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Proper usage of SAE 20W, 30, or 40 on a 110 cc Engine using Premium, Pertalite, or Pertamax for Optimum Specific Fuel Consumption and Thermal Efficiency

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Abstrak.

Artikel ini membahas penentuan minyak pelumas yang tepat untuk mesin bensin 110 cc. Honda Blade diambil sebagai sampel mesin bensin motor 110 cc. Artikel ini ditujukan untuk bisa dijadikan pedoman pada pemilihan jenis pelumas mesin monograde yang tepat sesuai dengan jenis bahan bakar bensin yang digunakan. Pengukuran Torsi dan putaran mesin dilakukan dengan dyno meter sedangkan konsumsi bahan bakar ditentukan dengan flow meter dan pengukur waktu. Penelitian ini mendapatkan SAE 20W sebagai pelumas mesin yang paling tepat untuk menghasilkan konsumsi bahan bakar spesifik dan efisiensi termal mesin terbaik. Sebagai pilihan kedua terbaik pelumas yang dapat dipilih adalah SAE 30. Ketika digunakan pelumas SAE 20W dan bahan bakar Pertamax maupun Pertalite, putaran optimum mesin motor untuk menghasilkan konsumsi bahan bakar spesifik dan efisiensi termal mesin optimumnya adalah 2900 [RPM].

Kata kunci: *Monograde, SAE 20W, SAE 30, SAE 40,* Konsumsi bahan bakar spesifik optimum, Pemilihan oli pelumas.

Abstract.

This article determines the right lubricating oil for a 110-cc petrol engine. The Honda Blade was a sample for a 110-cc petrol motorbike engine. This article is aimed to be used as a guide for selecting the right type of monograde engine lubricant according to the gasoline used. Torque and engine speed measurements are carried out using a dyno meter, while fuel consumption is determined using a flow meter and stopwatch. This research found SAE 20W as the most appropriate engine lubricant to produce the best specific fuel consumption and engine thermal efficiency. The second-best lubricant option is SAE 30. When SAE 20W lubricant and Pertamax or Pertalite fuel are used, the optimum motor engine speed to produce specific fuel consumption and optimum engine thermal efficiency is 2900 [RPM].

Keywords: Monograde, SAE 20W, SAE 30, SAE 40, Optimum specific fuel consumption, Selection lubrication oil.

Introduction

Lubrication oil is essential to keep the engine operating since it reduces friction between moving parts [1]. Using the unsuitable oil can damage the engine shortly [2]. In Indonesia, motorcycle engines with a capacity of 110 cc have a choice to use monograde lubrication oil of SAE 20W, SAE 30, or SAE 40 [3]. Then the question arises what is the most appropriate lubrication oil should be used [4]? This paper discusses the proper choice of lubrication oil for a 100-cc motorcycle engine using Premium, RON 76, Petralite, RON 90, and Pertamax RON 92 gasoline.

The result helps to choose proper motorcycle engine lubrication oil according to fuel [5]. The consideration factors are engine Specific Fuel Consumption, SFC, and Engine Thermal Efficiency. The best engine lubrication oil based on specific fuel consumption, SFC, and Thermal Engine Efficiency is observed and is nominated as the proper oil that should be used for the engine.

Experimental Method

The motorcycle engine used in this experiment is the Honda Blade 110 cc [6,7]. Engine torque and rotation are measured using a motorcycle dynamometer. The testing is conducted at engine speeds of 2300, 2800, and 3200 RPM, as these speeds are representative of typical daily motorcycle operation. Fuel is purchased from a PERTAMINA petrol station, and the mass flow rate is measured using a fuel flow meter in conjunction with a stopwatch, as shown in Fig. 1. To determine the optimal lubrication, the engine's performance, focusing on the optimum Specific Fuel Consumption (SFC) and Engine Thermal Efficiency are analyzed. The optimum parameters are established first by calculating the engine power, SFC, and overall engine efficiency, then relating these performance criteria to each other. The engine power is calculated using Eq. 1

$$Ne = T\,N/716.2 \quad (1)$$

Ne = Power [PS]
T = Torsion [Nm]
N = Engine Rotation [RPM]
1 PS = 0.736 kW

SFC and ηe are calculated by Eq.2 and Eq.3 respectively.

$$SFC = FC/Ne \quad (2)$$

FC = Fuel Consumption [kg/s]

$$\eta e = 632\,Ne/(FC/Qc) \quad (3)$$

ηe = Thermal Engine Efficiency
Qc = Fuel Calorific Value [kcal/kg]

The experiment setup is as shown in Fig. 1

Fuel flow through a fuel flow meter into the engine filled with the lubrication oil sample. The engine torque and rotation are measured with a computer-controlled Dyno meter.

