ECT-2022

Indian Real Driving Emissions

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10-Nov-2022

ABOUT ICAT

The International Centre for Automotive Technology (ICAT), Manesar is a centre under NATRIP (**N**ational **A**utomotive **T**esting and **R**&D **I**nfrastructure **P**roject), Govt. of India.

ICAT provides services for

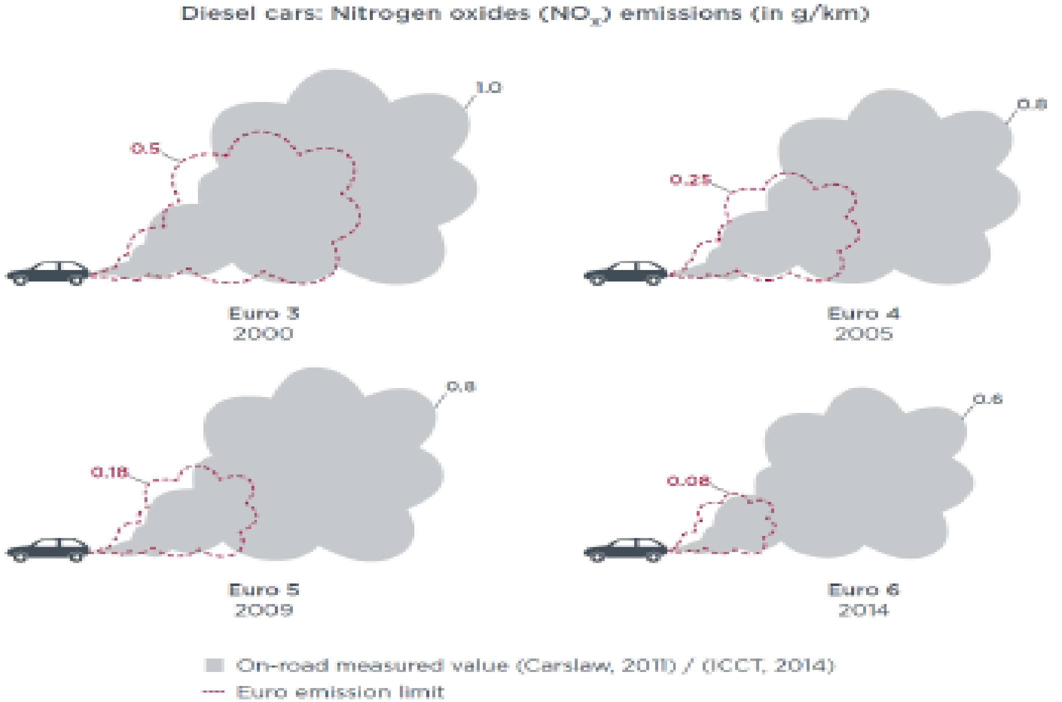
- ❖ Test
- ❖ Validation
- ❖ Design
- ❖ Homologation

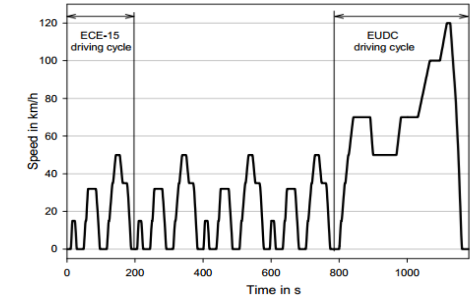
- ➢ Established : 2006
- ➢ Human resource : 535+
- ➢ Location : Manesar, Haryana (38 km from Delhi Airport)
- ➢ Area : Centre I - 8 Acres & Centre II - 46.6 Acres

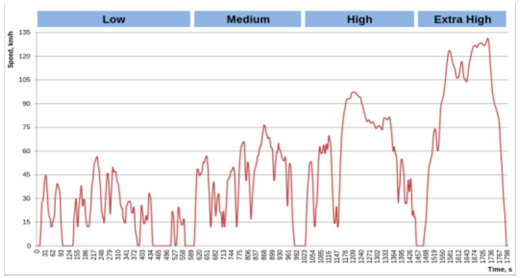
THE NECESSITY OF RDE

- Real Driving Emissions (RDE) methodology has been proven to be an excellent way to measure emissions in real world conditions
- Emissions should be kept below the emission levels not only in the laboratory but in normal conditions of use as well

WHY RDE OVER LAB EMISSION TEST REGIME







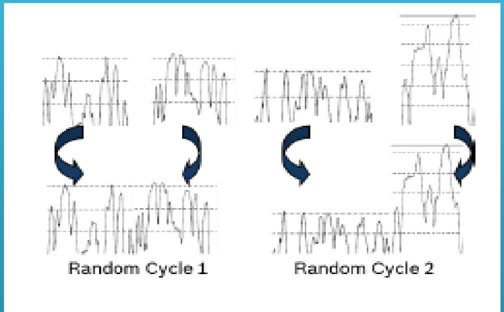
<u>In 2011, Joint research Centre (JRC) published a report, c</u>laiming discrepancies between lab testing and on road emissions. Mainly for NOx emissions from Diesel cars.

<u>Consequence:</u> Formation of working group on RDE under the supervision of EU Commission.

RDE BACKGROUND [EU]

Initially two test procedures were proposed:

Laboratory based testing – Random Cycle (RC)



On road emission testing – PEMS

Both test procedures were evaluated by JRC (PEMS) and Vehicle manufactures (RC) in 2012
Result: PEMS testing was chosen as “golden” method RC were kept as backup

RDE DEVELOPMENTS IN EUROPE

2011-2015:

- Kick-off: Working group on RDE
  - Complementary procedure for type approval and in-service conformity testing of LDVs
  - Covering a wide range of normal operating conditions; limiting defeat strategies
- Evaluation of candidate procedures by EU stakeholders (JRC report)
- Development of a PEMS testing protocol
- Pilot program to assess the feasibility of PN-PEMS

2016:

- Development of RDE Regulations 2016/427 and 2016/646 as first on-road test procedure worldwide
  - NOx Conformity factor 2.1 – applicable from Sept. 2017/2019 (new types/all new vehicles)
  - NOx Conformity factor 1.5 – applicable from Jan. 2020/2021(new types/all new vehicles)
  - Compliance during urban driving and the entire RDE trip

RDE DEVELOPMENTS IN EUROPE

2017:

- RDE 3rd Package in Regulation 2017/1151
  - Testing of hybrid vehicles, coverage of cold-start and regeneration events, particle number emissions
  - PN Conformity factor 1.5 – applicable from Sept. 2017/2018 (new types/all new vehicles)

2018:

- RDE 4th Package:
  - Provisions for in-service conformity
  - Reviewing RDE procedure & New NOx CF = 1.43 was proposed
  - Adapting provisions to ensure practicality and effective emissions testing
  - New Validation criteria that work with hybrids
  - New simple and transparent evaluation method

- Since then, JRC has carried out 2 more technical studies, published in year 2020 & 2021 highlighting improvements in PEMS Equipments and has proposed CF of 1.32 & 1.23 respectively. However, above CF yet not accepted in Europe

RDE DEVELOPMENT STAGES IN EUROPE

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In 1990

EU followed Lab Testing.

For Emission Certification Purpose.

NEDC cycle.
Avg. Speed = 32 kmph.

Max. Acc. = 1.2 m/s^2.

In 2011

<u>Joint research Centre (JRC) published a report.</u>
Claimed discrepancies between lab testing and on road emissions.
Mainly for NOx emissions from Diesel cars.
<u>Consequence:</u> Formation of working group on RDE under the supervision of EU Commission.

In 2016

New Complementary Procedure Introduced.- WLTP

The new complementary test procedure was published.

New legislative text was split into 4 “packages”(discussed in subsequent slides)

In 2017

RDE test implemented for **new model** approvals from Sep 2017

NOx limit = 2.1 (CF) x Euro 6 Limit.
(= 2.1 X 80 mg/km = 168 mg/km).

In 2019

RDE test will be applicable for **all model** TA from Sep 2019.
<u>From 2020</u>
CF will be changed from 2.1 to 1.5 for new models
<u>From 2021</u>
CF will be changed from 2.1 to 1.5 for **all models**

RDE IN JAPAN

Scope

•Diesel vehicles having a gross weight of 3.5t or less

•Diesel powered passenger cars having a capacity of 9 or less people

Schedule of Introduction for RDE in Japan

•New Type Approval Vehicle : October 2022

•Continuous Production Vehicle : October 2024

JAPAN'S RDE METHOD

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- RDE method shall be able to check whether result of chassis-dynamometer test has effect on real driving correctly as well or not.
- The Japan's RDE method is based on EC's RDE method, but it is slightly modified by taking into consideration difference of real world driving conditions and adopted different phase of WLTC between Japan and Europe .
- Especially driving condition and speed threshold of Moving Average Window(MAW) and CF value under EC's RDE method are developed based on chassis-dynamometer test (WLTC) and real world driving conditions.
- Only measures NOx on Chassis Dyno test and RDE test and do not measure PN while Europe measure NOx and PN for Diesel Vehicle .

JAPAN RDE V/S EUROPEAN RDE

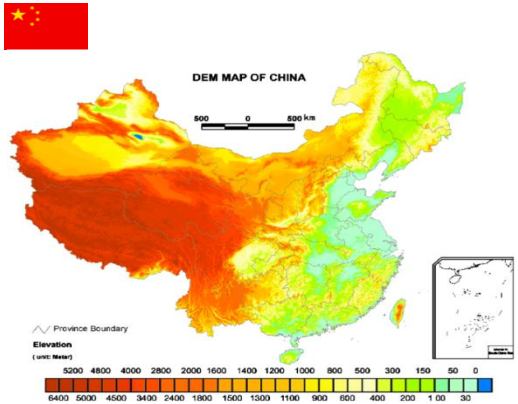
➢ Based on difference of WLTP phases, Japan modified some of factors slightly as below.

	J-RDE			E-RDE		
Vehicle speed and Consist	Routes	Speed [km/h]	Consist [%]	Routes	Speed [km/h]	Consist [%]
	Urban/Rural	V≦60	40-65	Urban	V<60	29-44
				Rural	60<V<90	23-43
	Motorway	60<V	35-55	Motorway	90<V	23-43
Window speed characteristics	V<50:urban/rural speed 50≦V:motorway speed			V<45 : urban speed 45≦V<80:rural speed 80≦V<145:motorway speed		
CO_2 characteristic curve reference points	P1 : Same as E-RDE P2 : Same as E-RDE P3 : —			P1:v_{p1}=18.882km/h (Average Speed of the Low Speed phase of the WLTP cycle) P2:v_{p2}=56.664km/h (Average Speed of the High Speed phase of the WLTP cycle) P3:v_{p3}=91.997km/h (Average Speed of the Extra High Speed phase of the WLTP cycle)		

CHINA RDE METHOD

China RDE reference to EU RDE ,but make some changes according to own conditions.

