Technical Report

DKR-AUT-GNR-2020-028

Uniform Provisions Concerning The Approval Of;
Motor Vehicles Having At Least Four Wheels With Regard To Their Sound Emissions

Test standard
ECE Regulation 51
Level of amendment
03 Series, Supplement 1
(08.10.2016)

Approval Status	
☐	Granting of a type approval:
☐	Extension to type approval number:
☐	Correction to type approval number:
☒	Only test report:

1 General

1.1	Make:	BMW
1.2	VIN Number	WBAAB21000EA22785
1.3	Commercial description:	3.16iA
1.4	Category of vehicle:	M1
1.5	Applicant of testing:	DELTA Plastik Makine San. Ve Tic. Ltd. Şti. Sümer Mah. 30.Sokak No:29 TR-Zeytinburnu / Istanbul

1.7 Equipment for measuring and testing

Parameter of the test area	27 °C, %45 Humidity and clean

1.8 Calibration Equipments

Test Instrument	**Type**	**Manufacturer**	**ID - No.**	
Noise meter	2250	Brel&Kjaer	AUTO-07	☒
Tape measure	--	FISCO	AUTO-015	☒
Anomemeter	20032316141200	Benetech	AUTO-06	☒
Tyre pressure	--	CEM	AUTO-10	☒
Humidity&Temp. Meter	--	CEM	AUTO-08	☒

LIST OF ANNEXES		
Annex	**No of Pages**	**Subject**
1	--	--
2	--	--

TEST SPECIFICATION AND WORST CASE RATIONALE

There is not any worstcase scenario.That report had been prepared according to applicant demand. There are engine air filter and that report show how is the result with that product according to regulation rules.

Test required

- Vehicle inspection
- Visual inspection

MANUFACTURER'S DOCUMENTATION Manufacturer's documentation is complete and reflects the agreed specification for the component tested and covers all variants and versions agreed in the worse case rationale	**Not applicable**

Vehicle Category	*Vehicles used for the Carriage of Passengers*	*Limit Values (dB(A))*		
		Phase 1	*Phase 2*	*Phase 3*
M_1	PMR ≤ 120	72	70	68
	120 < PMR ≤ 160	73	71	69
	PMR > 160	75	73	71
	PMR > 200, no. of seats ≤ 4, R-point height < 450mm from the ground	75	74	72
M_2	M ≤ 2.5t	72	70	69
	2.5t < M ≤ 3.5t	74	72	71
	M > 3.5t; P_n ≤ 135kW	75	73	72
	M > 3.5t; P_n > 135kW	75	74	72
M_3	Pn ≤ 150kW	76	74	73
	150kW < P_n ≤ 250kW	78	77	76
	P_n > 250kW	80	78	77
Vehicle Category	*Vehicles used for the carriage of goods*	*Phase 1*	*Phase 2*	*Phase 3*
N_1	M ≤ 2.5t	72	71	69
	M > 2.5 t	74	73	71
N_2	Pn ≤ 135kW	77	75	74
	Pn > 135 kW	78	76	75
N_3	P_n ≤ 150kW	79	77	76
	150kW < P_n ≤ 250kW	81	79	77
	P_n > 250kW	82	81	79

1. Test Report

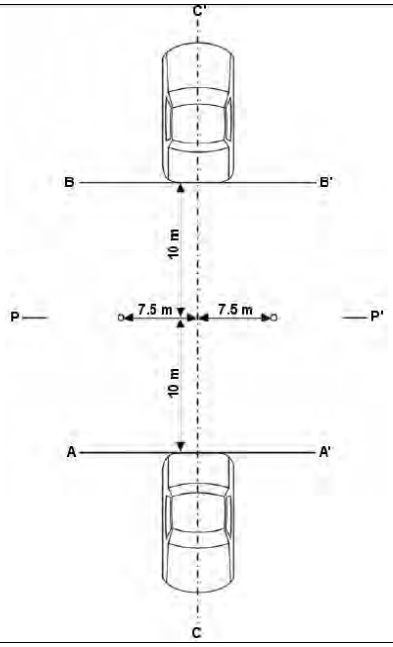
Test vehicle specification and worst case rationale

