be prohibited.

### ANNEX I

#### Euro VI Emission Limits

	Limit values							
	CO (mg/kWh)	THC (mg/kWh)	NMHC (mg/kWh)	CH <sub>4</sub> (mg/kWh)	NO <sub>x</sub> <sup>(1)</sup> (mg/kWh)	NH <sub>3</sub> (ppm)	PM mass (mg/kWh)	PM number (#/kWh)
WHSC (CI)	1 500	130			400	10	10	8,0 × 10 <sup>11</sup>
WHTC (CI)	4 000	160			460	10	10	6,0 × 10 <sup>11</sup>
WHTC (PI)	4 000		160	500	460	10	10	(2) 6,0 × 10 <sup>11</sup>

Note:

PI = Positive Ignition.

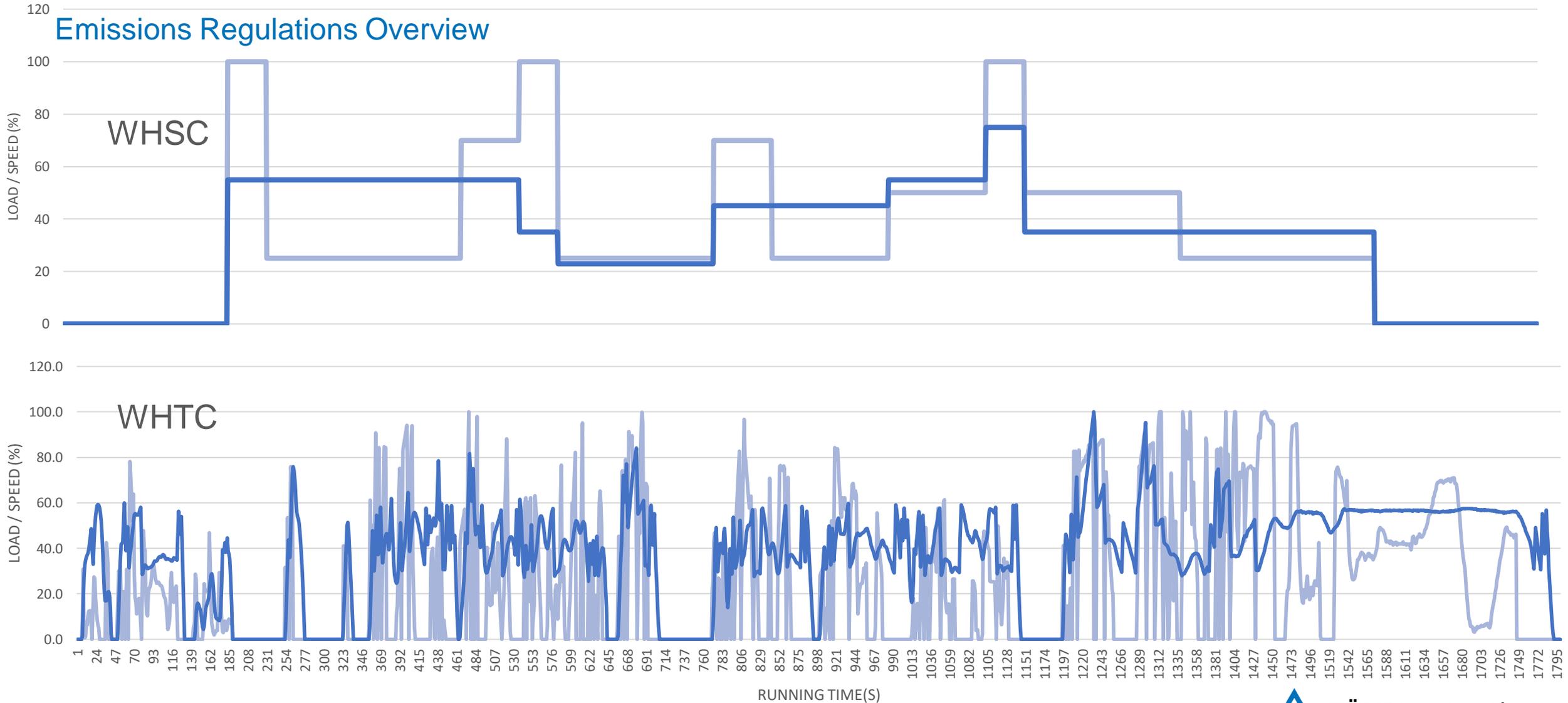
CI = Compression Ignition.