Items		Requirements
Test procedure & PEMS requirements		Package 1,2
Boundary Condition	Altitude	Moderate: [0m, 700m]
		Extended: (700m, 1300m]
		Enhance extended: (1300m~2400m]
	Temperature	Moderate: [0℃, 30℃]
		Extended: [-7℃, 0℃) or (30℃, 35℃]
Data post-process	ICE, NOVC-HEV	Package 2 Moving Average Window Method
	OVC-HEV	Package 3
Conformity Factors	NOx, PN	2.1



* Extended factor: 1.6   Enhanced extended factor: 1.8

Korea RDE-LDV in

- Korea implemented EU RDE-LDV to diesel vehicle's emission regulation with same technical requirement and same enforcement schedule

  * under amendment for RDE package 4

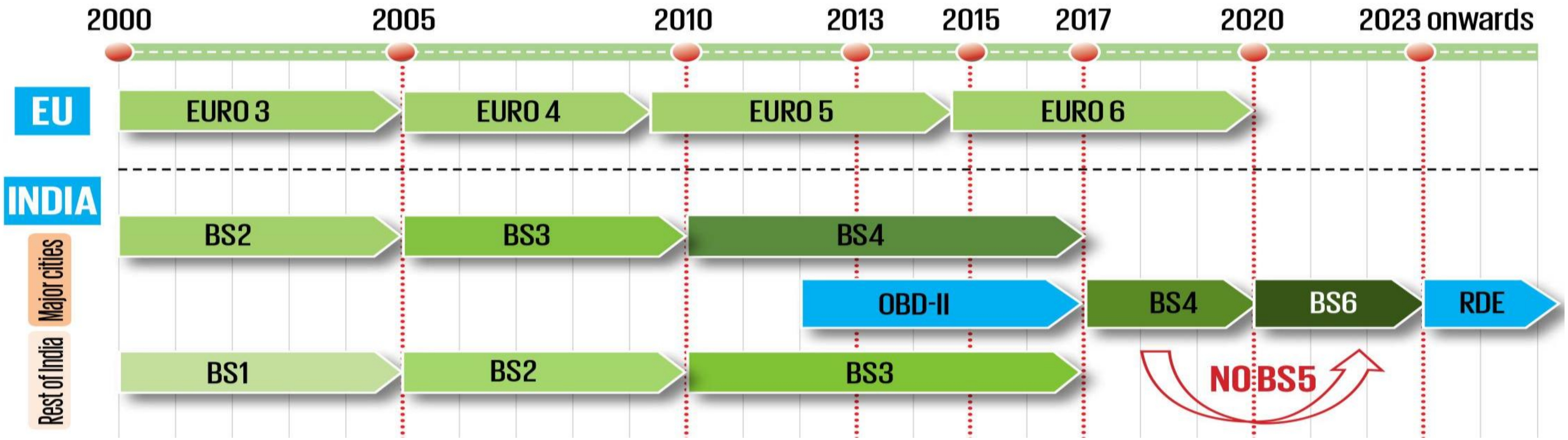
EU RDE-LDV stage	contents	EU (enforcement)	Korea (enforcement)
Package 1	methodologies measuring on-road NOx emissions and performance requirement of PEMS equipment	EU 2016/427, 646 (Sep. 2017)	CAA amend. in 2016 (Sep. 2017)
Package 2	on-road NOx emission limit		
Package 3	methodologies measuring on-road PN emissions and emission limit including cold start provision	EU 2017/1151, 1154 (Sep. 2017)	CAA amend. in 2017 (Oct. 2017)
Package 4	reviewing performance of PEMS equipment and revising on-road NOx emission limit with improved data analysis method	EU 2018/1832 (Jan. 2019)	Under amend.

Introduction of RDE in India

BS VI NOTIFICATION

Govt. Gazette Notification No G.S.R. 889 (E) dated 16th Sept 2016 notified implementation of BS VI with effect from April 1, 2020. BS VI included :

- RDE monitoring phase from April 1, 2020
- CF from 1 April 2023



RDE DEVELOPMENT IN INDIA

- IRDE Tech Committee under Chairmanship of Director ICAT was constituted by MoRTH direction on 26th Dec 2016.
- Mandate: To define IRDE Test Procedure for Light Duty Vehicles.
- IRDE Report published in Nov. 2018.
- Thereafter, committee undertook the work of deriving “Conformity Factor” as per below plan.
- Same plan was presented in 60th SCOE Meeting held on 22-Aug-2019.
- The committee presented completion of “study” and proposal for CF by end of Sep-2021.

IRDE DEVELOPMENT- METHODOLOGY

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EU Model (3rd Package) + **Adaptations - India Specific Items** = **Indian RDE**

Key India Specific Adaptation

- Ambient Temperature
- Test Fuel option reference/commercial.
- Speeds (Trip Share Distance)
  - Low Speed in Indian Cities / Highways.
  - Maximum Speeds Lower in India
  - Typical Indian Vehicles (Small Engines / Low PMR)
- Driving Dynamics (V*apos_95 & RPA)
  - Typical Traffic Conditions in India Cities / Highways
  - Typical Indian Vehicles (Small Engines / Low PMR)
- Data Post Processing
  - Based on Type-1 Test (MIDC); Reference CO_2.
  - Adaptation of other Factors for Post Processing; Speed Bins, Normality, Completeness and multiplication factor.

Methodology Adopted

Data Survey.

- Indian Climate Data (15 Year Monthly Avg. Data with correction for Regional & Seasonal Extremes)

Data Collection by Experimentation.

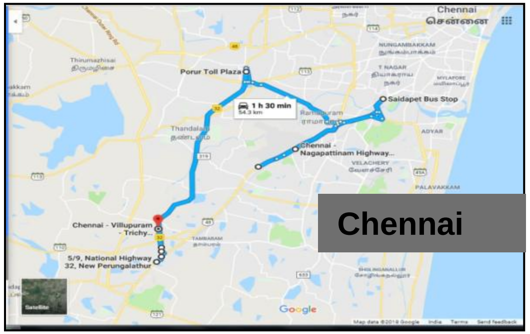
- Data Collection on Indian Roads in different Cities & Speed Distribution Analysis
- V*Apos & RPA Scatter based on Data Collection on Indian Roads considering Usable Acceleration Potential.
- Adaption using MIDC (2-Point Post Processing & Validation for CO2 Correction Factors, Normality and Completeness)

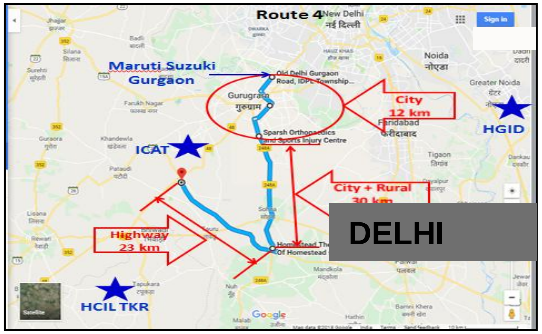
IRDE test procedure was mainly developed based on EU 3rd Package with Adaptations for India

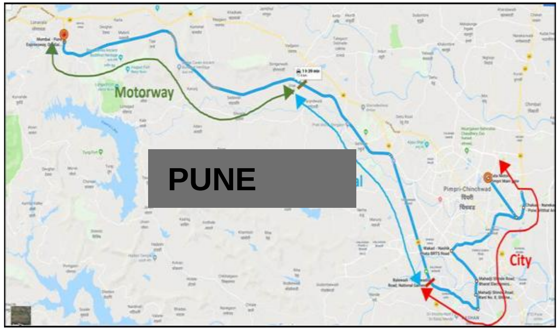
IRDE DEVELOPMENT : SNAPSHOT

- Over 60 vehicles Evaluated across various categories(M1, N1 & Low powered M1 & N1)
- Across Various Regions (North, West and South India) in different seasons
- Approx. 10,000km of Road Tests done.
- 15 IRDE Committee Meetings and Over 50 Expert Group Meetings & Telecoms
- Around 2 years of Work since commencement of activities from Jan 2017

Examples of Test Routes Pan India

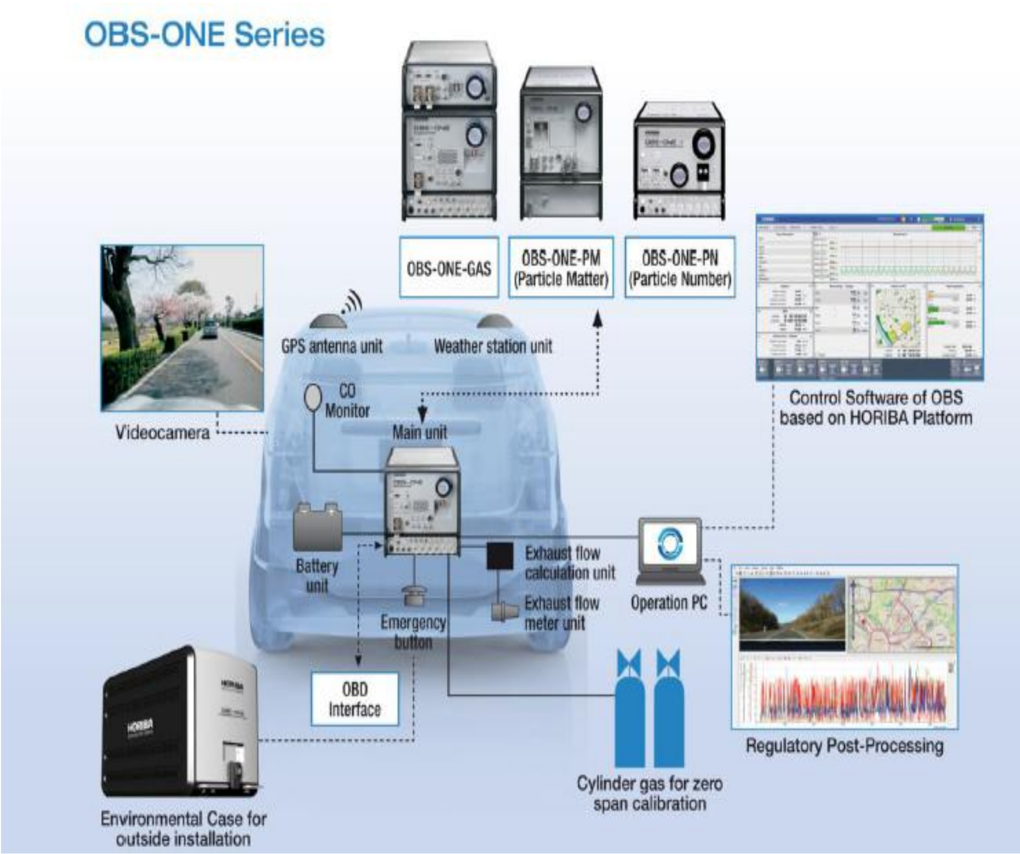






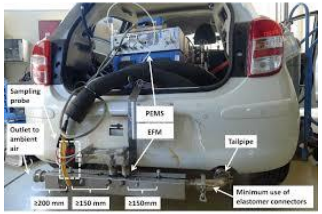
IRDE TEST PROCEDURE

PEMS Equipment Configuration



IRDE Methodology

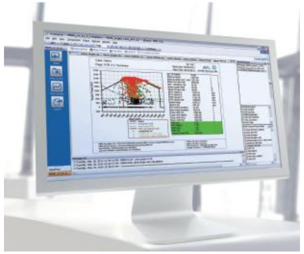
1. PEMS Installation & Instrumentations.