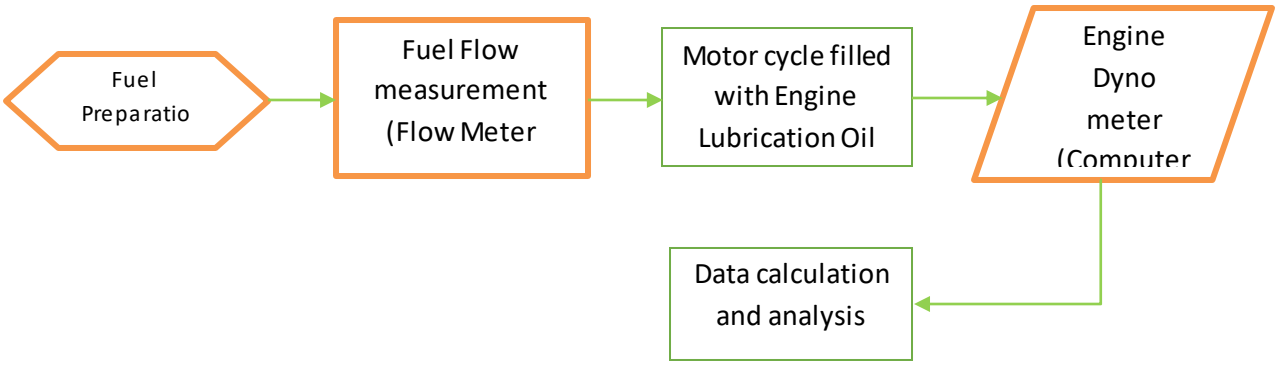

Fig.1 Experimental setup

Discussion

Figures 2, 3, and 4 illustrate the relationship between various fuels and motorcycle engine rotation in relation to Specific Fuel Consumption (SFC) and Thermal Energy Efficiency, as represented by the percentages above the bar diagrams for different lubricating oils used.

The data consistently reveals that for all fuel types, lower engine rotation corresponds to reduced SFC, indicating greater fuel consumption efficiency. This trend is similarly observed in terms of thermal energy efficiency. The findings suggest that, regardless of the lubricating oil employed, the optimal engine performance for all fuel types when considering both SFC and thermal energy efficiency occurs at approximately 2300 RPM. Maintaining this operating rotation allows for efficient engine operation irrespective of the fuel type. However, it should be noted that at higher operating rotations, there is a trade-off between thermal energy efficiency and SFC, as shown in Figures 8 and 9.

