

The Idiot's Guide to Becoming a Scooter Nerd

Or how to calculate your engine speed

Since Vespa scooters are obsolete and slow, nobody cares about RPM. However, if you spend too much time working on your scooter and you eventually want to know your engine RPM according to your actual speed, follow this easy step-by-step guide.

A) This section is for stock scooter nerds only:

- 1) Go outside or at least don't do this on your carpet.
- 2) Make a paint line on your rear tire
- 3) Sit on your scooter, because the tire will squish and lower the circumference
- 4) Roll the scooter forward until one wheel revolution is completed
- 5) Measure the distance between the two lines in centimetres

If you are American and measure in inches, multiply that value by 2.54, and kick yourself in the ass, or blame your parents.

This value will be known as **C** (for circumference)

- 6) Calculate the RPM, knowing the final gear ratio (Haynes manual) and the speed (in Km/h) you want to go at. If you are American, multiply MPH by 1.62 to get Km/h and kick yourself in the ass once again and blame your teachers.

GR = final gear ratio, **S** = speed in Km/h, **C** = circumference in centimetres

The engine RPM is:
$$\text{RPM} = (\text{GR} \times \text{S}) / (60 \times \text{C})$$

The wheel turns at this speed:
$$\text{WPM} = \text{RPM} / \text{GR}$$

B) This section is for modified scooter nerds only:

So if you want to put in an upgear kit,

- 1) Calculate your Transmission ratio and a new Primary gear ratio in order to know your new final gear ratio

1.1) **TR = Transmission gear ratio**

Ratio between the tooth count of the layshaft and drive shaft gears

ie.: V90 (has 3 gears) Layshaft, 10, 16, 22 Drive shaft 60, 54, 47

1st gear: $TR = 60/10 = 6$

2nd gear: $TR = 54/16 = 3.375$

2nd gear: $TR = 47/22 = 2.136$

1.2) PR= Primary gear ratio

Ratio between the tooth count of the sprocket on the crank and on the clutch basket.

ie: Standard V90; crank sprocket: 22, clutch basket sprocket: 63

$PR = 63/22 = 2.86$

$GR = TR \times PR$

1st gear: $GR = 6 \times 2.86 = 17.16$

2nd gear: $GR = 3.375 \times 2.86 = 9.65$

3rd gear: $GR = 2.136 \times 2.86 = 6.11$

C) Summary

$GR = TR \times PR$

$RPM = (GR \times S) / (60 \times C / 100000)$ if variables were measured in Km/h and centimetres

$RPM = (GR \times S \times 1.62) / (60 \times C \times 2.54 / 100000)$ if variables were measured in MPH and inches, don't forget to kick yourself!

D) Questions

If the circumference of the wheel is 51" (this is an approximation, for learning purposes only):

1) What RPM will be hypothetically achieved at a speed of 20 MPH in 2nd gear on a standard slow-as-a-pig V90? (Gear ratio in 2nd gear is 9.65)?

2) How fast is the wheel turning, that is what is the wheel RPM (who cares!!)?

3) You are a modified scooter nerd and you just bought that primary drive upgear kit from Scooter Nerds Inc. It has a primary drive ratio of 2.34. Your Malossi 135 equipped smallframe had a primary drive of 24 x 61 and has standard 4 speed transmission. You have a Haynes manual so you know the final gear ratio but you are too lazy to open your cases and count the teeth on the drive shaft and layshaft. Now,

a) You need to calculate RPM with the new primary gears but the Haynes doesn't have the final gear ratios listed in their manual with an upgear kit. What do you do?

b) What is the RPM at 120 Km/h with the old and new upgear kit in 4th gear?

D) ANSWERS

1)

$$\text{RPM} = (\text{GR} \times \text{S}) / (60 \times \text{C} / 100000) = (9.65 \times 20 \times 1.62) / (60 \times 51 \times 2.54 / 100000) = 4023 \text{ RPM}$$

2)

$$\text{WRPM} = \text{S} / (60 \times \text{C} / 100000) = (20 \times 1.62) / (60 \times 51 \times 2.54 / 100000) = 417 \text{ WRPM}$$

or

$$\text{WRPM} = \text{RPM} / \text{GR} = 4023 / 9.65 = 417 \text{ WRPM}$$

So as you can see, the rear hub bearing turns much less than the main bearings!!

3)

a)

PR=2.34, and what is TR in 4th gear ???

On the old set up, TR = GR/PR = 5.31/2.54 = 2.09 (remember 61/24 = 5.31)

Since you are not changing the tranny, TR stays the same with the new set up.

Only PR changes, thus affecting GR.

So with the new primary drive, GR = 2.09 x 2.34 = 4.89 in 4th gear

b)

Old set up:

$$\text{RPM} = (\text{GR} \times \text{S}) / (60 \times \text{C} / 100000) = (5.31 \times 120) / (60 \times 51 \times 2.54 / 100000) = \mathbf{8198 \text{ RPM}}$$

New set up:

1st method:

$$\text{RPM} = (\text{old RPM} / \text{old final gear ratio}) \times \text{GR} = \mathbf{8198 / 5.31 \times 4.89}$$

or if math is not your thing, just start with the whole formula:

$$\text{RPM} = (\text{GR} \times \text{S}) / (60 \times \text{C} / 100000) = (4.89 \times 120) / (60 \times 51 \times 2.54 / 100000) = \mathbf{7550 \text{ RPM}}$$

2nd Method (even simpler):

Old primary drive: 2.54 New primary drive: 2.34..... $2.34/2.54=.92$

8198 RPM x .92 = 7550 RPM, because of 8% taller gearing.

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