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EXPERIMENTAL SOUND LEVEL ANALYSIS FOR MOTORCYCLE APPLICATION

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ABSTRACT:

Exhaust noise created by the engines is important noise pollution to the environment. Exhaust systems are required to attenuate noise meeting required dB levels and sound quality, emissions based on environment norms. Hence this is become an important area for research and development. Mufflers are important part of engine system and used in exhaust system to minimize sound transmissions caused by exhaust gases. Design of muffler is a complex function that affects noise characteristics, emission and fuel efficiency of engine. Thus muffler design becomes more and more important for noise reduction. This research deals with a practical approach to design, develop reactive muffler for exhaust system, which will give advantages over the conventional method with shorten product development cycle time and validation.

KEYWORDS: Exhaust muffler; Experimentation, sound level meter, pollution norms.

1. INTRODUCTION:

The measurement of sound level is important in exhaust system of an automobile. The noise which is emitted by the engine is going to exhaust system. In exhaust system muffler plays an important role. In this research paper noise measurement is carried out for muffler with a double expansion chamber. The measurement of sound pressure level (dB) is carried out when vehicle is at stationary condition.

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2. EXPERIMENTAL PROCEDURE:

2.1GENERAL TEST CONDITIONS:

1) The test carried out under stationary condition. During test motorcycle must be at normal running temperature.

2) During testing Motorcycle should be in vertical position and stable. If operator cannot maintain this position by themselves, an assistant can help them by standing on the opposite side from the microphone and as close to the front of the vehicle as possible.

3) The motorcycle should be in neutral condition during testing..

5) The calibration of sound level meter is necessary. If the value displayed on the sound meter is more than 0.2 dB of the calibrator value, calibrate or adjust the sound meter.

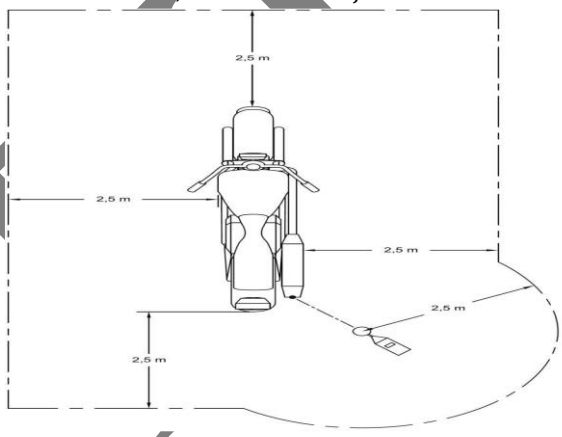
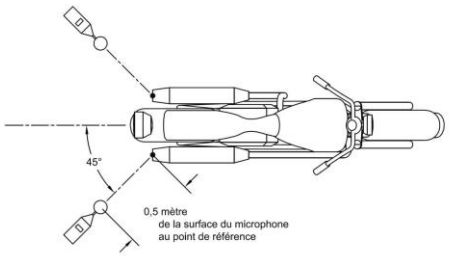


Fig.1 Experimental Setup



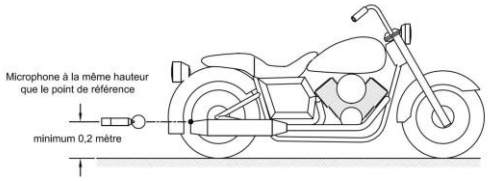


Fig.2 General Test Conditions.

6) The microphone position placed behind the exhaust pipe at a distance of 50 cm ±2 cm from the reference point of the exhaust pipe, at the same height as the reference point ±2 cm if this point is more than 20 cm from the ground, on an imaginary line at a 45° angle ±10° with respect to the longitudinal axis of the motorcycle. The microphone pointed at the reference point The microphone must be supported by a tripod, and no other accessory used to position the microphone in relation to the exhaust pipe should be left in place. The windscreen

should be put on the microphone to take the measurement. If there is more than one exhaust pipe on the same side of the motorcycle, see Figure 2 to determine which exhaust pipe to use for the measurement.

7) The sound meter must be set on the scale for A frequency-weighting and on the F time-weighting. It must be used in a measurement mode that memorizes the maximum sound pressure level (L_{AFMAX}) during the measurement period planned.

8) If the motorcycle's tachometer is used, the sound meter operator or an assistant must take the readings during the test. This person must stand on the side opposite the microphone.