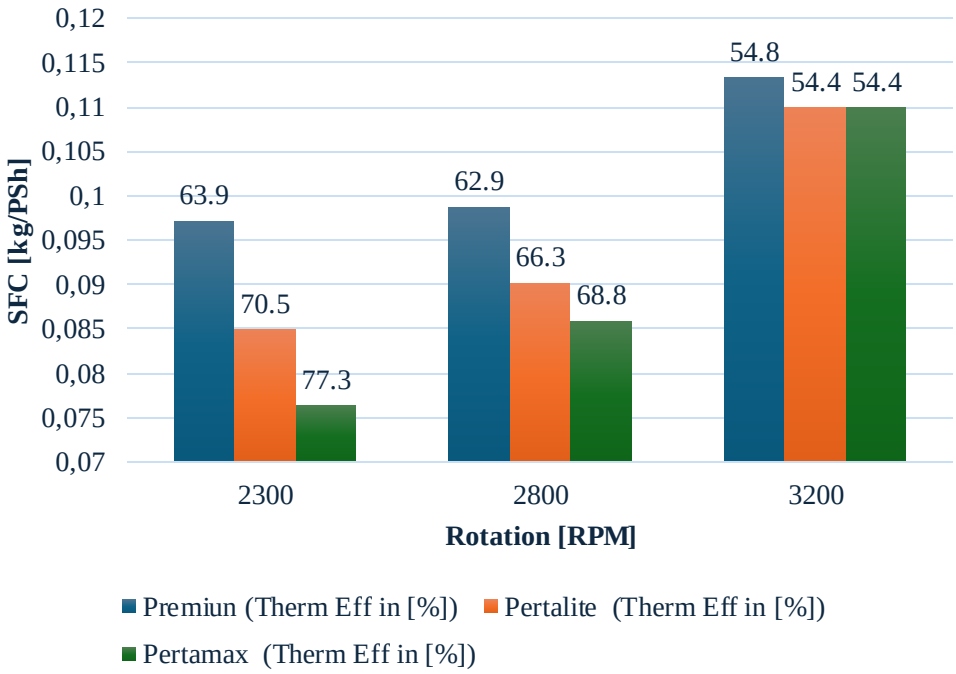

Fig. 2. Relationship between rotation and fuel type on specific fuel consumption (SFC) in [kg/PSh] and thermal efficiency in [%], using SAE 20W lubricating oil.

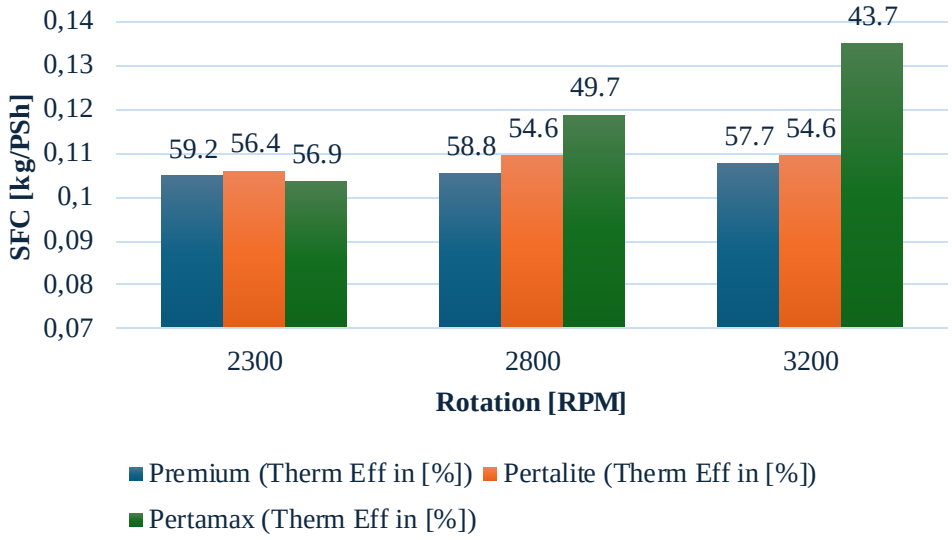

Fig. 3. Relationship between rotation and fuel type on specific fuel consumption (SFC) in [kg/PSh] and thermal efficiency in [%], using SAE 30 lubricating oil

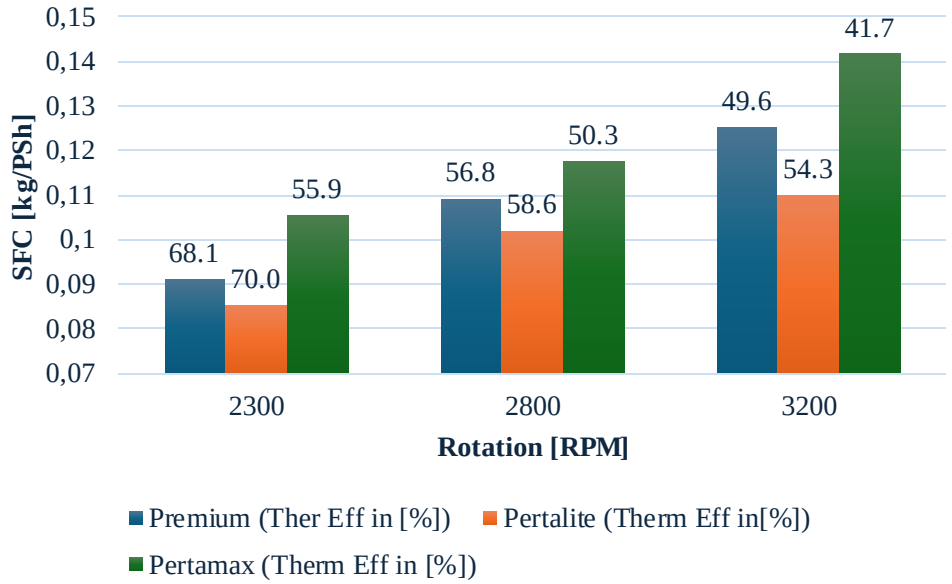

Fig. 4. Relationship between rotation and fuel type on specific fuel consumption (SFC) in [kg/PSh] and thermal efficiency in [%], using SAE 40 lubricating oil