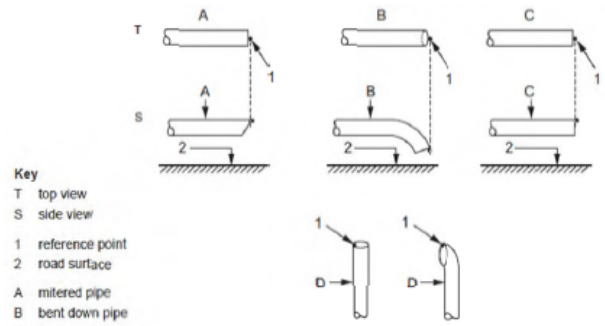
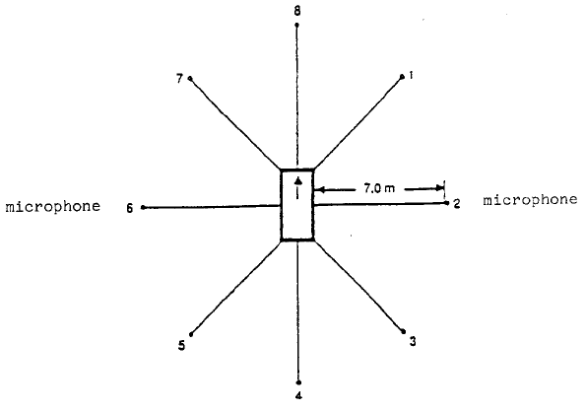
Commercial description:	3.16iA
Vehicle identification number:	WBAAB21000EA22785
Vehicle category:	M1
Dimension of the tyres:	215/40ZR 16
Number of passenger seat:	4
Engine capacity:	1590 cc

Clause	Requirements	Results
6.	**Specificatons**	
6.1.	**General Specifications**	
6.1.1.	The vehicle, its engine and its sound reduction system shall be so designed, constructed and assembled as to enable the vehicle, in normal use, despite the vibration to which it may be subjected, to comply with the provisions of this Regulation	Fulfilled
6.1.2.	The sound reduction system shall be so designed, constructed and assembled as to be able to reasonably resist the corrosive phenomena to which it is exposed having regard to the conditions of use of the vehicle, including regional climate differences.	Fulfilled
6.2.	**Specifications Regarding Sound Levels**	
6.2.1.	**Methods of Measurement**	
6.2.1.1.	In the case of a hybrid electrical vehicle of Category M1 where an internal combustion engine cannot operate when the vehicle is stationary, the emitted sound shall be measured according to Annex 3, Paragraph 4. Vehicles having a technically maximum permissible laden mass exceeding 2,800kg shall be subjected to an additional measurement of the compressed air noise with the vehicle stationary in accordance with the specifications of Annex 5, if the corresponding brake equipment is part of the vehicle.	Not applicable
6.2.2.1.	For vehicle types of Category M1 derived from N1 vehicle types having a technically permissible maximum laden mass above 2.5t and a R-point height greater than 850mm from the ground, the limits of vehicles types of Category N1 having a technically permissible maximum laden mass above 2.5t apply.	Not applicable
6.2.2.2.	For vehicle types designed for off-road(1) use, the limit values shall be increased by 2dB(A) for M3 and N3 vehicles category and 1dB(A) for any other vehicle category	Not applicable