(1) The admissible level of NO<sub>2</sub> component in the NO<sub>x</sub> limit value may be determined at a later stage.

(2) The limit value shall apply as from the dates set out in row B of Table 1 of Appendix 9 of Annex I to Regulation (EU) No 582/2011.

# III. Emissions of Heavy Duty Vehicles

## Emissions Regulations Overview



# III. Emissions of Heavy Duty Vehicles

## Emissions Regulations Overview – CoP and ISC

### CoP

- Referring to framework regulation
- Engines taken randomly from series production
- Three engines shall be taken for testing
  - Newly manufactured engines
  - May have run-in up to 125 hours
- For the testing procedure the Regulation refers to UN-R 49

### ISC

- Report schedule and sampling plan at the time of initial TA
- Minimum of three engines to be tested (three vehicles)
- Testing on the road over normal driving patterns, conditions and payloads → prove the choice towards TAA
- Defined payload, ambient conditions, vehicle conditions
- Trip requirements defined for different vehicle classes
  - N2, M2, M3 → 45 % urban, 25 % rural, 30 % motorway
  - N3 → 30 % urban, 25 % rural; 45 % motorway
- Emission evaluation is allowed to include conformity factor of 1,5
- Send report to GTAA

# III. Emissions of Heavy Duty Vehicles

## Emissions Regulations Overview

### Remedial Measures:

- Submit remedial actions within 60 days to GTAA and receive confirmation within another 30 days
- Submit to GTAA within the plan:
  - Each affected engine type
  - Details of modifications, corrections, repairs, adjustments to be done
  - Copy of manufacturers information to vehicle owners
  - Copy of instructions to persons who will perform the repair
- Report regularly to GTAA

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II. Emissions of Light Passenger and Commercial Vehicles