2. Correlation test between Lab & PEMS.

3. On road test with PEMS in cold condition.

4. Post Processing of Data

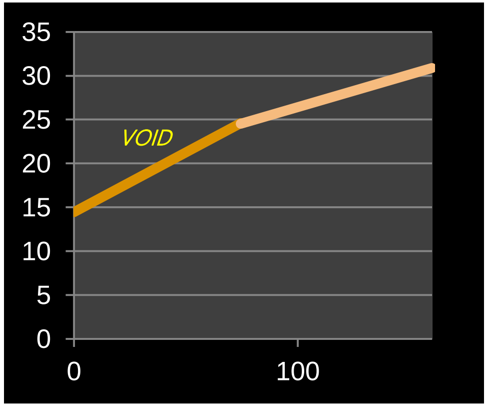


IRDE TEST PROCEDURE

IRDE Trip Requirement

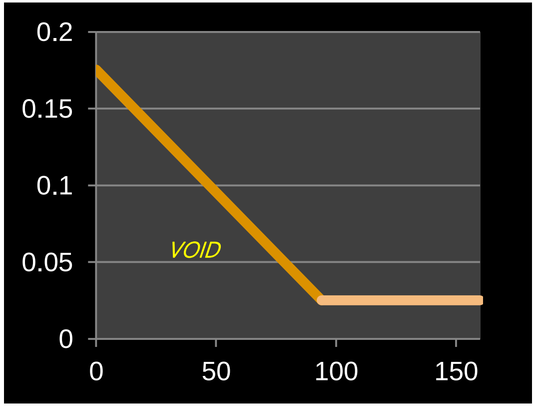
Existing ICAT Route →

UPPER BOUNDARY CONDITION



$(v \times a_{pos})_k$_[95]

LOWER BOUNDARY CONDITION



Relative Positive Acceleration (RPA)

1. If the test results are beyond upper/lower boundary then the test is VOID.
2. Dynamic boundary conditions exclude the driving that is too smooth or too aggressive

CHALLENGES FACED WORLDWIDE

- Selection of a Driving Route to minimise void tests and compliance to route requirement for trip share.
- Set-up for each vehicle is unique and hence adaptations to be panned carefully to ensure EFM fit for each engine size.

- Set-up to be made carefully to avoid damage to equipment due to exhaust temperatures.

- In India PEMS cannot be mounted outside the vehicle and hence needs to be accommodated inside the vehicle .
- PEMS is expensive equipment and subject to high risk of using on road.

- CO concentration increase inside the vehicle due to exhaust leakage and hence occupant at risk. Monitoring of CO levels required in the vehicle.
- Trip duration limited by battery capacity of the PEMS

CHALLENGES FACED WORLDWIDE

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- Cycle mandates that all Trip share to be completed within set period of time, otherwise test might fail due to invalid result and be repeated.
- Trained drivers who have good knowledge of routes and driving style are required to maximize test validity are required.
- Confidentiality of vehicle prototypes to be maintained.
- Functioning of equipment in extreme hot conditions is a big challenge in India.
- High spread of results due to route selection, driver, traffic, results are not reproducible.
- Insurance of PEMS equipment is a big challenge due to its inherent usage.
- Customization of software to suit local regional requirements.

IRDE REGULATION

(VEHICLE CATEGORYWISE HIGHLIGHTS)

#	Items	M Category	N1 Category	**M1 & N1 (Low Power)** (PMR < 22kw/ Ton & Max. Designed Speed ≤ 70 kmph)
Environment Boundary Conditions				
1	Temperature	Moderate: $10 \le T \le 40$, Extended: $40 < T \le 45$; $8 \le T < 10$		
2	Altitude	Moderate: $A \le 700$ m , Extended: $700 < A \le 1300$ m		
Trip Requirements				
1	Speed Ranges	Phase1: $V < 45$ km/h Phase2: $45 \le V < 65$ km/h Phase3: $V \ge 65$ km/h V>75km/h for min 5 min	Phase1: $V < 40$ km/h Phase2: $40 \le V < 60$ km/h Phase3: $V \ge 60$ km/h V>70km/h for min 5 min	Phase1: $V < 45$ km/h Phase2: $V \ge 45$ km/h V>55km/h for min 5 min
2	Trip distance share	Phase 1: 34 % (±10%) Phase 2: 33 % (±10%) Phase 3: 33 % (±10%) (Same for M1 / N1)		Phase 1: 50 % (±10%) Phase 2: 50 % (±10%)
3	Maximum vehicle velocity	For M1: Wherever **legal max speed limit permits**, the vehicle velocity **can exceed 100 km/h** for not more than **3 % of the time duration of the Phase 3 driving, maximum up to 120km/hr.** **For N1: Restricted to 80km/h.** **For LP M1/N1: Restricted to 70 km/h**		
4	Phase 1 Average Speed	15-30 km/h		
5	Total trip duration	90 – 120 min		

IRDE REGULATION

(VEHICLE CATEGORYWISE HIGHLIGHTS)

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Sr. No	Points	M Category	N1 Category	M1 & N1 (Low Powered) (PMR < 22kw/ Ton & Max. Designed Speed ≤ 70 kmph)
6	Minimum Distance	16km for each Phase (Phase 1, Phase 2, Phase3) (Same for M1/N1)		24 km for each Phase (Phase 1, Phase 2)
7	Stop periods	• 6 to 30% of Phase -1 duration • May contain several stop periods of 10 seconds or longer. • Single stop period must not exceed 5 Mins. • Vehicle should not be driven continuously below 20 km/h for more than 20 minutes.		
Trip Dynamics				
8	Number of Acceleration points	Minimum 150 for each for Phase1, Phase2 Minimum 100 for Phase3		Minimum 150 for Phase 1 Minimum 100 for Phase 2
9	Relative Positive Acceleration (RPA)	(V≤55.9 km/h) Y = -0.001825 X + 0.1755 (V>55.9 km/h) Y = -0.0011 X + 0.1350	Y = -0.0016x + 0.1406	(V≤ 54.76 km/h) Y = -0.0022X + 0.1271 (V> 54.76 km/h) Y = 0.0066
10	V*Apos	(V≤56.9 km/h) Y = 0.0467X + 12.2490 (V>56.9 km/h) Y= 0.1665 X+ 5.4352	(V ≤ 51.40 km/h) Y= -0.0614X + 6.9439 (V> 51.40 km/h) Y= 0.0045X + 9.8664	Y = 0.0142X + 4.6214

IRDE TRIP REQUIREMENT

(GLOBAL COMPARISON)

#	Items	EU RDE	Japan RDE	Indian RDE
Environment Boundary Conditions				
1	Temperature	Moderate: 0 < T ≤ 30 Extended: -7 < T ≤ 0 ; 30 < T ≤ 35	Moderate: 0 < T ≤ 35 Extended:-2 < T ≤ 0 ; 35 < T ≤ 38	Moderate: 10 ≤ T ≤ 40, Extended:40 < T ≤ 45 ; 8 ≤ T < 10
2	Altitude	Moderate: A ≤ 700 m Extended: 700 < A ≤ 1300 m	Moderate: A ≤ 700 m Extended: 700 < A ≤ 1000 m	Moderate: A ≤ 700 m , Extended: 700 < A ≤ 1300 m
Trip Requirements				
1	Speed Ranges	Phase 1: V < 60 km/h Phase 2: 60 ≤ V < 90 km/h Phase 3: V ≥ 90 km/h V>100 km/h for at-least 5 min	Phase 1: V < 40 km/h Phase 2: 40 ≤ V < 60 km/h Phase 3: V ≥ 60 km/h V>80 km/h for at-least 20% of Phase 3 duration	Phase1: V < 45 km/h Phase2:45 ≤ V <65 km/h Phase3: V ≥65 km/h V>75km/h for min 5 min
2	Trip distance share	Phase 1: 34 % (+10%,not less than 29%) Phase 2: 33 % (±10%) Phase 3: 33 % (±10%)	Phase 1: 20-35 % Phase 2: 30 % (±10%) Phase 3: 45 % (±10%)	Phase 1: 34 % (±10%) Phase 2: 33 % (±10%) Phase 3: 33 % (±10%)
3	Maximum velocity	145 km/h (can exceed by15 km/h for not more than 3% of Phase 3 time)	100 km/h	100km/h (can exceed by 100 km/h for not more than 3% of Phase 3 time)
4	Phase 1 Average Speed	15-40 km/h	NA	15-30 km/h
5	Total trip duration	90 – 120 min		90 – 120 min
6	Minimum Distance	16 km for each Phase	NA	16 km for each Phase

IRDE TRIP REQUIREMENT

(GLOBAL COMPARISON)

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#	Points	EU RDE	Japan RDE	Indian RDE
7	Stop periods	• 6 to 30% of Phase -1 duration • May contain several stop periods of 10 seconds or longer. • Single stop period must not exceed 5 minutes	• 7 to 36% of Phase -1 duration • May contain several stop periods of 10 seconds or longer. • Maximum single stop time is 300 seconds. • Vehicle should not be driven continuously below 20 km/h for more than 20 minutes.	• 6 to 30% of Phase -1 duration • May contain several stop periods of 10 seconds or longer. • Single stop period must not exceed 5 Mins. • Vehicle should not be driven continuously below 20 km/h for more than 20 minutes.
Trip Dynamics				
8	Number of Acceleration points	Minimum 150 (EU Package 3) Minimum 100 (EU Package 4)	Minimum 150 for each phase	Minimum 150 (Phase1, Phase2) Minimum 100 (Phase3)
9	RPA & V*Apos	<u>V*apos_95</u> y = 0.0467x + 12.2490 for Vavg ≤ 56.903 y =0.1665x + 5.4352 for Vavg > 56.903 <u>RPA</u> y = -0.001825x + 0.1755 for Vavg ≤ 55.860 y = -0.0011x + 0.1350 for Vavg > 55.860		

Conformity Factor (CF) Derivation

Limit (For RDE Test) = Limit (Type-1 Test) x Conformity Factor (CF)

Example

NOx BS-VI (Diesel Vehicle) Limit= 80 mg/km

If, CF = 1.5

Then, RDE Limit = 80 mg/km x 1.5 = 120 mg/km

Uncertainty in measurement of PEMS Equipment

Conformity Factor with improvement in PEMS equipment will keep on reducing.