9) If the motorcycle is equipped with an exhaust pipe on both sides, a measurement must be taken on both sides. The highest sound pressure level measured is the one to record. If the level measured on the first side exceeds the allowed limit, it is not necessary to test the other side.

3. VALIDATION OF SOUND LEVEL:

3.1 NOISE STANDARDS FOR MOTOR VEHICLES:

Every motor vehicle shall be constructed and maintained so as to conform to noise standards as indicated in the table below, and these Standards shall be tested as per IS: 3028.

Table 1.Noise limits for vehicles applicable at manufacturing stage from year 2003.

Sr.No	Type of vehicle	Noise Limits from 1st January, 2003. (dB)	Date of implementation
1	i) Two wheeler Displacement upto 80 cm^3 ii) Displacement more than 80cm^3 but upto 175 cm^3 iii) Displacement more than 175 cm^3	75 77 80	1st January, 2003
2	Three wheeler i) Displacement upto 175 cm^3 ii) Displacement more than 175 cm^3	77 80	1st January, 2003
3	Passenger Car	75	1st January, 2003
4	Passenger or commercial vehicle i) Gross vehicle weight upto 4 tonne. ii) Gross vehicle weight more than 4 tonne but upto 12 tonne. iii) Gross vehicle weight more than 12 tonne.	80 83 85	1st July 2003

(Source: Central Motor Vehicles Rules, 1st January 2003)

3.2 MOTORCYCLE SPECIFICATIONS:

Table 2.Motorcycle Specifications.

Sr.No.	Parameter	Specifications
1.	Model	Royal Enfield Bullet 350cc (Classic)
2.	Engine Type	Single Cylinder 4 Stroke, OHV, Dual Spark Ignition, Air Cooled
3.	Bore	70 mm.
4.	Stroke	90 mm
5.	Swept volume	346 cc.
6.	Compression ratio	8.5:1.
7.	Max Power	@ rpm19.8 BHP @ 5250 rpm
8.	Max Torque	-@ rpm28 Nm @ 4000 rpm
9.	Idle RPM	1050±200 rpm
10.	Starting	Kick Start/E-Start
11.	Air filter	element/Paper element
12.	Carburetor	Ucal - BS 29.
13.	Lubrication	Wet sump Forced lubrication
14.	Engine oil capacity	2.75 Litres.
15.	Engine oil grade	Royal Enfield 15 W 50 API SL Engine Oil (JASOMA).
16.	FD Sprocket	16 Teeth.
17.	Rear Wheel	38 Teeth.

4. MEASUREMENT OF EXHAUST PIPE SOUND LEVEL:

As per the Indian BIS a standard IS: 3028 for the two wheelers maximum permissible sound is 80dB.

Plate.1.Sound Level indication from Instrument

Plate 2. Sound with existing muffler without and With Raised.

Plate 3. Measurement of sound level by using Double expansion chamber.

Plate.4. Muffler with double expansion chamber.

Table 3.Sound Level Measurement.

Sr.No	Sound with existing muffler(dB)	Sound with first gear shift & raised muffler (dB)	Sound without muffler (dB)	Sound without muffler with first gear shift and raised (dB)	Sound with double expansion chamber (dB)	Sound with double expansion chamber with first gear shift and raised (dB)
1.	67.9	90.7	70.2	86.5	64.00	79.8
2.	68.4	90.8	70.5	86.3	63.7	80.2
3.	67.5	90.2	71	86.9	63.8	79.7
4.	67.3	90.4	70.8	86.4	63.7	79.5
5.	67.8	90.3	70.6	85.5	63.2	80
6.	67.9	90.9	71.2	85.9	63.8	79.8
7.	67.3	90.5	70.9	85.8	63.5	78.9
8.	67.8	90.9	70.5	86.0	63.7	79.3
9.	68	90.5	70.6	86.4	63.9	79.5
10.	68.2	90.4	70.6	86.2	63.2	79.6

5. CONCLUSION:

As per the Indian BIS standards IS: 3028 for the two wheelers maximum permissible sound is 80dB. The sound with existing silencer with & without raised the value comes above 80dB which is not accepted. The sound with existing muffler and sound with first gear shift this will gives values above 80dB.Sound with double expansion chamber at neutral condition and with first gear shift and raised gives optimum results than existing silencer. Sound with double expansion chamber with and without raised gives values bellow 80 dB.

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