III. Emissions of Heavy Duty Vehicles

**IV. CO<sub>2</sub> Emissions and Fuel Consumption of Heavy Duty Vehicles**

# IV. CO<sub>2</sub> Emissions and Fuel Consumption of Heavy Duty Vehicles

## Emissions Regulations Overview

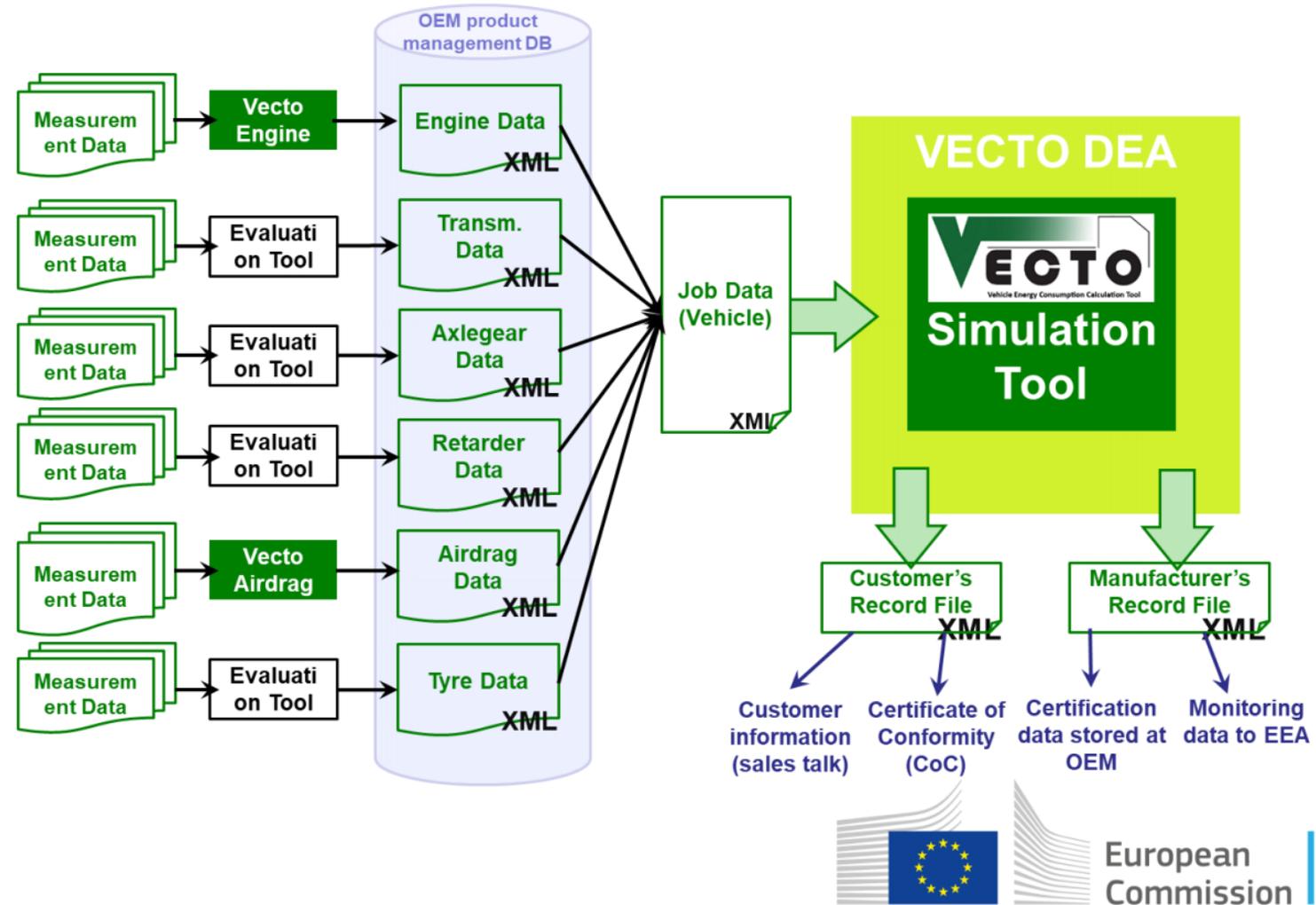
**Due to multiple combinations of axle types, number of driven axles, gear boxes, engines and cabins, the number of variations within one HDV model range can exceed 1000. Therefore measuring every possible configuration on a chassis dynamometer or with PEMS would be a very burdensome approach.**



# IV. CO<sub>2</sub> Emissions and Fuel Consumption of Heavy Duty Vehicles

## Emissions Regulations Overview

- Every vehicle gets an individual VECTO result
- All data shall be handled in electronic form
- Data integrity measures installed („hashing“)