EU BACKGROUND

Conformity Factors

Fuel Type	Pollutants	EU CF (Defined on 20-Apr-2016)		EU CF (Defined on 17-Jun-2017)		EU CF (Defined 05-Nov-2018)
Implementation Date		**Sep. 2017 (NT) Sep. 2019 (AT)**	**Jan. 2020 (NT) Jan. 2021 (AT)**	**Sep. 2017 (NT) Sep. 2019 (AT)**	**Jan. 2020 (NT) Jan. 2021 (AT)**	**Jan. 2020 (NT) Jan. 2021 (AT)**
Gasoline/ CNG Vehicles	NOx	2.1	1.5	2.1	1.5	**1.43**
	PN	TBD	TBD	1.5	1.5	**1.5**
Diesel Vehicles	NOx	2.1	1.5	2.1	1.5	**1.43**
	PN	TBD	TBD	1.5	1.5	**1.5**

REFERENCE REPORTS OF JRC, EUROPE

Timeline of JRC Report Matrix		
Document/Report Reference	**Year Published**	**Final CF Value as per Document/Report**
JRC's Technical Report	Data for 2017 Published in 2018	**NOx CF = 1.43 (Current CF in Europe)**
JRC's Technical Report	Data for 2018-19 Published in 2020	**NOx CF = 1.32 (Proposed)**
JRC's Technical Report	Data for 2020 Published in 2021	**NOx CF = 1.23 (Proposed)** **PN CF = 1.34 (Proposed)**

PHASES DEFINED BY IRDE SUB GROUPS FOR CF DERIVATION STUDY

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After drafting test procedure for IRDE, different studies & experiments were carried out for different parameters for the derivation of the Uncertainty which are as follows:-

Phase-1	Phase-2	Phase-3	Phase-4
Distance Accuracy	EFM Drift	EFM Accuracy	Boundary Condition
Gas Accuracy	EFM Linearity	Analyzer Accuracy	Vibration
Analyzer Linearity		Zero Drift	
Time Alignment		Span Drift	

Note: All above studies has been completed under IRDE committee and data compiled & analysed

1. DISTANCE ACCURACY (PHASE-1)

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Data Information

Data Taken:- **Existing Validation Test Data**

Data Provided By:-

- ICAT
- ARAI
- MSIL
- TATA MOTORS
- M & M

Uncertainty Derived: 0.99 %

Uncertainty (JRC-2017 Report): 4%

Uncertainty (JRC-2021Report): 4%

Uncertainty Proposed (IRDE): 4%

Methodology

- Distance from Chassis Dyno (Reference) & Vehicle OBD was compared.
- A correction factor was derived for correction of OBD distance.
- Corrected OBD distance was compared with GPS Speed.
- Percentage difference of OBD & GPS distance was considered as relative deviation.
- Finally, standard deviation of all data was considered as “Derived Uncertainty”.

Distance Obtained During Correlation Test		Correction factor (Dyno to OBD factor) from dyno Correlation test	OBD Distance From On Road IRDE Trials (In Km)	Corrected OBD Distance From On Road IRDE Trials (In Km)	GPS Distance (In Km)	Absolute Deviation (In Km)	Relative Deviation (In %)
From CD	From Veh. OBD (PEMS)						
X	Y	CF= X/Y	Z	A = CF x Z	B	A-B	(A-B) %

*Reference from AIS 137 Part-3 Chapter-20.

The total trip distance as calculated from the corrected GPS data shall deviate by no more than 4% from the reference. If the GPS data do not meet these requirements and no other reliable speed source is available, the test results shall be voided.

2. GAS ACCURACY (PHASE-1)

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Data Information

Data Taken:- **Directly from Gas Bottles**

Uncertainty Derived: N/A

Uncertainty (JRC-2017 Report): 2%

Uncertainty (JRC-2021 Report): 2%

Uncertainty Proposed (IRDE): 2%

*Reference from AIS 137 Part-3 Chapter-20.

The concentration of the test gas shall be at a level to give a response of approximately 80% of full-scale deflection, for the operating range. The concentration shall be known, to an accuracy of ±2% in reference to a gravimetric standard expressed in volume. In addition, the gas cylinder shall be pre- conditioned for 24 hours at a temperature between 293 K and 303 K (20 and 30 °C).

Methodology

- As per Sub Group Meeting held on 12-Oct-2020, 2% agreed by all members.

- Gas Accuracy:- 2% agreed as per directions of committee. But, sub group members may visit Gas manufacturer's facility before March 2020 to check the process followed by gas bottle manufacturer.

ilac-MRA

Certificate No. TC-7667

INOX AIR PRODUCTS

ULR-TC766720000001321F

IAP-QF-7.8 : Issue No / Dt : 01/21.04.2020, Rev.No/Dt :00/00

CERTIFICATE OF ANALYSIS

Date of Issue : 12.10.2020
Test Item No : IAP-20-21/1092
Report No : 2000002781
Sales Order No : 119543
Material No : FLCALG0007716
Item No. : 000510
Cylinder No : 508976F
Cylinder Capacity : 34.0000
MOC of Cylinder: ALUMINIUM
Valve Type : G 5/8-11H
MOC of Valve : S.S.

Customer Name : Inox Air Products Pvt Ltd.Production Dept.
Address : A/5, M.I.D.C. Industrial Area, Rasayani, Patalganga, 410220.
*Pressure : 140.00 kg/cm2
*Content : 4.83 m3
*Stability : 24 Months
Date Of Analysis : 12.10.2020
*Expiry Date : 12.10.2022
Recom.Usage Temp : 27 DEG.C

CHEMICAL TESTING

GASES

Test Method : ISO 6143: 2001, Gas Analysis Comparison Method

Component	Ordered Concentration	Certified Concentration	Expanded Uncertainty
NITRIC OXIDE	2855 ppm	2840 ppm	+/-1%
PROPANE	2855 ppm	2871 ppm	+/-1%
CARBON MONOXIDE	4.2300 %	4.29 %	+/-1%
CARBON DIOXIDE	17.1000 %	17.02 %	+/-1%
NITROGEN	Balance Gas	Balance Gas	

Traceability

CRM/PRM/No	Expiry Date	Cylinder No	Component	Concentration	Standard	Accuracy
C1713410-26	06.08.2023	D791385	NITRIC OXIDE	2307 PPM	VSL	+/-0.22%
C1713410-14	31.07.2024	D791191	PROPANE	3445 PPM	VSL	+/-0.20%
C1713410-07	02.08.2024	D791160	CARBON MONOXIDE	9.012 %	VSL	+/-0.10%
C1713410-30	01.08.2024	D791180	CARBON DIOXIDE	14.995 %	VSL	+/-0.10%

Other Details

Instrument	Make	Model	Last Calibrated	Principle
NO-NO2- NOX ANALYSER	THERMOFISHER SCIENTIFIC	42I-HL	12.10.2020	CLD
GAS CHROMATOGRAPH	AGILENT	7890B	12.10.2020	GC-FID
CO,CO2 ANALYSER	FISCHER ROSEMOUNT	NGA2000	12.10.2020	NDIR
CO,CO2 ANALYSER	FISCHER ROSEMOUNT	NGA2000	12.10.2020	NDIR

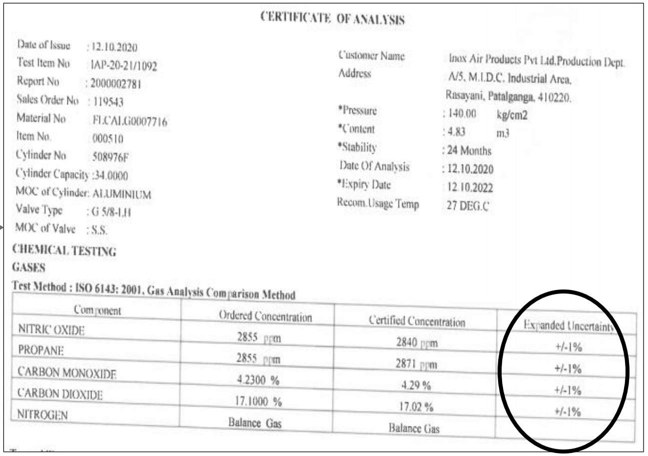
Remarks : In order to obtain accurate results of the analysis it is recommended to use gas Mixture at pressure / weight not less than 5 KG/CM2

Page 1 of 2

INOX Air Products Pvt. Ltd.
An affiliate of Air Products & Chemicals, Inc., USA
CIN: U24999MH1963PTC012625 | inoxairproducts.com
Tel.: +91 22 40323960 Fax: +91 22 40323191

Regd. Office:
7th Floor, Ceejay House,
Dr. Annie Besant Road, Worli,
Mumbai - 400 018. India

Factory :
A/5, M.I.D.C. Industrial Area,
P.O. Patalganga - 410220.
Dist. Raigad, Maharashtra
Tel.: +91 2192 250667,
Tel.: +91 2192 250668,9
E-mail: info@inoxap.com



CERTIFICATE OF ANALYSIS

Date of Issue : 12.10.2020
Test Item No : IAP-20-21/1092
Report No : 2000002781
Sales Order No : 119543
Material No : FLCALG0007716
Item No. : 000510
Cylinder No : 508976F
Cylinder Capacity : 34.0000
MOC of Cylinder: ALUMINIUM
Valve Type : G 5/8-11H
MOC of Valve : S.S.

Customer Name : Inox Air Products Pvt Ltd.Production Dept.
Address : A/5, M.I.D.C. Industrial Area, Rasayani, Patalganga, 410220.
*Pressure : 140.00 kg/cm2
*Content : 4.83 m3
*Stability : 24 Months
Date Of Analysis : 12.10.2020
*Expiry Date : 12.10.2022
Recom.Usage Temp : 27 DEG.C

CHEMICAL TESTING

GASES

Test Method : ISO 6143: 2001, Gas Analysis Comparison Method

Component	Ordered Concentration	Certified Concentration	Expanded Uncertainty
NITRIC OXIDE	2855 ppm	2840 ppm	+/-1%
PROPANE	2855 ppm	2871 ppm	+/-1%
CARBON MONOXIDE	4.2300 %	4.29 %	+/-1%
CARBON DIOXIDE	17.1000 %	17.02 %	+/-1%
NITROGEN	Balance Gas	Balance Gas	

3. ANALYZER LINEARITY (PHASE-1)

Innovation • Service • Excellence

Data Information

Data Taken:- **From Analyzer Linearity Certificates.**

Data Provided By:-

- ICAT
- ARAI
- MSIL
- TATA MOTORS
- M & M

Uncertainty Derived: 0.13%

Uncertainty (JRC-2017 Report): 1%

Uncertainty (JRC-2021 Report): 1%

Uncertainty Proposed (IRDE): 1%

Methodology

- The value for Standard Error of estimate(SEE) was taken from Calibration certificates.
- In case of HORIBA, SEE was calculated.
- The standard deviation of all the SEE values was taken as uncertainty due to analyzer Linearity.