<table>
<tr><td>6.2.2.4.</td><td>For vehicle types of Category M3 having a gasoline only engine, the applicable limit value is increased by 2dB(A).</td><td>Not applicable</td></tr>
<tr><td>6.2.2.5.</td><td>For vehicle types of Category N1 having a technically permissible maximum laden mass of less than or equal to 2.5t, the engine capacity not exceeding 660cc and the power-to-mass ratio (PMR) calculated by using the technically permissible maximum laden mass not exceeding 35 and a horizontal distance "d" between the front axle and the driver's seat R point of less than 1,100mm, the limits of the vehicle types of Category N1 having a technically permissible maximum laden mass above 2.5t apply.</td><td>Not applicable</td></tr>
<tr><td>Annex 3
İtem 2</td><td>Conditions of Measurement</td><td></td></tr>
<tr><td>2.1.</td><td>Test Site and Ambient Conditions</td><td></td></tr>
<tr><td></td><td>The meteorological instrumentation should be positioned adjacent to the test area at a height of 1.2m ± 0.02m. The measurements shall be made when the ambient air temperature is within the range from 5°C to 40°C.</td><td>Fulfilled</td></tr>
<tr><td></td><td>The tests shall not be carried out if the wind speed, including gusts, at microphone height exceeds 5 m/s, during the sound measurement interval.</td><td>Fulfilled</td></tr>
<tr><td></td><td>The background noise shall be measured for duration of 10s immediately before and after a series of vehicle tests.</td><td>Fulfilled</td></tr>
<tr><td></td><td><table>
<tr><td>Difference between ambient noise and sound to be measured dB(A)</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr>
<tr><td>Correction dB(A)</td><td>0.5</td><td>0.4</td><td>0.3</td><td>0.2</td><td>0.1</td><td>0.0</td></tr>
</table></td><td></td></tr>
<tr><td>2.2.</td><td>Vehicle</td><td></td></tr>
<tr><td></td><td>Measurements shall be made on vehicles at the test mass mt specified according to the following table.</td><td>Fulfilled</td></tr>
<tr><td></td><td>Target mass, mtarget, is used to denote the mass that N2 and N3 vehicles should be tested at. The actual test mass of the vehicle can be less due to limitations on vehicle and axle loading.</td><td>Fulfilled</td></tr>
</table>

	<table><tr><td>Vehicle Category</td><td>Vehicle test mass</td></tr><tr><td>M_1</td><td>$m_t = m_{ro}$ ±5%</td></tr><tr><td>N_1</td><td>$m_t = m_{ro}$ ±5%</td></tr><tr><td>N_2, N_3</td><td>m_{target} = 50 [kg/kW] × P_n [kW] Extra loading, m_{xload}, to reach the target mass, m_{target}, of the vehicle shall be placed above the rear axle(s). The sum of the extra loading and the rear axle load in an unladen condition, $m_{ra\ load\ unladen}$, is limited to 75% of the technically permissible maximum laden mass allowed for the rear axle, $m_{ac\ ra\ max}$. The target mass shall be achieved with a tolerance of ±5%. If the centre of gravity of the extra loading cannot be aligned with the centre of the rear axle, the test mass, m_t, of the vehicle shall not exceed the sum of the front axle in an unladen condition, $m_{fa\ load\ unladen}$, and the rear axle load in an unladen condition, $m_{ra\ load\ unladen}$ plus the extra loading, m_{xload}, and the mass of the driver m_d. The test mass for vehicles with more than two axles shall be the same as for a two-axle vehicle. If the vehicle mass of a vehicle with more than two axles in an unladen condition, $m_{unladen}$, is greater than the test mass for the two-axle vehicle, then this vehicle shall be tested without extra loading. If the vehicle mass of a vehicle with two axles, $m_{unladen}$, is greater than the target mass, then this vehicle shall be tested without extra loading.</td></tr><tr><td>M_2, M_3</td><td>$m_t = m_{ro}$ The mass in running order shall be achieved with a tolerance of ±10%.</td></tr><tr><td>Incomplete M_2, M_3</td><td>If the tests are carried with an incomplete vehicle not having a bodywork, m_{target} = 50 [kg/kW] × P_n [kW] is calculated in compliance with conditions above (see N_2, N_3 category). or $m_t = m_{chassisM2M3} + m_{xloadM2M3} = m_{ro}$ The mass in running order shall be achieved with a tolerance of ±10%.</td></tr></table>	
2.2.3.	Before the measurements are started, the engine shall be brought to its normal operating conditions.	Fulfilled
2.2.4.	If the vehicle is fitted with more than two-wheel drive, it shall be tested in the drive which is intended for normal road use.	Fulfilled
2.2.5.	If the vehicle is fitted with fan(s) having an automatic actuating mechanism, this system shall not be interfered with during the measurements.	Fulfilled
2.2.6.	If the vehicle is equipped with an exhaust system containing fibrous materials, the exhaust system is to be conditioned before the test according to Annex 4.	Fulfilled
3.	**METHODS OF TESTING**	
3.1.	**Measurement of Sound of Vehicles in Motion**	
3.1.1.	General conditions of test	Fulfilled
	Two lines, AA' and BB', parallel to line PP' and situated respectively 10m ± 0.05m forward and 10 m ± 0.05 m rearward of line PP' shall be marked out on the test runway	Fulfilled