Figures 5, 6, and 7 illustrate the relationship between motorcycle engine rotation, the type of engine lubrication, and their impact on Specific Fuel Consumption (SFC) and Thermal Energy Efficiency (as indicated by the percentage values above the bar diagrams).

These figures demonstrate that SAE 20W results in lower SFC, leading to reduced fuel consumption when the engine rotation is around 3000 RPM. Additionally, SAE 20W enhances thermal engine efficiency, making it the most suitable lubricant for all fuel types when considering SFC and thermal efficiency. However, SAE 30 offers more stable performance regarding SFC and engine efficiency across varying engine rotations when using Petralite and Premium fuels (see Fig. 5 and Fig. 6). Therefore, while SAE 20W is effective, SAE 30 could be considered an alternative, especially when fluctuations in engine rotation are expected. Compared to SAE 40, SAE 30 may prove to be a better choice in these scenarios. Previous research also indicates that SAE 30 monograde oil provides faster lubrication of engine parts during startup compared to SAE 40 oils. [10].

The criteria for selecting engine lubricating oil in this study focus on Specific Fuel Consumption (SFC) and Engine Thermal Efficiency. However, further research is necessary to explore the cleanliness of the engine in terms of carbon deposits.

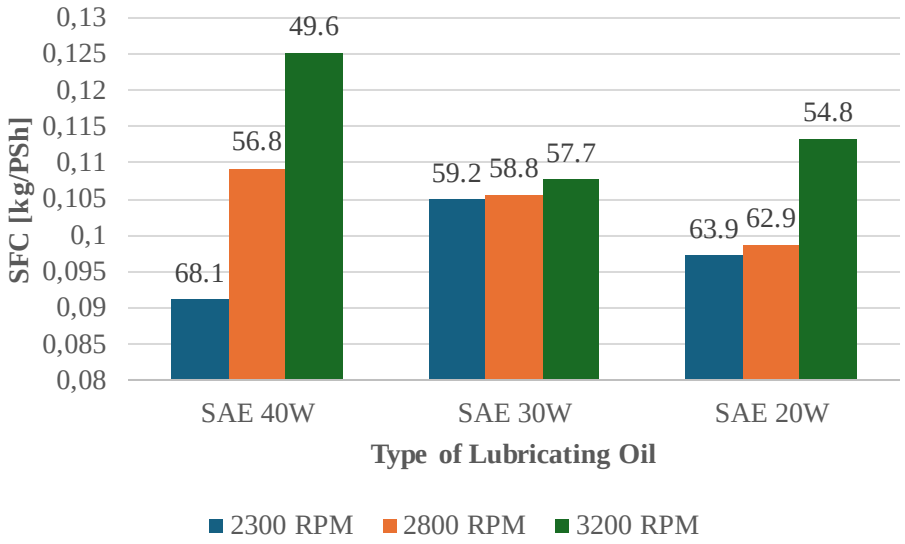

Fig. 5. Variation of Specific Fuel Consumption (SFC) in [kg/PSh] and Thermal Efficiency in [%] with engine rotation speed and lubricating oil type when using Premium.