HORIBA

Current Data Set				Current Curve		
Point #	Cut [%]	Gen. Conc. [ppm]	Z/S Adj. Counts	Measured Conc. [ppm]	Error [%]	Status
1	100.0	475.0	128520	475.0	0.00(PT)	Pass
2	90.0	427.5	115773	427.9	0.01(FS)	Pass
3	80.0	380.0	102862	380.5	0.02(FS)	Pass
4	70.0	332.5	89918	332.9	0.01(FS)	Pass
5	60.0	285.0	77008	285.2	0.01(FS)	Pass
6	50.0	237.5	64018	237.3	-0.01(FS)	Pass
7	40.0	190.0	51079	189.2	-0.03(FS)	Pass
8	30.0	142.5	38189	141.4	-0.04(FS)	Pass
9	20.0	95.00	25324	93.81	-0.04(FS)	Pass
10	10.0	47.50	12667	46.82	-0.02(FS)	Pass
11	0.0	0.000	82	0.000	0.00(FS)	Pass

Yi	Y'	(Yi-Y')	(Yi-Y')²
498	498	0	0
445.4	448.2	-2.8	7.84
394.7	398.4	-3.7	13.69
345	348.6	-3.6	12.96
295.4	298.8	-3.4	11.56
246.2	249	-2.8	7.84
196.4	199.2	-2.8	7.84
146.9	149.4	-2.5	6.25
97.19	99.6	-2.41	5.8081
48.44	49.8	-1.36	1.8496
0	0	0	0
		∑i=1, n (Yi-Y')²	75.6377
		n	11
		n-2	9
		x_{max}	498
		$1/x_{max}$	0.002008032
	∑i=1, n (Yi-Y')² / (n-2)		8.404188889
	SQRT ∑i=1, n (Yi-Y')² / (n-2)		2.898997911
	1/ x_{max} x SQRT ∑i=1, n (Yi-Y')² / (n-2)		0.005821281

AVL

Test results		
Description	**Calculated**	**Limits**
a1 slope	1.0013	a1 = 1.0013 (0.990 - 1.010 mandatory)
|Xmin(a1-1)+a0|	0.3707	|Xmin(a1-1)+a0| = 0.3707 <=0.5% of analyzer range 12.5/2500
SEE	0.0011	SEE = 0.0011 <= 1% of analyzer range 25/2500
r2 coefficient of det.	1.0000	R² = 1.0000 (>= 0.998 mandatory)
Min. number points	10	10 points - min. 10 points
Per point. dev.	PASSED	<= 2% of ref. or <= 0.3 % FS 7.5/2500 FS

*Reference from AIS 137 Part-3 Chapter-20.

Measurement parameter/ instrument	$\|\chi_{min} \times (a_1 - 1) + a_0\|$	Slope a_1	Standard error SEE	Coefficient of determination (r^2)
Gas analysers	≤0.5% max	0.99 - 1.01	≤1%	≥0.998

4. TIME ALIGNMENT (PHASE-1)

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Data Information

Data Taken:-**Existing Validation Test Data**

Data Provided By:-

- ICAT
- ARAI
- MSIL
- TATA MOTORS
- M & M

Uncertainty Derived: 2.55%

Uncertainty (JRC-2017 Report): 3%

Uncertainty(JRC-2021 Report): 3%

Uncertainty Proposed (IRDE): 3%

*Reference from JRC Report (2017)

The time alignment/dynamics uncertainty was kept 3%. Similar values were found from the limited number of real time data received in 2017 (all were laboratory tests, no tests from the road) (no figure shown).

Methodology

•The data of RDE tests and the validation tests were collected and the analysis was done.

•The variation for the RAW NOx value for the total trip was calculated and its standard deviation was considered as the uncertainty due to Time Alignment.

Emission

	Total Mass	Unit	Mass / Distance	Unit
CO	8.237	g	0.1192	g/km
CO2	7988	g	115.6	g/km
THC	---	g	---	g/km
CH4	---	g	---	g/km
NMHC	---	g	---	g/km
NO (*1)	8.059	g	0.1166	g/km
NO2 (*2)	17.67	g	0.2557	g/km
NOx	25.72	g	0.3723	g/km
NOxCorre	---	g	---	g/km
PM	---	g	---	g/km
PN	1.11E10	#	1.61E8	#/km

→

Nox (MAW) at time alignment -3 to +3

	Phase-1	Total
-3.0		0.3635
-2.0		0.3681
-1.0		0.3719
0.0		0.3723
1.0		0.3686
2.0		0.3638
3.0		0.3600

→

NOx (MAW) at time alignment -3 to +3 (in %)

	P1	Total
-3.0		-2.36
-2.0		-1.13
-1.0		-0.11
0.0		0.00
1.0		-0.99
2.0		-2.28
3.0		-3.30

All data (±1sec) with Modulus (As recommended/followed by JRC)	**1.98%**
All data (±3 sec) with Modulus	**2.55%**

5. EFM DRIFT (PHASE-2)

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Data Information

Data Taken:- **From EFM Calibration Certificates.**

Data Provided By:-

- AVL
- HORIBA
- SENSORS

Uncertainty Derived: 0.86 %

Uncertainty (JRC-2017 Report): 2%

Uncertainty (JRC-2021 Report): 2%

Uncertainty Proposed (IRDE): 2%

*Reference from AIS 137 Part-3 Chapter-20.

The span response drift is defined as the mean response to a span flow during a time interval of at least 30 s. The span response drift can be verified based on the reported primary signals, e.g., pressure. The drift of the primary signals over a period of 4 h shall be less than ± 2 % of the maximum value of the primary signal recorded at the flow at which the EFM was calibrated.

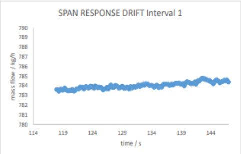
Methodology

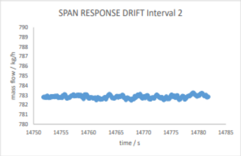
- Percentage deviation of EFM span drift was calculated in case of Sensors PEMS.
- For calculating its Uncertainty the standard deviation of this data was taken.

AVL

7.2.7. Span response drift: Span response is defined as the mean response to a span flow during a time interval of at least 30 seconds. The span response drift can be verified based on the reported primary signals, e.g. pressure. The drift of the primary signals over a period of 4 hours shall be less than ± 2 per cent of the maximum value of the primary signal recorded at the flow at which the EFM was calibrated

➔ **OK: Please refer to each measuring point below**





Calculated mean values for the interval 1 and 2:

$\overline{X_1} = 784.0528 \frac{kg}{h}$

$\overline{X_2} = 782.8301 \frac{kg}{h}$

$(\overline{X_1} - \overline{X_2}) = 1.2227 \frac{kg}{h} \leq \pm 2\% \, M_{max} = 15.69622 \frac{kg}{h}$

AVL EFM_EU_2016-427 2017.docx Date: 01/02/2017 Page 6/8

HORIBA

5.1.5 Nullpunktdriftprüfung / *Zero Drift Check*:
- **Reg. (EU) 2017/1151, Ann. IIIA, App. 2, § 7.2.6.**

Anforderungen erfüllt / *Requirements fulfilled*:

≤ ± 2% des kalibrierten Höchstdurchsatzes über 4 Stunden / *of calibrated max. flow over 4 hours*

5.1.6 Justierausschlagdriftprüfung / *Spandrift Check*:
- **Reg. (EU) 2017/1151, Ann. IIIA, App. 2, § 7.2.7.**

Anforderung erfüllt / *Requirements fulfilled*

≤ ± 2% des kalibrierten Höchstdurchsatzes über 4 Stunden / *of calibrated max. flow over 4 hours*

SENSORS

Calculated based on data of drift check provided by SENSORS

6. EFM LINEARITY (PHASE-2)

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Data Information

Data Taken:- **From EFM Calibration Certificates**.

Data Provided By:-

- AVL
- HORIBA
- SENSORS

Uncertainty Derived: 0.088 %

Uncertainty (JRC-2017 Report): 2%

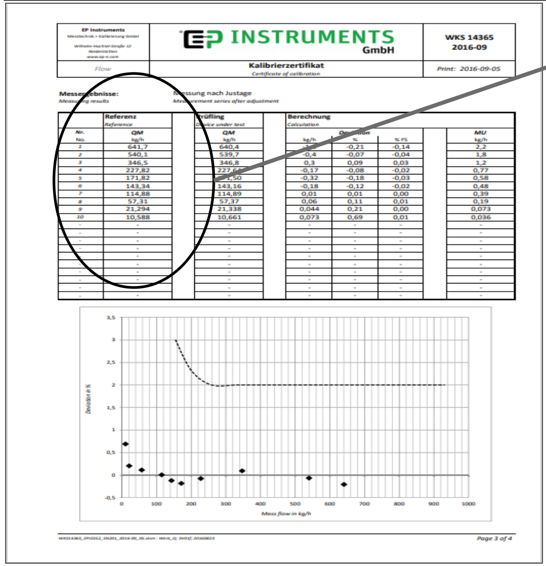
Uncertainty (JRC-2021 Report): 2%

Uncertainty Proposed (IRDE):- 2%

Methodology

- The value for Standard Error of estimate(SEE) was taken from Calibration certificates.
- In case of AVL, SEE was calculated.
- The standard deviation of all the SEE values was taken as uncertainty due to EFM Linearity.

AVL EFM LINEARITY CERTIFICATE



Yi	Y'	(Yi-Y')	$(Yi-Y')^2$
641.70	640.40	1.3	1.69
540.10	539.70	0.4	0.16
346.50	346.80	-0.3	0.09
227.82	227.64	0.18	0.0324
171.82	171.50	0.32	0.1024
143.34	143.16	0.18	0.0324
114.88	114.89	-0.01	0.0001
57.31	57.37	-0.06	0.0036
21.29	21.34	-0.048	0.002304
10.58	10.66	-0.081	0.006561
0	0	0	0
		$\sum i=1, n\ (Yi-Y')^2$	2.119765
		n	10
		n-2	8
		x_{max}	581.3
		$1/x_{max}$	0.001720282
	$\sum i=1, n\ (Yi-Y')^2 / (n-2)$		0.264970625
	SQRT $\sum i=1, n\ (Yi-Y')^2 / (n-2)$		0.514752975
	$1/x_{max}$ x SQRT $\sum i=1, n\ (Yi-Y')^2 / (n-2)$		0.00088552