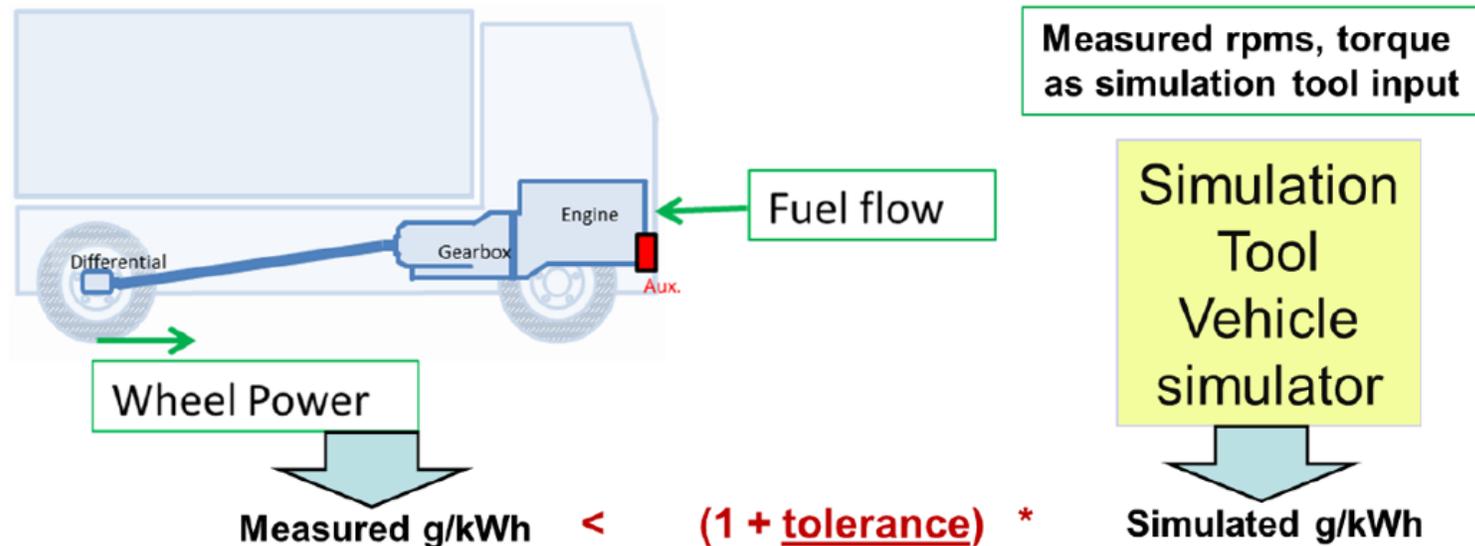


# IV. CO<sub>2</sub> Emissions and Fuel Consumption of Heavy Duty Vehicles

## Emissions Regulations Overview

### Verification Test Procedure (VTP)

- On-road test to verify CO<sub>2</sub> Emissions
- Carried out by manufacturer and verified by GTAA
- Pass/Fail check: specific fuel consumption from VTP to be lower than VECTO simulation results +7,5 % tolerance



# IV. CO<sub>2</sub> Emissions and Fuel Consumption of Heavy Duty Vehicles

## Conformity of CO<sub>2</sub> Emissions and Fuel Consumption Related Properties

### Engine

- 0,05 % of all engines produced in the past production year but a minimum number of 30 (=n<sub>COP,base</sub>)
- first two CO<sub>2</sub> -families shall be those with the highest production volumes
- Sample size per family  $4 < n < 19$
- Margin of 4 % for a single test



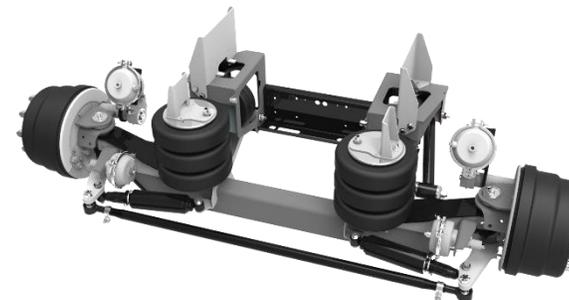
### Transmission

- Number of tests depending on production of transmissions  
e.g.:  
>10.000-30.000 => 2  
>30.000 => 3  
>100.000 => 4
- Above a production of 10.000 the transmission with highest production volume needs to be tested
- Margin of up to 3 % depending on the type of transmission