		
	The microphone shall be located at a distance of 7.5m ± 0.05m from the reference line CC' of the track and 1.2m ± 0.02m above the ground.	Fulfilled
3.2.	**Measurement of Sound Emitted by Stationary Vehicles**	
	The microphone shall be located at a distance of 0.5m ± 0.01m from the reference point of the exhaust pipe defined in Figure 2 and at an angle of 45º (±5º) to the vertical plane containing the flow axis of the pipe termination. The microphone shall be at the height of the reference point, but not less than 0.2m from the ground surface.	Fulfilled
3.2.5.3.2. 1.	Target engine speed The target engine speed is defined as: **(a) 75% of the rated engine speed S for vehicles with a rated engine speed ≤5,000min-1;** **(b) 3,750min-1 for vehicles with a rated engine speed above 5,000min-1 and below 7,500min-1;** **(c) 50% of the rated engine speed S for vehicles with a rated engine speed ≥7,500min-1.** If the vehicle cannot reach the engine speed as stated above, the target engine speed shall be 5% below the maximum possible engine speed for that stationary test.	Fulfilled

		
Annex 5 İtem 1	**METHOD OF MEASUREMENT**	
	The measurement is performed at microphone positions 2 and 6 according to Figure 1, wit the vehicle stationary. The highest A-weighted sound level is registered during venting the pressure regulator and during ventilating after the use of both the service and parking brakes.	Fulfilled
2.	**EVALUATION OF THE RESULTS**	
	For all microphone positions two measurements are taken. In order to compensate for inaccuracies of the measuring equipment, the meter reading is reduced by 1dB(A), and the reduced value is taken as the result of measurement.	Fulfilled
	The noise during venting the pressure regulator is measured with the engine at idling speed.	Fulfilled
		
3.	**LIMITING VALUE**	
	The sound level shall not exceed the limit of 72dB(A).	Fulfilled

2. Test Results

Test Vehicle

Vehicle Category	M1
Technically Permissible Unladen Mass	1170 kg
Test Speed (km/h)	50 km/h
Gearbox type and gear choice	Automatic / D3
Engine Speed (rpm)	3000 rpm
Test result by motion vehicle	73 dB*
Test result by stationary vehicle	79 dB*
Compressed air noise	63 dB

***According to base vehicle manucaturer values, test results had been decreased 2 dB(A) with VGT system.**

3. Test place and date

TR-Istanbul 11/08/2020

4. Final Confirmation

As the result of inspections of DELTA Plastik Makine San. Ve Tic. Ltd. Şti. sample product, it has been confirmed that the sample vehicle fulfilled the requirements related to the ECE R-51.03 as given.

This report can not be multiplied without written approval of Dekra A.Ş. That report can not be used as a homologation projetcs.

This technical report consists of 9 pages.

TR-Istanbul 21.08.2020

Recognized Expert
Eren AKDAĞ