7. EFM ACCURACY (PHASE-3)

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Data Information

Data Taken:- **From Calibration Certificates.**

Data Provided By:-

- ICAT
- AVL
- HORIBA
- SENSORS

Uncertainty Derived: 6.5%

Uncertainty (JRC-2017 Report): 9.6%

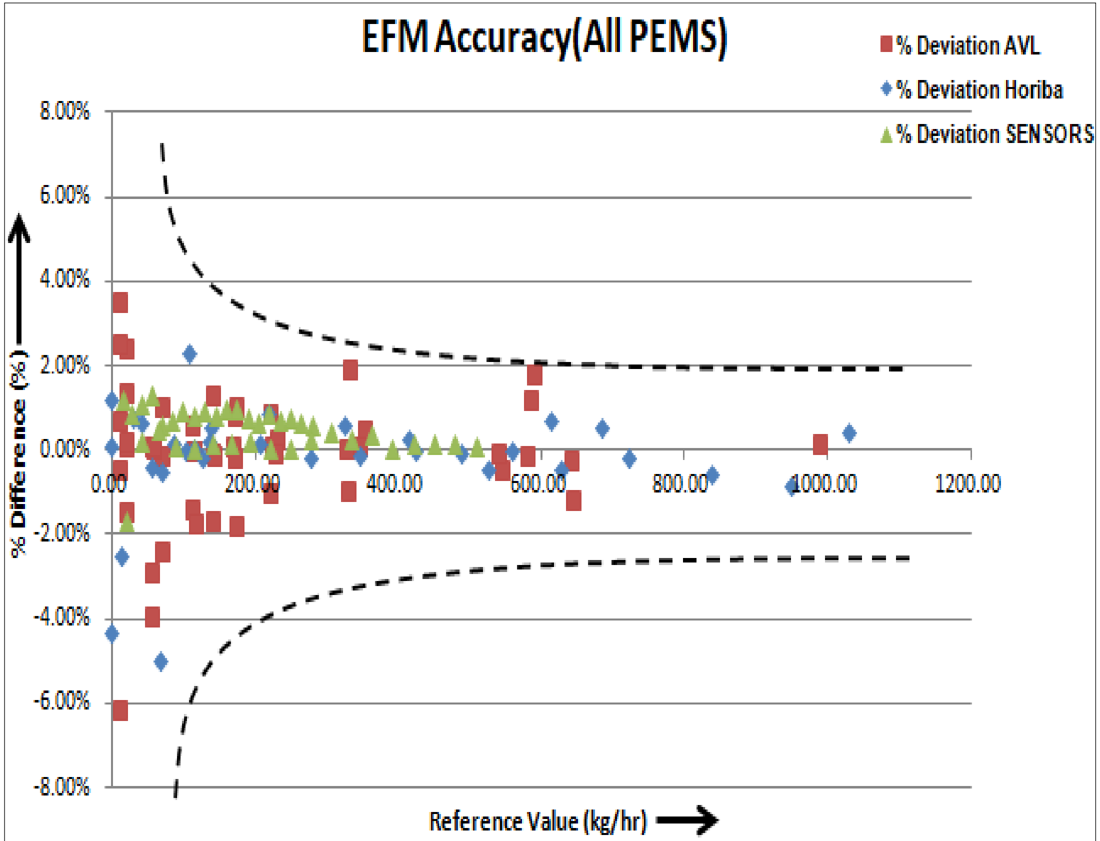
Uncertainty (JRC-2021 Report): 7.5%

Uncertainty Proposed (IRDE):- 9.6%

Methodology

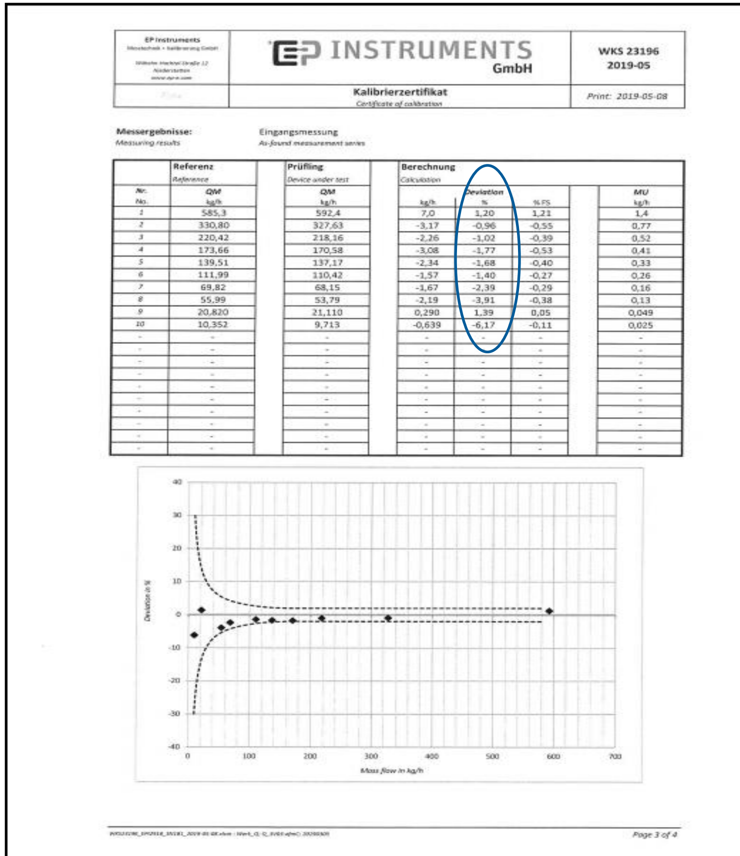
1. **Based on the Calibration Certificates** – In this method, the EFM Linearity Certificates are taken and its % deviation is calculated with respect to its standard flow for each type of EFM at each Flow.
2. It was found that the deviation was large at lower flow rates and small at high flow rates. Thus, the worst value was considered as Uncertainty.

7. EFM ACCURACY (USING CAL CERTIFICATES)



• Graph plotted between Reference Flow rate vs deviation in percentage.

• Values Taken from the Linearity Certificates.



EP INSTRUMENTS GmbH

WKS 23196
2019-05

Kalibrierzertifikat
Certificate of calibration

Print: 2019-05-08

Messergebnisse: *Measuring results*

Eingangsmessung *As-found measurement series*

	Referenz *Reference*	Prüfling *Device under test*	Berechnung *Calculation*			MU
Nr. No.	QM kg/h	QM kg/h	kg/h	Deviation %	% FS	kg/h
1	585,3	592,4	7,0	1,20	1,21	1,4
2	330,80	327,63	-3,17	-0,96	-0,55	0,77
3	220,42	218,16	-2,26	-1,02	-0,39	0,52
4	173,66	170,58	-3,08	-1,77	-0,53	0,41
5	139,51	137,17	-2,34	-1,68	-0,40	0,33
6	111,99	110,42	-1,57	-1,40	-0,27	0,26
7	69,82	68,15	-1,67	-2,39	-0,29	0,16
8	55,99	53,79	-2,19	-3,91	-0,38	0,13
9	20,820	21,110	0,290	1,39	0,05	0,049
10	10,352	9,713	-0,639	-6,17	-0,11	0,025
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

Page 3 of 4

8. ANALYZER ACCURACY (PHASE-3)

Innovation • Service • Excellence

Data Information

Data Taken:- **Through Special Benchmarking Experimentation**

Data Provided By:-

- ICAT
- ARAI

Uncertainty Derived: 0.73%

Uncertainty (JRC-2017 Report): 2%

Uncertainty (JRC-2021 Report): 2%

Uncertainty Proposed (IRDE):- 2%

*Reference from Regulation AIS137 Part-3, Ch-20

4.2.2. **Accuracy**

The accuracy, defined as the deviation of the analyser reading from the reference value, shall not exceed 2 % of reading or 0.3 % of full scale, whichever is larger.

Methodology

- ICAT derived the methodology to calculate the uncertainty due to Analyzer Accuracy.
- NOx gas was passed through the PEMS and the Raw Analyzer simultaneously.
- Both readings were taken for Zero and Span (NOx) and the deviation was calculated for all readings.
- The Standard deviation of it was calculated as the Uncertainty.

NOx Concentration (NOx = 466 ppm)					
Reading	PEMS (HORIBA)		Raw Analyser (HORIBA)		% Diff.
	Zero	Span	Zero	Span	
1	X1	Y1	X2	Y2	(Y1-Y2)/Y2*100
Ex=	0.0	466.6	0.0	467.4	-0.17%

9. ZERO DRIFT (PHASE-3)

Data Information

Data Taken:- **Through experimentation.**

Data Provided By:-

- ICAT
- TATA

Uncertainty Derived: 4 mg/km – Zero drift; 2 mg/km – Worst Case drift

Uncertainty Derived: 11 mg/km – Zero drift; 4 mg/km – Worst Case Drift
(Considering 5ppm as per reg.)

Uncertainty (JRC-2017 Report): 15 mg/km – Zero drift; 10 mg/km – Worst Case Drift

Uncertainty (JRC-2021 Report): 16 mg/km

Uncertainty Proposed (IRDE): 15 mg/km Zero drift; 10 mg/km Worst Case Drift

Methodology

- The PEMS unit was installed on-board of the vehicles.
- The standard Pre and Post Test procedures were systematically followed.
- A nitrogen (N_2) bottle was placed on-board the vehicle.
- The PEMS was set to sample from the vehicle exhaust following the regulated procedures.
- At regular intervals of 10-15 minutes , Zero checks were performed while the vehicle was running through a predefined route.
- Therefore, zero drift was calculated with the help of the readings taken.

*Reference from Regulation AIS137 Part-3, Ch-20

Permissible Analyser Drift Over a PEMS Test

Pollutant	Absolute Zero response drift	Absolute Span response drift (1)
CO_2	≤2000 ppm per test	≤2% of reading or ≤2000 ppm per test, whichever is larger
CO	≤75 ppm per test	≤2% of reading or ≤75 ppm, per test, whichever is larger
NO_X	≤5 ppm per test	≤2% of reading or ≤5 ppm per test, whichever is larger

10. SPAN DRIFT (PHASE-3)

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Data Information

Data Taken:- **Through experimentation.**

Data Provided By:-

- ICAT
- TATA

Uncertainty Derived: 0.54%

Uncertainty (JRC-2017 Report): 2%

Uncertainty (JRC-2021 Report): 2%

Uncertainty Proposed (IRDE): 2%

Methodology

- As similar to the Zero drift, the PEMS unit was installed on-board of the vehicles.
- The standard Pre and Post Test procedures were systematically followed.
- A Mixed Span Gas bottle (NOx) was placed on-board the vehicle.
- The PEMS was set to sample from the vehicle exhaust following the regulated procedures.
- At regular intervals of 10-15 minutes , zero checks were performed while the vehicle was running through a predefined route.
- Therefore, span drift was calculated with the help of the readings taken.

*Reference from Regulation AIS137 Part-3, Ch-20

Permissible Analyser Drift Over a PEMS Test

Pollutant	Absolute Zero response drift	Absolute Span response drift (1)
CO_2	≤2000 ppm per test	≤2% of reading or ≤2000 ppm per test, whichever is larger
CO	≤75 ppm per test	≤2% of reading or ≤75 ppm, per test, whichever is larger
NO_X	≤5 ppm per test	≤2% of reading or ≤5 ppm per test, whichever is larger

11. BOUNDARY CONDITION (INDIA SPECIFIC) (PHASE-4)

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Data Information

Data Taken:- **Through Experimentation.**

Data Provided By:-

- ICAT
- ARAI

Uncertainty Derived: 0.52%

Uncertainty (JRC-2017 Report): 0%

Uncertainty (JRC-2021 Report): 0%

Uncertainty Proposed (IRDE): 0%

As result was within analyser accuracy specified in regulation.

Methodology

- To check the analyzer behaviour in stringent ambient conditions, the analyzer was operated and its Zero and Span drift was checked at different temperatures.
- For this, the equipment was installed in climatic chamber and set to measurement.
- The Pre and Post test was performed at normal room temperature.
- After Calibration, the temperature was increased by 5˚C and the readings for Zero and Span (NOx) was taken.
- The readings taken at maximum temperature was at 45˚C and minimum at 10˚C.
- The deviation between the actual concentration and given value was calculated.

12. VIBRATION (INDIA SPECIFIC) (PHASE-4)

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Data Information

Data Taken:- **Through Experimentation.**

Data Provided By:-

- ICAT

Uncertainty Derived: 0.30%

Uncertainty (JRC-2017 Report):-

Not Considered by JRC.

Uncertainty (JRC-2021 Report):-

Not Considered by JRC.

Uncertainty Proposed: 0%

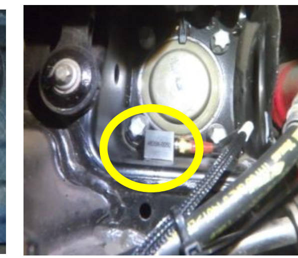
As result was within analyser accuracy specified in regulation.