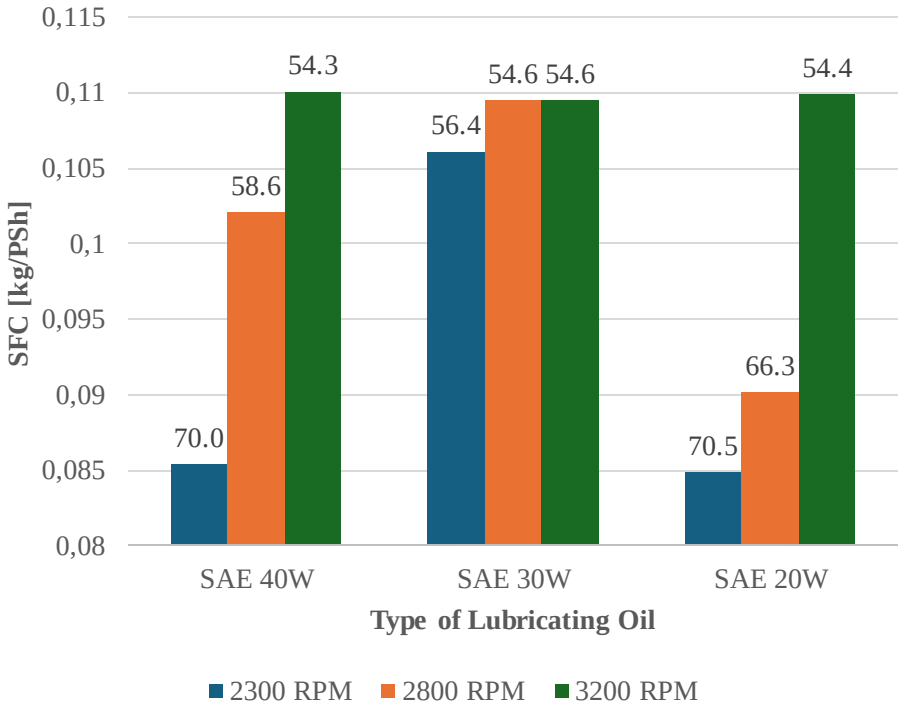

Fig. 6. Variation of Specific Fuel Consumption (SFC) in [kg/PSh] and Thermal Efficiency in [%] with engine rotation speed and lubricating oil type when using Pertalite

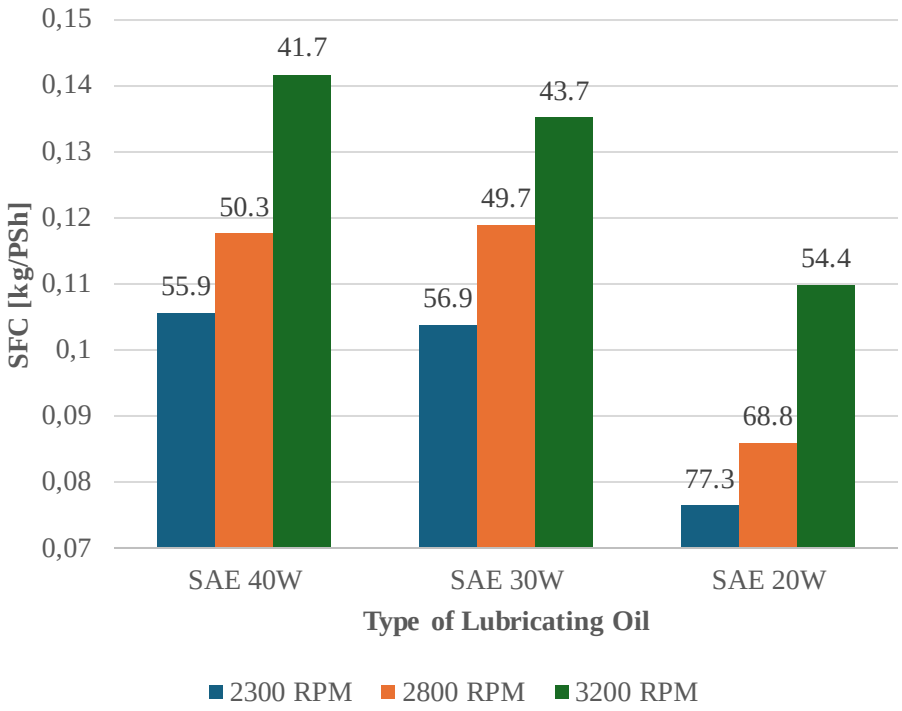

Fig. 7. Variation of Specific Fuel Consumption (SFC) in [kg/PSh] and Thermal Efficiency in [%] with engine rotation speed and lubricating oil type when using Pertamax.