### Axle

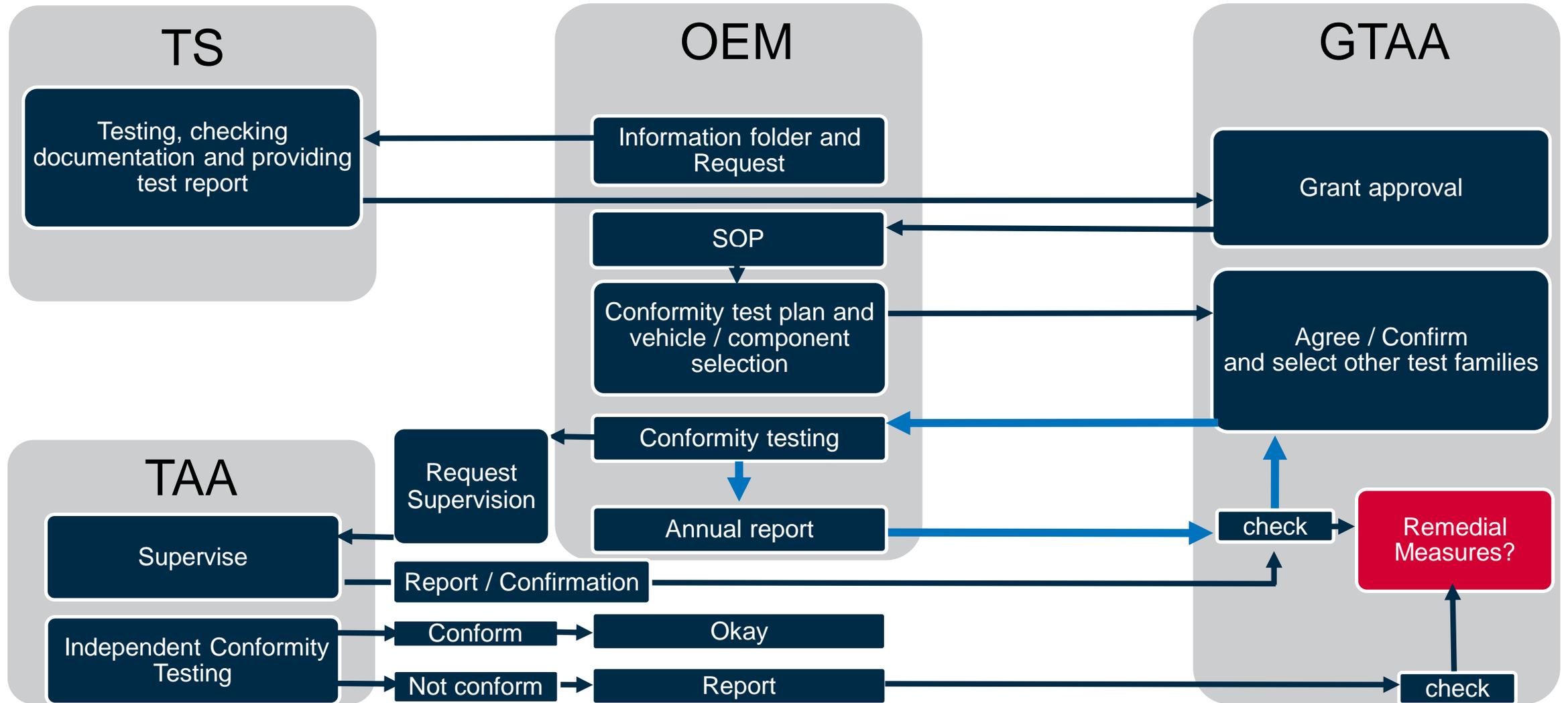
- Number of tests depending on production of axles  
e.g. for single reduction (SR) axles:  
50.001-60.000 => 3  
60.001-70.000 => 4  
70.001 and more => 5
- first two axle-families shall be those with the highest production volumes
- Margin of 1,5 % for SR axles and torque loss measurements



### Air drag

- Number of tests depending on production of vehicles  
e.g.:  
 $\leq 50.000 \Rightarrow 3$   
 $\leq 75.000 = 4$   
 $< 100.001 = 6$
- first two air drag-families shall be those with the highest production volumes
- Additional requirements like ambient temperature within a range of  $\pm 5$  °C and high speed test within a range of  $\pm 2$  km/h of certification tests
- Margin of 7,5 %