Methodology

- The effect of the vibration was analysed by checking the drift of Zero and Span gas while keeping the PEMS on a vibration simulating (MAST) bench.
- For this, the collection of data of vibration was done through a Data Acquisition system.
- For this, accelerometer sensors were mounted on the vehicle at different points like in boot space(1), wheel centre(2), Suspension top(3), PEMS(4).
- Then, the vehicle was taken on the RDE compliant route and was driven for the whole test.

Accelerometer-1

Accelerometer-2



Accelerometer-3

Accelerometer-4

12. VIBRATION (PHASE-4)

• After collecting the data the PEMS was mounted on the MAST Bench and the data collected on road was simulated on the bench.

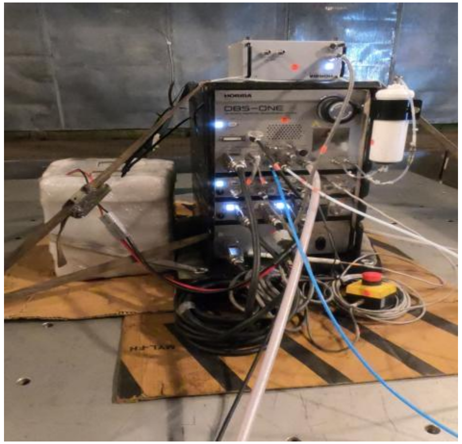
• The readings for Zero and Span (NOx) were taken at an interval of 5 minutes.

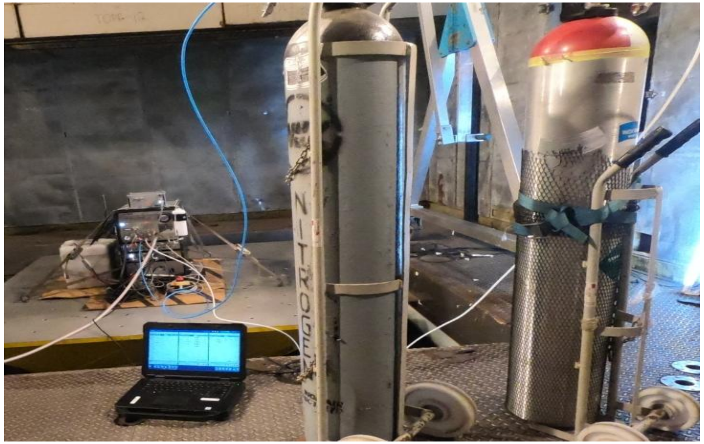
• The Pre and Post test was conducted normally.

•After taking the readings for Zero and Span, the worst value of it was taken and it was observed that it is well within the Analyzer's accuracy requirements.

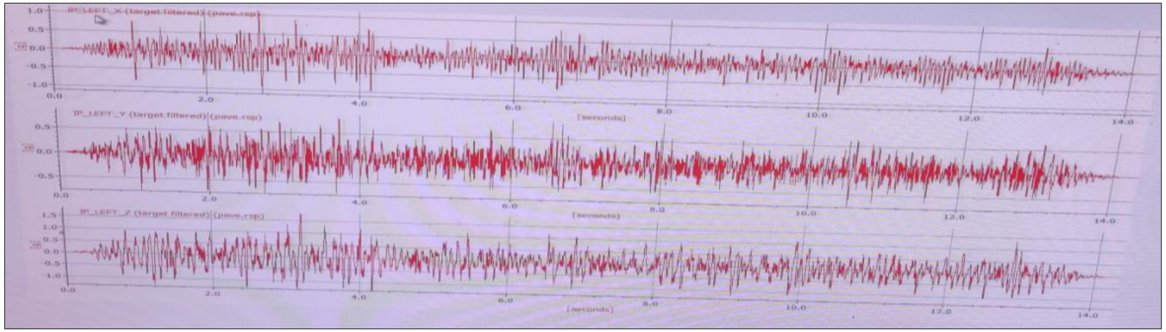
• Since, it is having no effect on the analyzer, therefore, it can neglected.