Due to the significant variation in Specific Fuel Consumption (SFC), and engine thermal efficiency when using SAE 20W oil with Pertalite or Pertamax at different engine rotations (see Figures 5 and 6), it is important to determine the optimum engine rotation. As engine rotation increases, SFC also increases, meaning the engine consumes more fuel per unit of power produced. Conversely, engine thermal efficiency tends to decrease. The optimal engine rotation can be identified by finding the point where the SFC and engine thermal efficiency curves intersect (refer to Figures 8 and 9). Both figures suggest that the optimum engine rotation is approximately 2900 RPM. Therefore, it is recommended to operate the engine around this rotation speed when using Pertalite or Pertamax with SAE 20W oil.

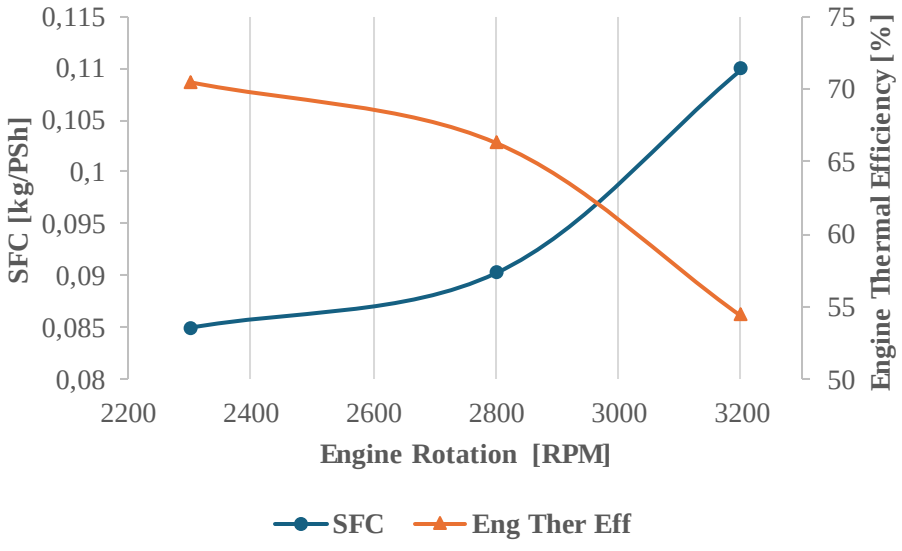

Fig. 8 Determining the optimal engine rotation for using Pertalite and SAE 20W engine oil.

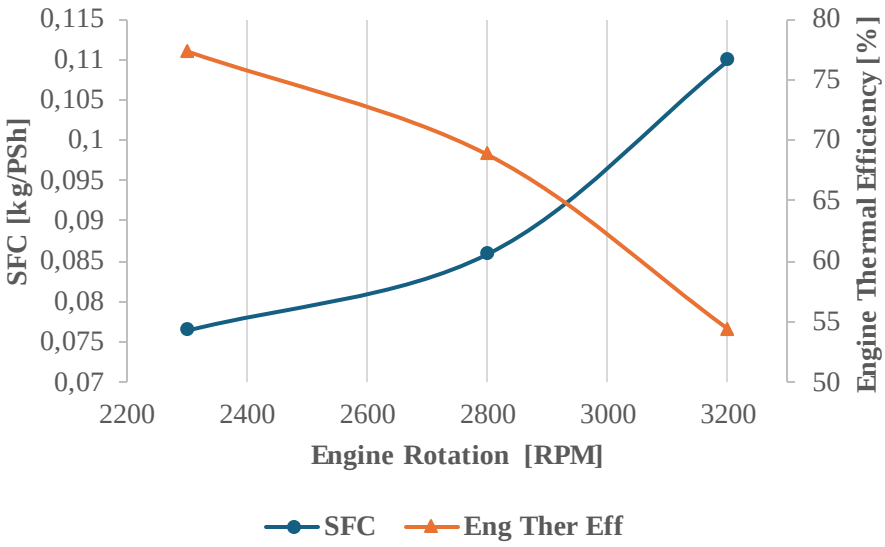

Fig. 9 Determining the optimal engine rotation for using Pertamax and SAE 20W engine oil.

Conclusion

The optimal specific fuel consumption (SFC) for a 110 cc motorcycle engine occurs at an engine speed of 2300 RPM, regardless of the lubrication oil grade or gasoline used. However, if higher engine speeds are needed, the best performance is achieved at 2900 RPM. For lubrication, the recommended engine oil for using Premium, Pertalite, and Pertamax fuels is SAE 20W, with SAE 30W as a suitable alternative.

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