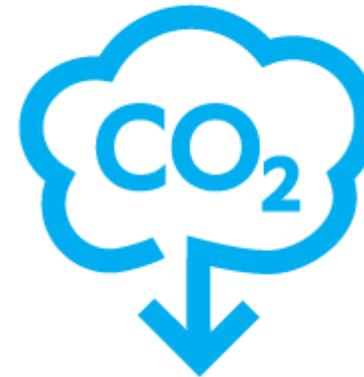
# IV. CO<sub>2</sub> Emissions and Fuel Consumption of Heavy Duty Vehicles



# IV. CO<sub>2</sub> Emissions and Fuel Consumption of Heavy Duty Vehicles

## Emissions Regulations Overview – Emission Targets in the EU

- Regulation (EU) 2019/1242 reduction of the CO<sub>2</sub> level of 2005 by:
  - 15 % by 2025
  - 30 % by 2030
  - Emissions premium 4.250 €/gCO<sub>2</sub>/tkm from 2025
  - Emissions premium 6.800 €/gCO<sub>2</sub>/tkm from 2030

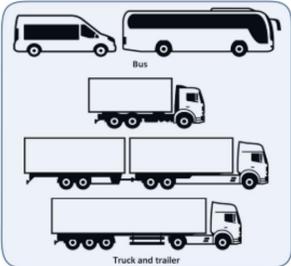


# Emissions Compliance in the EU: Understanding the Fundamentals

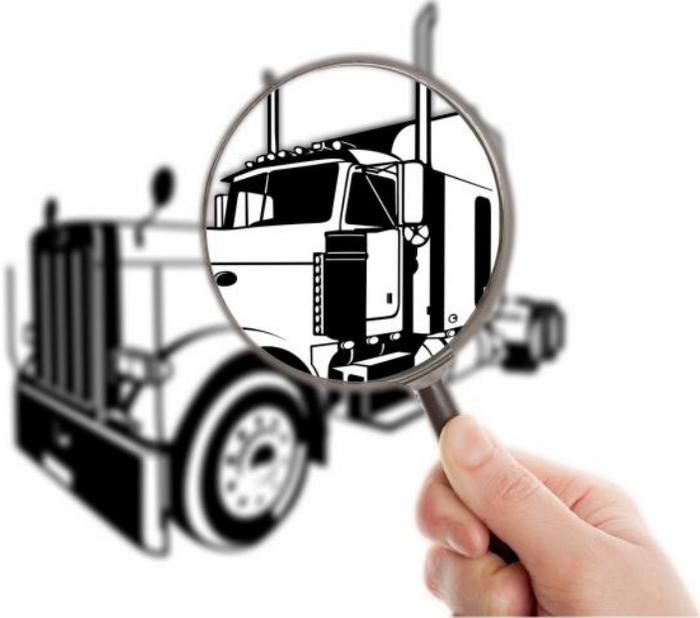
## Summary



Light Duty Vehicles



Heavy Duty Vehicles



## Key Takeaways: EU v. US

Both EU and US regulations require extensive documentation and testing for Emission Approvals

- US: Manufacturers work directly with US EPA and CARB to submit Applications for Certification
  - EPA and CARB requirements are very similar but require independent approvals, for every Model Year
- EU: Manufacturers work through Technical Service to submit Applications for Type Approval to governmental Authorities in any one of 27 different Member States
- Test cycles, documentation formats, and other regulatory requirements are generally similar but are not identical between US and EU

Both EU and US regulations require compliance demonstrations on production vehicles

- New vehicles: Manufacturer requirements
  - Production Vehicle Evaluation Testing, In-Use Verification Program testing in US
  - Conformity of Production testing in EU
- In-Service vehicles: Agency enforcement
  - Separate In-Use Compliance programs at US EPA and CARB, in place for 40+ years
  - Member State activity increasing in recent years



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# Thank you for your attention.

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