Test setup on MAST Bench



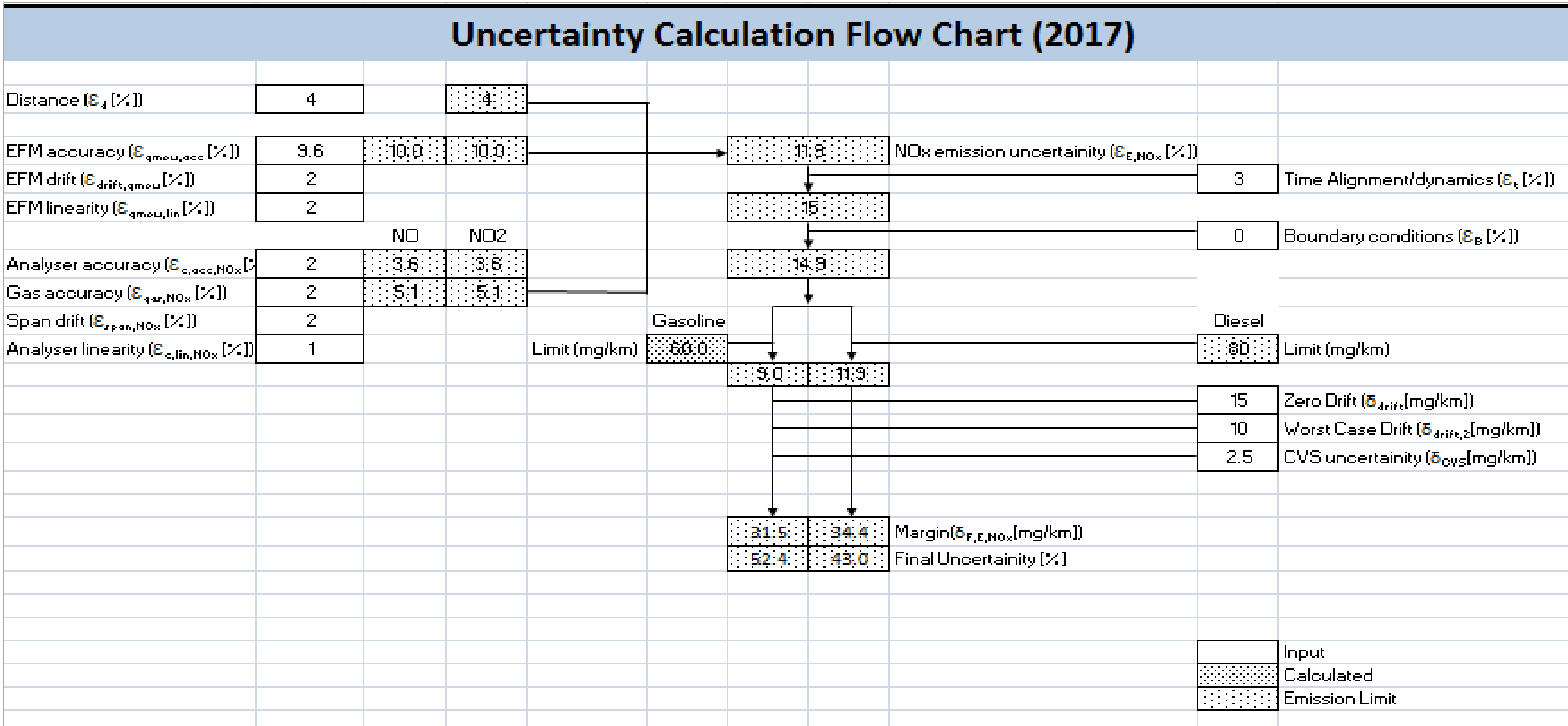


Vibration cycle profile



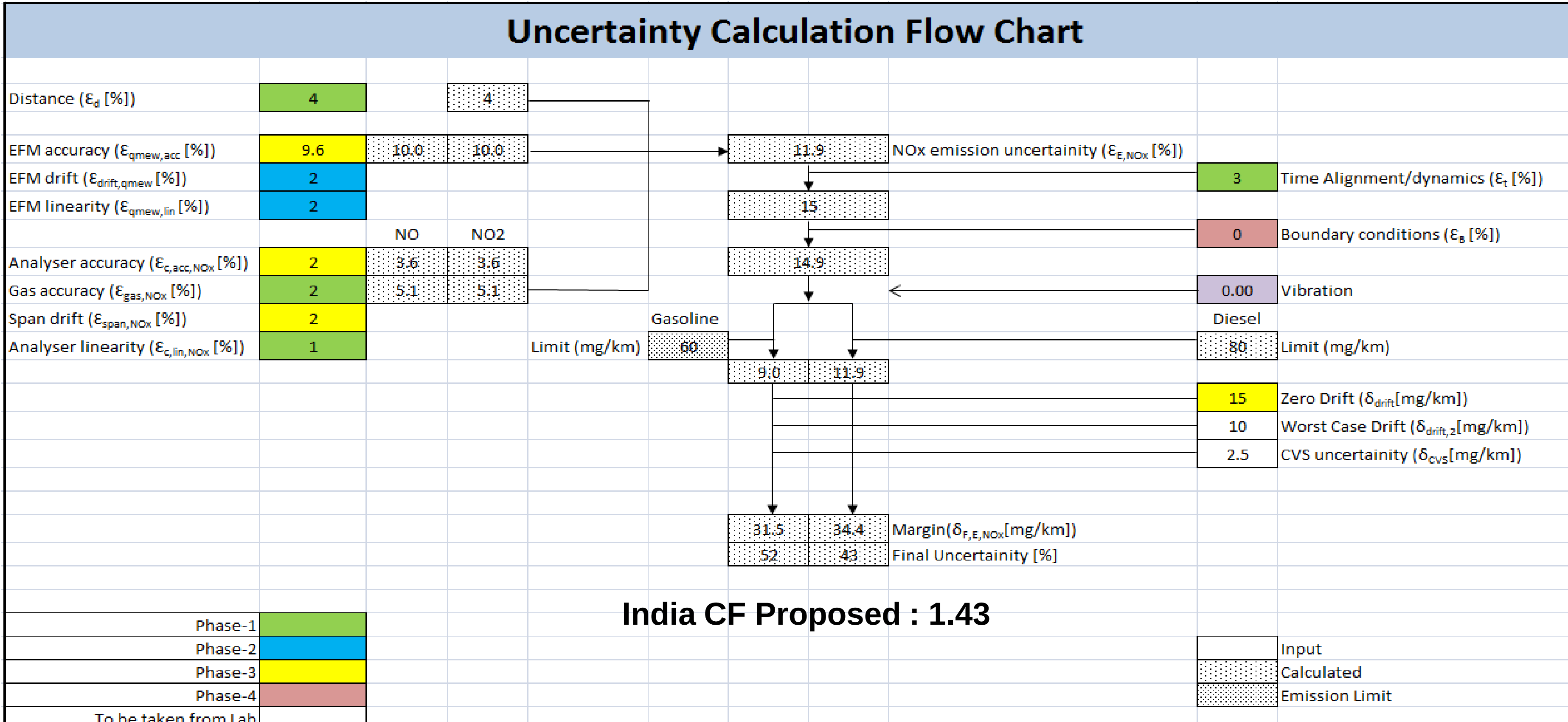
FLOW CHART

Europe Uncertainty Flow Chart as per JRC 2017 Report



FLOW CHART

Indian Uncertainty Flow Chart 2021_Proposed

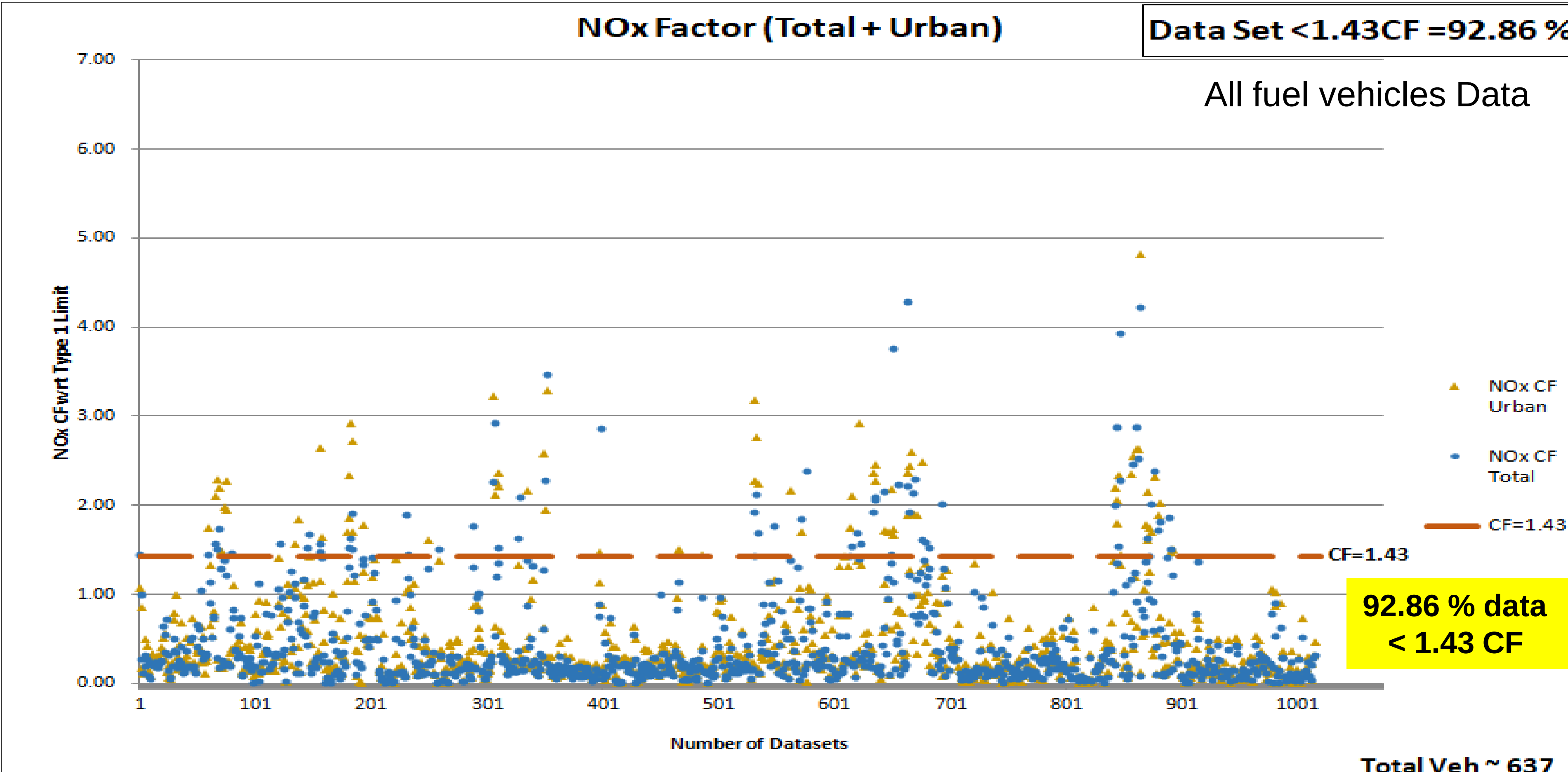


Monitoring Phase “CF Data” analysis for Industry

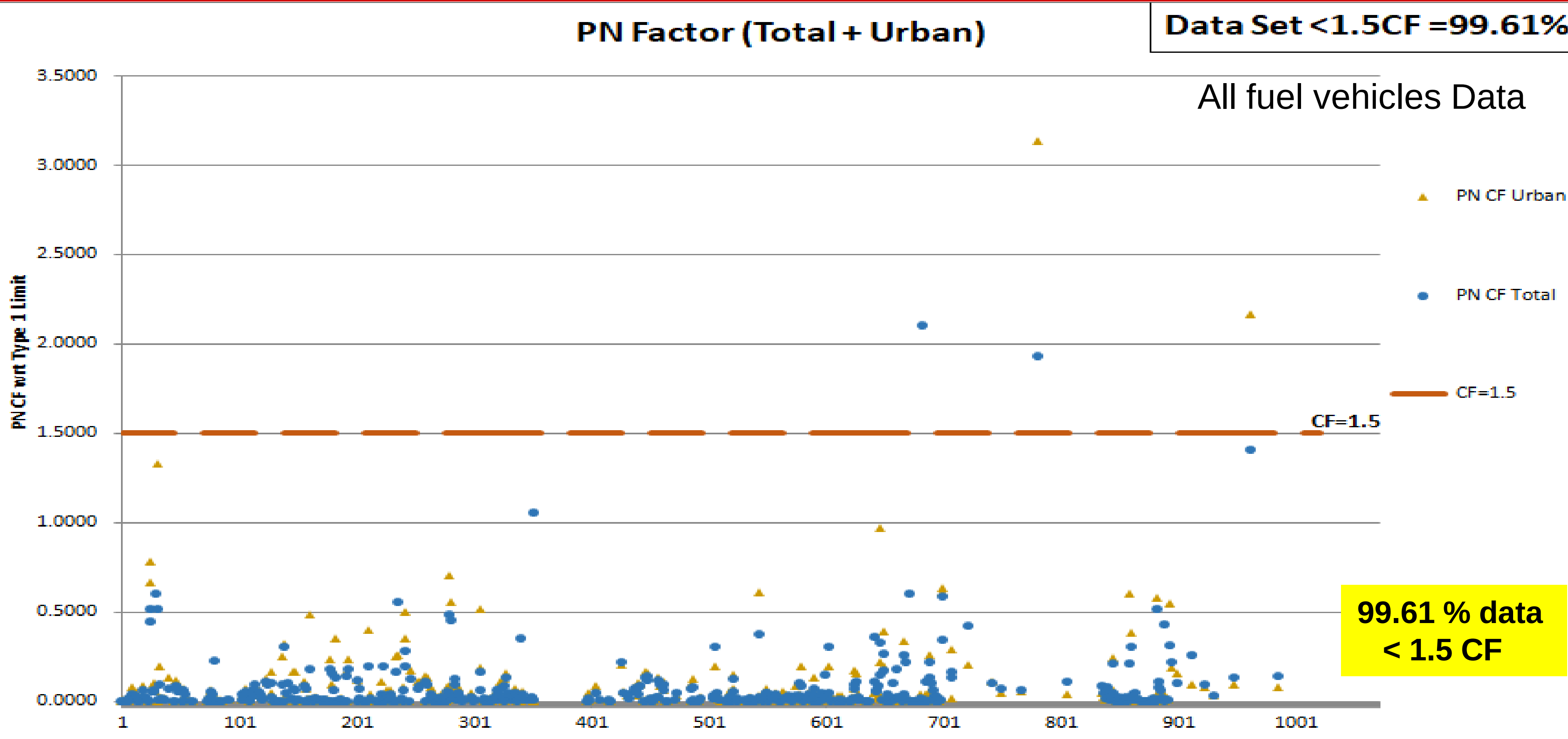
(ICAT & ARAI)

(Less than 3.5 Ton)

Monitoring Phase Data – Industry
(ICAT & ARAI)



Monitoring Phase Data – Industry
(ICAT & ARAI)



CF Proposal for India

Conformity Factors							
Fuel Type	**Pollutants**	**EU CF (Defined on 20-Apr-2016)**		**EU CF (Defined on 17-Jun-2017)**		**EU CF (Defined 05-Nov-2018)**	**Proposal for INDIA**
Implementation Date		**Sep. 2017 (NT) Sep. 2019 (AT)**	**Jan. 2020 (NT) Jan. 2021 (AT)**	**Sep. 2017 (NT) Sep. 2019 (AT)**	**Jan. 2020 (NT) Jan. 2021 (AT)**	**Jan. 2020 (NT) Jan. 2021 (AT)**	**Apr. 2023**
Gasoline/ CNG Vehicles	NOx	2.1	1.5	2.1	1.5	**1.43**	***1.43**
	PN	TBD	TBD	1.5	1.5	**1.5**	**1.5**
Diesel Vehicles	NOx	2.1	1.5	2.1	1.5	**1.43**	**1.43**
	PN	TBD	TBD	1.5	1.5	**1.5**	**1.5**

**** Applicable for Gasoline Direct Injection (GDI) Only***

GLOBAL TECHNICAL REGULATION (GTR) ON RDE

Innovation • Service • Excellence

- In its June 2018 session, WP.29 decided to set up an informal group under GRPE to prepare, within the coming years, a GTR on Real Driving Emissions procedure.

- The goal of the informal group was to prepare and propose to GRPE, for its June 2020 session a draft text of an RDE GTR, including suggestions for the organization of the future work.

- The mandate for the informal group was limited, in a first step, to June 2020, but may need to be extended to work on additional items.

- 15 informal group meetings held where contracting parties shared country specific data for evolving Global RDE and the work is under progress.

- Lately, group decided to start work on Phase-2 and current draft text was tittle as Phase-1, which included India specific points.

Key inclusions from India as CP in GTR on RDE

- Addition of M1/N1 Low Powered category, which is specific to India.
- Trip requirements were proposed as per Indian RDE.
- Trip Dynamics were proposed as per Indian RDE.
- Evaluation of windows proposed as per WLTC 3-Phase (India).
- Reference CO_2 Mass values were kept open for future validation on WLTP.
- For final RDE Emission result calculation, India proposed to use calculation as per RDE Package-4, as & when India will shift to WLTP from MIDC.

WLTP RDE (AIS-175) STATUS

- In 61st SCOE Meeting, different sub committee's were formulated to start WLTP activity in India.
- WLTP RDE Sub committee was assigned to ICAT which has started its work.
- Committee has published final draft IRDE WLTP Document on 19-Jul-2022 after several deliberations.
- The same would be incorporated in AIS-175 document.

SUMMARY

- IRDE Committee had laid down test procedure in year 2018 : Phase 1
- Based on experimentation & existing data IRDE Committee has worked out the CF for vehicle less than 3.5 tons : Phase 2
- Analysis of Monitoring Phase data of IRDE was done by the IRDE committee
- IRDE Committee forwarded the recommendation to MoRTH and final notification on the same is awaited.
- Global RDE Phase-1 concluded in draft stage with India Specific inputs. Phase-2 work is expected to commence soon by GRPE.
- WLTP IRDE Final Draft released on Jul' 2022.

THANK YOU